FEAR OF STRANGERS AND PLAY BEHAVIOR IN KITTENS WITH VARIED SOCIAL EXPERIENCE

ROBERTA R. COLLARD

University of California, Davis

5-week old kittens (littermates of the same sex) were given one of three treatments: (a) *handling and opportunity to play for a specified time with a different person 5 days a week for 4 weeks,* (b) *the same treatment with experimenter only, or* (c) *no special treatment. Once a week all kittens were given the same treatments by a stranger and by the experimenter. Fear of strangers was measured by number of escape attempts and retreats from persons. 1-person and no-treatment kittens were found to show significantly more fear of strangers than did 5-person kittens. 1-person cats made more social contacts and played with a string more and with greater skill than the other kittens did. It was concluded that while the stress of adapting to many persons may have led to less fear of strangers in the 5-person kittens, it also may have decreased their social and play behaviors.*

Fear of persons and of novel situations is decreased in rats, kittens, and puppies if they are handled before a certain age by human beings. Handled rats have generally been shown to be more gentle and less fearful than unhandled ones (Denenberg, 1964). Kittens handled 5 minutes a day up to 45 days of age were found by Wilson, Warren, and Abbott (1965) to show less fear of strangers and of novel objects than unhandled subjects did. Freedman, King, and Elliot (1961) observed the critical period of socialization in puppies to be between 5 and 6 weeks of age. Puppies handled during this period showed a marked decrease in fear of strangers and an increase in number of social contacts initiated with persons. Accord-

This study was made possible by a grant from the Committee on Research University of California, Davis. Appreciation is due to Pat Brown, Margaret Knox, Leila McDowell, Elise and Renee Pelissier, and Barbara Zadra for their assistance with the kittens, to the students and professors who were the "strangers" to the kittens, and to Dr. David Griffiths for his veterinary care and advice. Author's address: Department of Agricultural Education, University of California, Davis, California 95616.

ing to Scott (1963), the fear responses of puppies isolated beyond the critical period of socialization prevent them from making social contacts with strangers.

The writer has observed fear of persons to occur in rarely handled (but not completely isolated) kittens by about 5 weeks of age, and this fear appeared to increase up to 9 or 10 weeks of age. Kittens handled and played with during this period made affectionate or playful social responses to persons; but if they had little contact with humans, they developed fear of strangers during this time.

Infant chimpanzees cared for primarily by one person tend to develop fear of unfamiliar persons after 3 or 4 months of age. (Riesen, 1958). Human infants cared for chiefly by their mothers tend to develop this fear after they are 5 or 6 months old (Bayley, 1933; Gesell & Thompson, 1934; and Spitz, 1950).

Human infants cared for by many persons usually develop less fear of strangers than do infants cared for by 1 person. Rheingold (1956) found institutional infants cared for by an average of 13 persons a day to show little fear of strangers. She also found that care by 1 person (when the babies were between 6 and 8 months old) increased their social responsiveness compared to that of a control group cared for by many persons.

Freud and Burlingham (1944), Spitz and Wolf (1949), and Provence and Lipton (1962) all observed institutional infants to play less than home infants. These authors attributed this deficit in play to emotional insecurity arising out of the absence of a close relation to a mothering person. Caldwell (1963) found 1-year-old infants cared for by mothers alone to be more emotionally dependent on their mothers than those reared by several persons. Six-month-old infants cared for by several persons tended to be more irritable than those reared by one person. Rheingold (1961) observed a group of home-reared infants 3½ months old to receive more social and caretaking contacts than a group of institutional babies the same age, but this difference in social stimulation did not make a difference in the amount of play shown by the two groups. Institutional babies 9–13 months old were found by the writer (Collard, 1962) to explore significantly less, to show fewer patterns of play, and to make fewer social responses than did home babies cared for by one person. In addition to being cared for by many persons, these institutional babies had received less stimulation from objects and had less opportunity to explore than the home infants had.

