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SOCIAL BEHAVIOR OF CHILDREN.

The Ohio State Univeristy, Ph.D., 1971
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CHALSA MARY LOO

1971

THE EFFECTS OF SPATIAL DENSITY ON THE
SOCIAL BEHAVIOR OF CHILDREN

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

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The Ohio State University
1971

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TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS	ii-iv
VITA	v-vi
LIST OF TABLES AND FIGURES	viii & ix
 Chapter	
I. INTRODUCTION	1
II. METHOD	16
Experimental Design	
Apparatus	
Subjects	
The Behavioral Rating Form	
Raters and Raters' Training	
Procedure	
III. RESULTS	26
Density and Sex Differences	
Session Differences	
Correlation Matrix	
Mobility and Zone of Activity	
IV. DISCUSSION	60
V. SUMMARY	71
 APPENDIX	
A.	74-75
B.	76-78
C.	79-82
D.	83
BIBLIOGRAPHY	84-86

LIST OF TABLES AND FIGURES

Table	Page
1. Means and Standard Deviations of All Variables for Males, Females and for Both Density Conditions ...	26-27
2. Analysis of Variance for Aggression	28
3. Density Differences Between Means for Aggression for Males and Females	29
4. Analysis of Variance for Dominance	30
5. Density Differences Between Means for Dominance for Males and Females	31
6. Analysis of Variance for Nurturance	32
7. Analysis of Variance for Number of Interruptions .	33
8. Analysis of Variance for Number of Children Interacted With	34
9. Analysis of Variance for Time Spent in Solitary Play	35
10. Analysis of Variance for Time Spent as Onlooker ..	36
11. Analysis of Variance for Time Spent in Group Involvement	37
12. Analysis of Variance for Appeal	37
13. Analysis of Variance for Resistance	38
14. Analysis of Variance