Although babies cared for by one person may show more social and exploratory behavior because they are given more stimulation than are most babies cared for by many persons in an institution, it may also be true that the stress of having to adapt to many different persons has an adverse effect on development in these areas. The familiarity and mutual adaptation between mother and infant which allows each to know what to expect from

the other may lead the infant to be less fearful and thus able to play and explore more freely.

The present study was an attempt to test in infant animals of another species whether social stimulation given by many persons leads to less social and play behaviors than the same kind of stimulation given for an equal time by one person. The effect of no special handling, handling by one person, and handling by many persons on fear of strangers was also measured.

METHOD

Subjects

Thirty 5-week-old kittens were divided into groups of 10, consisting of 6 males and 4 females. Littermates of the same sex were assigned randomly to one of three treatment groups:

1. *Five-person group.*—These kittens were handled and played with for a period of time by a different person each day on 5 consecutive days per week for 4 weeks.

2. *One-person group.*—These subjects were given the same treatment as the first group except that only the experimenter handled and played with them.

3. *No-person group.*—These kittens did not receive treatment from anyone. To adapt them to the test room, they were allowed to explore the room for 2 minutes 5 days a week, while the subjects in the other two groups received handling and play experience in addition to a 2-minute exploration period in the room.

The subjects were genetically similar; two of the mothers were sisters; one mother was a daughter of one of the former, and the father was the same for most of the litters. Size of litters ranged from four to eight with an average of five kittens per litter. The kittens were housed with their mothers in a warm, sunny room, containing only an old rug, a plastic wastebasket, and corrugated cardboard boxes with bedding or cat litter. Weaning was begun at 5 weeks, using strained beef and dilute evaporated milk. This diet was changed to canned cat food and ground raw beef within a week.

The kittens were rarely handled by the experimenter. When they were weaned, their first bite of solid food was given by spoon, and they were placed around the food dish the first few days. All kittens were carried to and from the test room by the experimenter. Sometimes they had to be placed back in their room when they tried to escape when the door was momentarily open. During their second week, three litters of kittens developed an eye infection requiring several applications of antibiotic ointment,

and two of the litters were given drops of oral antibiotic for mild pneumonitis three times a day for 2 or 3 days.

Procedure

Differential treatment of the three groups of kittens was begun when they were 5 weeks and 3 days old and was continued for 4 weeks. Because of the great change in their development, the treatment procedure was changed after the first week. It was observed in a pilot study that rarely handled kittens barely 5 weeks old taken into a strange room without their mother and released immediately usually stayed near the experimenter, would not play, and tended to freeze or occasionally would run frantically and cry. Therefore, the treatment developed for the first week did not include any specific stimuli for play. It consisted of four items:

1. The kitten was carried around the room for 1 minute. (The animal was held against the person's body with its hind feet and back supported.)
2. The person held the kitten in her lap for 1 minute, stroking its head.
3. The person held the kitten in her lap for 2 more minutes, stroking its head and talking to it.
4. The kitten was allowed to explore the room for 2 minutes.

The kitten's activities while exploring the room were recorded at the time and included descriptions of kind of contacts with objects and persons (such as sniffing or pawing), of its position in the room in relation to rugs or furniture, and of its movement, for example, whether it walked or ran. The first three items were recorded at the end of the treatment period, except for numbers of escape attempts, which were written down while the kitten explored the room. Recording also included a description of the kitten's tonus (whether tense, relaxed, or shaking) and behaviors such as crying. Many of these kittens, which had not been held before except momentarily, reacted by crying or shaking, and some struggled violently to escape.

Treatment procedures during the second, third, and fourth weeks consisted of the following:

1. The person carried the kitten around the room or held it in one spot for 1 minute. (It was carried about or held still on alternate days.)
2. The kitten was allowed to explore the room for 2 minutes.
3. The person called the kitten (from a distance of 5 feet), saying, "Here kitty, kitty; come on, kitty." (It was given 30 seconds to come.)
4. The person called the kitten in the same manner while moving a string up and down from floor level to about 2 inches off the floor. (The kitten was given 30 seconds to respond.)

Distance was marked by a 3- by 5-foot gray throw rug and a small orange rug centered on it for purposes of uniformity of procedure and description. Before it was called, the kitten was placed in a corrugated

cardboard box near the starting place by the experimenter. The one-person kittens were lifted out of the box to the starting point by one of the five assistants who treated the five-person cats, and the five-person kittens were lifted out by the experimenter. While this exposure to strangers of the one-person kittens may have made a difference in their degree of adaptation to other people, it was minimal in terms of time and of exposure to a variety of human behaviors. Also, any effects would operate against the hypothesis in the study that kittens exposed to one person would be more afraid of strangers than would kittens exposed to several people. The one who placed the subject at the starting position stood quietly back of the kitten and did not move more than was necessary to place the animal and operate the stop watch. Items 1 and 2 were recorded while the kitten was exploring the room, and items 3 and 4 were recorded at the end of the treatment period. In recording the kitten's play with the string, behaviors such as catching the string in the mouth or pouncing were counted each time they occurred, but others, which were impossible to count (such as pawing the string) were listed as having occurred on that occasion or trial. All tabulations of play and social responses were made on the latter basis. During the second week, the string test was repeated with the kitten near the string, because at first most of them did not notice it from 5 feet away. It was not necessary to do this the third week. During week 4, the procedure was the same as weeks 2 and 3, except that the tester repeated the calling sentence three times and moved the string horizontally instead of vertically.

At the end of each 5-day period, a "stranger test" was given to all subjects. In these tests, the treatment given the preceding week was repeated with each kitten by a stranger who did not know which group a subject belonged to and also by the experimenter. A different stranger tested the kittens each week. The kittens from the three groups were tested in counterbalanced order; the order of testing a subject from a particular group and by experimenter first or stranger first was determined by chance. This was important, because the kittens were fed within an hour before testing, and they tended to be sleepy at first, and also they seemed to be less frightened and more alert the second time they were tested. In the stranger tests given the second, third, and fourth week, the tester held the kittens still for 1 minute instead of walking with them, because it was observed the first week that they tried to escape less often when they were carried about than when they were held still.

Measures

Fear of strangers.—This was measured by the number of escape attempts made by the kittens when they were held for 1 minute by stranger or experimenter in the tests made once a week. During this time, the tester

was standing up and held the kitten loosely against her body with its hind feet and body supported. An escape attempt was defined as a progression (or a walking away) in any direction. When this occurred, the tester adjusted the kitten to its former position. Constant attempts to escape were counted as 15, as this was the highest number of attempts ever counted during any 1-minute period. A kitten which was too wild to be held also received a score of 15. A strong lunge, which sometimes resulted in the kitten's jumping down, was rated as a violent escape attempt. Fear of persons was also measured by the number of times the kittens froze or retreated when called by the tester. A "retreat" was defined as a rapid running away (usually in a crouching position) to a protected position under or behind something. A "freeze" was immobility in a crouching position for 10 seconds or more.

Social responses.—These responses were measured by counting the number of trials during the stranger tests in which the kittens initiated exploratory, playful, or affectionate contacts with the tester: (1) while held in the tester's lap the first week, (2) when called from a distance the second, third, and fourth weeks, and (3) when allowed to explore the room in all four tests. Responses included looking at, sniffing, pawing, biting or licking, climbing on, and snuggling, treading, or rubbing against the tester.

Exploratory and play responses.—These responses were measured during the tests given at the end of weeks 2 and 3 when the string was moved vertically at a distance of 5 feet from the kitten. Responses included looking at the string, approaching it, pawing or batting it, mouthing it, and pursuing and pouncing on it.

Hypotheses

It was predicted that:

1. One-person kittens would show significantly more fear of strangers than of the experimenter. Kittens handled and played with by five persons would show less fear of strangers than those receiving such treatment by one person, and kittens receiving no special handling and play experiences would show the most fear of all. Five-person kittens should also tend to make more approaches and fewer retreats from persons than would animals in the other groups.

2. One-person kittens would show more social behavior than would five-person kittens, and no-person kittens would show the least social behavior of all.

3. One-person kittens would make more exploratory and play responses in the tests with the experimenter than would kittens in the other two groups.

The differences between groups in number of escape attempts was analyzed on the t test, using the pooled estimate-of-error variance from all groups of kittens. The accepted level of significance was less than .05.

Other data is presented descriptively in terms of number of trials in which the behavior occurred within a particular group and the number of subjects showing the behavior.

RESULTS

Fear of Strangers

From Tables 1 and 2, it can be seen that the kittens handled and played with by one person tried to escape much more often from the strangers than from the experimenter. This difference is significant at the .005 level on the *t* test. In fact, the one-person kittens tried to escape from the strangers the same average number of times as the no-treatment kittens did. There was not a significant difference between number of escape attempts from strangers and experimenter in the five-person kittens, who showed little fear of either, and the no-treatment kittens, who showed fear of both.

TABLE 1

ESCAPE ATTEMPTS MADE BY KITTENS IN TESTS 2, 3, AND 4

	FIVE-PERSON KITTENS		ONE PERSON KITTENS		NO-PERSON KITTENS	
MEASURES	From Strangers	From Experimenter	From Strangers	From Experimenter	From Strangers	From Experimenter
Mean.....	8.0	4.0	14.8	5.9	14.8	10.6
SD.....	3.7	3.2	9.1	5.5	9.5	6.4

The five-person kittens tried to escape from the strangers significantly less often than did the one-person and no-treatment kittens. Thus, it appears

TABLE 2

DIFFERENCES IN NUMBERS OF ESCAPE ATTEMPTS MADE BY GROUPS OF KITTENS WHEN HELD IN TESTS 2, 3, AND 4

Groups Compared	Differences between Tests Given by Strangers	Differences between Tests Given by Experimenter	Differences between Tests Given by Strangers and Experimenter
Five-person: one-person.....	<.025	N.S.	...
Five-person: no-person.....	<.025	<.025	...
One-person: no-person.....	N.S.	Near .05[a]	...
One-person: one-person.....	...	...	<.005
Five-person: five-person....	...	...	N.S.
No-person: no-person.....	...	...	N.S.

[a] This significance is lowered by one very wild subject. If this subject is omitted, the results are significant at <.025 on the *t* test of the differences.

that exposure to several persons made it possible for the five-person kittens to adapt more easily to people in general than did the other groups of cats. The one-person kittens showed little fear of the person to whom they had become adapted but did show fear of strangers; the no-treatment kittens, which had little chance to become adapted to anyone, showed fear of both.

The average number of attempts to escape from the strangers tended to increase over weeks 2, 3, and 4 in the one-person and no-person kittens, but not in the five-person cats. The average number of attempts to escape from the experimenter increased in the no-person kittens but not in the one-person and five-person cats. The same trends were shown if the average number of violent escape attempts or the number of subjects making constant escape attempts was used as a measure of increase in fear of strangers over the series of tests.

Escape attempts are, of course, only one way an animal has of indicating fear. Other ways would be freezing (immobility with tense tonus and alerting) or shaking, which might be an alternation between an impulse to freeze and to escape. Although escape attempts may indicate fear, they could also be motivated by a desire to be active or to explore the surroundings. This difficulty would not be present in measures of degree of fear by freezing or by approaches or retreats from an object or person made when the animal was allowed to move freely. When these behaviors were used to measure fear of strangers in the test in which the kittens were called from a distance, it was found that although the one-person kittens approached the strangers about as often as the five-person cats did, they retreated from the strangers more often than the latter did, and they also retreated from the strangers more often than they did from the familiar experimenter (see Table 3). The no-treatment kittens made many more retreats and also showed more freezing and less approach behavior than the other two groups of kittens. In the test with the string, similar results were obtained using these measures.

Exploratory and Play Responses

All of the kittens except one subject in the no-treatment group looked at the string during the two tests, but the kittens in the five-person group approached the string more times than the animals in the other groups did (see Table 4). Kittens in the one-person group made many more play responses to the moving string than did kittens in the other groups. Five-person kittens did not play with the string on 3 trials, one-person kittens on 8 trials, and no-treatment kittens on 16 trials out of a possible 40.

Most of the five-person or one-person cats pawed and batted the string, and about half of the no-treatment cats showed these behaviors. The chief difference between the groups in play with the string was the greater amount of mouthing behavior shown by the one-person kittens.

TABLE 3

KITTENS' REACTIONS WHEN CALLED IN TESTS 2, 3, AND 4

BEHAVIOR	FIVE-PERSON KITTENS				ONE-PERSON KITTENS				NO-PERSON KITTENS			
	No. of Responses (30 Trials)		No. of Ss Making Responses		No. of Responses (30 Trials)		No. of Ss Making Responses		No. of Responses (30 Trials)		No. of Ss Making Responses	
	Stran-gers	Experi-menter	Stran-gers	Experi-menter	Stran-gers	Experi-menter	Stran-gers	Experi-menter	Stran-gers	Experi-menter	Stran-gers	Experi-menter
Approach	17	14	9	9	17	23	9	10	14	11	7	7
Retreat	1	2	1	2	5	2	5	2	6	6	5	5
Approach-retreat[a]	2	0	2	0	1	0	1	0	0	1	0	1
Freeze	0	0	0	0	1	0	1	0	4	1	3	1
Explore	10	14	9	10	6	5	5	5	6	11	2	5

[a] Or retreat-approach.

TABLE 4

KITTENS' EXPLORATORY AND PLAY RESPONSES TO VERTICALLY MOVING STRING IN TESTS 2 AND 3

BEHAVIOR	FIVE PERSON KITTENS				ONE-PERSON KITTENS				NO-PERSON KITTENS			
	No. of Occasions Response Occurred		No. of *Ss* Making Response		No. of Occasions Response Occurred		No. of *Ss* Making Response		No. of Occasions Response Occurred		No. of *Ss* Making Response	
	Strangers	Experimenter	Strangers	Experimenter	Strangers	Experimenter	Strangers	Experimenter	Strangers	Experimenter	Strangers	Experimenter
Exploration:												
Looked (near).....	17	18	10	10	15	17	10	10	12	12	8	8
Looked (far).....	0	0	0	0	1	0	1	0	2	1	2	1
No approach.....	3	0	3	0	4	3	4	3	6	7	4	5
Play:												
Pawed or batted....	17	18	9	8	12	18	9	9	10	15	6	7
Bit.....	6	4	4	4	6	6	5	5	4	6	4	4
Carried off in mouth	1	3	2	3	7	8	5	5	0	0	0	0
Pursued or pounced..	0	4	0	2	1	7	1	4	2	2	1	1
Total play.....	24	29	...	...	26	39	...	...	16	23	...	...

Not only did they show more trials in which mouthing occurred, but it occurred many more times within a trial than it did in the other two groups. Catching the string in the mouth occurred 16 times in the five-person group, 56 times in the one-person group, and 13 times in the no-person group.

The one-person kittens also appeared to be more advanced and much more skillful in their play than were the kittens in the other two groups. On the first test with the moving string, the five-person kittens made many more unsuccessful attempts to catch the string in their mouths than did the one-person cats. Their mouths would open and they would aim for the string and miss. The no-treatment kittens did not show this behavior, probably because almost all of their biting responses occurred during the second test with the string when they were more mature and may have learned to coordinate these movements in their play with the other kittens. The greater skill of the one-person cats was probably developed during the week of treatment preceding the first test with the string. During these five treatment periods, they made more play responses in every category except "pursuing the string" than the five-person kittens did (probably because the former caught it more often). The one-person kittens went through the hit-and-miss stage of trying to catch the string earlier than the five-person cats did. Eight of the one-person kittens learned to catch the moving string skillfully in their mouths and run off with it or try to pull it away, whereas only three of the five-person kittens did this. The no-treatment kittens never did show this kind of play, although six of them eventually bit the string. During the fourth week, when the string was moved horizontally rather than vertically, many of the subjects ran from it as if it were a novel object.

Social Responses

Counting social responses made in all trials except play with the string, the average number of exploratory social responses (looking at and sniffing the tester) were about the same in the three groups of kittens (see Table 5). The five-person kittens made more sniffing responses to persons, probably because they did not retreat as often as the other kittens did, and also because the experimenter was more novel to them than she was to the one-person cats.

The kittens in the one-person group made on the average over twice as many playful or affectionate contacts (climbing on, rubbing against, playful biting of fingers, etc.) as the cats in the other two groups. They also purred more often. Again, there was a marked difference in the amount of playful biting shown by the one-person kittens compared to the others. They showed this behavior on 17 trials compared to 5 shown by the five-person kittens and 4 by the no-treatment cats. In the test in which they

TABLE 5

SOCIAL BEHAVIOR OF KITTENS IN ALL TESTS

BEHAVIOR	FIVE-PERSON KITTENS				ONE-PERSON KITTENS				NO-PERSON KITTENS			
	No. of Occasions Response Occurred		No. of *Ss* Making Response		No. of Occasions Response Occurred		No. of *Ss* Making Response		No. of Occasions Response Occurred		No. of *Ss* Making Response	
	Strangers	Experimenter	Strangers	Experimenter	Strangers	Experimenter	Strangers	Experimenter	Strangers	Experimenter	Strangers	Experimenter
Exploratory:												
Looked at.....	20	35	10	10	20	44	9	10	22	28	10	9
Sniffed.....	18	27	7	10	18	18	9	9	14	17	7	9
Playful or affectionate:												
Pawed.....	3	0	2	0	1	4	1	3	0	0	0	0
Mouthed.....	0	5	0	3	3	14	3	9	1	3	1	2
Bodily contact[a].....	3	4	1	3	2	8	2	5	2	9	2	4
Purred.....	3	1	3	1	6	10	5	4	1	5	1	4
Total playful or affectionate.....	9	10	...	...	12	36	...	...	4	17	...	...

[a] Climbed on, rubbed against, snuggled or treaded.

were called, the one-person kittens approached the tester more often than did the subjects in the other groups. More of the five-person and no-treatment kittens ignored persons and explored the room than did the one-person cats.

DISCUSSION

The findings in this study show that in kittens from 5 to 9 weeks old, experience with several persons (which offers an opportunity to adapt to a variety of actions, appearances, and other sensory qualities) tends to lead to less fear of strangers than experience with one person. Fear of persons (measured by number of escape attempts when held) did not increase in the five-person kittens over the study, but the one-person and no-treatment subjects showed increasing fear of strangers over the 4-week period.

On the other hand, kittens exposed to five persons were found to play less and to show less social behavior than did one-person cats. During the first week of treatment, the five-person kittens appeared to be more upset when they were with the strangers than did the one-person kittens with the experimenter. Records made at this time showed that the five-person kittens tried to escape more often on all 5 days; they occasionally spit and scratched, and they did not purr or show social play. Kittens in the one-person group purred on 14 occasions and played with the experimenter's hands or clothing on 10 occasions. On the first 3 days they were carried, these kittens showed as much clinging with claws and crying as the five-person kittens did, but on the last 2 days, the one-person cats did not cling and cry, while the five-person kittens still showed this behavior. The one-person kittens also tended to orient their exploratory activities around the experimenter more than around the objects in the room. During the second week of treatment, possibly because they had less fear of the experimenter, the one-person kittens were able to play more freely with the string and to develop more skill in their play than the five-person kittens did.

All groups of subjects looked at the testers often, but the one-person kittens made many more mouthing responses to persons and objects. Mouthing is probably more inhibited by fear than is looking, which can be done safely at a distance. In an earlier study (Collard, 1962) the writer observed that institutional babies showed much less mouthing of objects in a strange room than in a familiar ward.

A few of the kittens in the one-person and five-person groups appeared to be more excitable and frightened than the others from the beginning of treatment, and treatment did not appear to modify their behavior as much as that of kittens not so easily aroused. These individual differences could be seen clearly in the records of the kittens during the first week of treatment, when some of the subjects were rated as relaxed and quiet on all 5 days while others were rated as tense and made many attempts to escape.

Two of the kittens in the no-treatment group (both males) were playful and sociable from the beginning, and they showed these qualities more rather than less over the period of study. It is tempting to speculate that these "failures" of treatment may have been based on genetic differences in degree of arousability in the subjects. It may be more difficult to decrease fear responses through adaptation in easily aroused animals than in animals having a higher threshold of arousal and less initial tendency to develop fear. Easily aroused kittens would tend to retreat more often from novel stimuli and thus would have less opportunity to adapt and would therefore remain more fearful, while kittens which are difficult to arouse would make more approaches and thus would have more opportunity to adapt, which would further reduce their fear.

In the present study, the kittens with an intermediate degree of arousability may have been the ones most easily affected by a specific treatment, because the very easily aroused subjects did not allow themselves much opportunity to adapt to the novel stimuli in the test room, and the ones which were hard to arouse became progressively more adapted regardless of treatment group. Thus, the effect of a particular treatment in this study probably depended upon the animal's initial degree of arousability *and* upon his opportunity to adapt to initially frightening stimuli in the testing environment.

The inferiority in amount and maturity of play of the five-person compared to the one-person cats indicates that even though kittens are given equal opportunity for play in terms of exposure to persons and objects for the same periods of time, their play will be influenced by their degree of fear in the presence of a familiar or a strange person. Because the one-person kittens had more opportunity to become adapted to a particular person than the five-person cats had, they showed less fear and more play and social behaviors in her presence. The greater fear observed in the five-person kittens during the first and second weeks when they were adapting to the idiosyncracies of handling and the sensory qualities of five different persons apparently interfered with the deveolpment of their play. On the other hand, exposure to this variety of persons led to a greater degree of adaptation to differences among persons in these kittens and allowed them to become less afraid of strangers than the other subjects were.

REFERENCES

Bayley, Nancy. *California First-Year Mental Scale.* Berkeley: University of California Press, 1933.

Caldwell, Bettye M. Mother-infant interaction in monomatric and polymatric families. *American Journal of Orthopsychiatry,* 1963, 33, 653–664.

Collard, Roberta R. *A study of curiosity in infants.* Unpublished doctoral dissertation, University of Chicago, 1962.

Denenberg, V. H. Critical periods, stimulus input, and emotional reactivity: A theory of infantile stimulation. *Psychological Review*, 1964, **71**, 335–351.

Freedman, D. G., King, J. A., & Elliot, E. Critical period in the social development of dogs. *Science*, 1961, **133**, 1016–1017.

Freud, Anna, & Burlingham, Dorothy. *Infants without families*. New York: International Universities Press, 1944.

Gesell, A., & Thompson, Helen. *Infant behavior: its genesis and growth*. New York: McGraw-Hill, 1934.

Provence, Sally, & Lipton, Rose C. *Infants in institutions*. New York: International Universities Press, 1962.

Rheingold, Harriet L. The modification of social responsiveness in institutional infants. *Monographs of the Society for Research in Child Development*, 1956, **21**, No. 2 (Serial No. 63).

Rheingold, Harriet L. The effect of environmental stimulation upon social and exploratory behaviour in the human infant. In B. M. Foss (Ed.), *Determinants of infant behaviour*. New York: Wiley, 1961. Pp. 143–177.

Riesen, A. H. Plasticity of behavior: psychological aspects. In H. F. Harlow & C. N. Woolsey (Eds.), *Biological and biochemical bases of behavior*. Madison: University of Wisconsin Press, 1958.

Scott, J. P. The process of primary socialization in canine and human infants. *Monographs of the Society for Research in Child Development*, 1963, **28**, No. 1 (Serial No. 85).

Spitz, R. A. Anxiety in infancy: a study of its manifestations in the first year of life. *International Journal of Psycho-analysis*, 1950, **21**, 138–143.

Spitz, R. A., & Wolf, Katherine M. Autoerotism. *Psychoanalytic Study of the Child*, 1949, **3/4**, 85–120.

Wilson, Margaret, Warren, J. M., & Abbott, Lynn. Infantile stimulation, activity, and learning by cats. *Child Development*, 1965, **36**, 843–853.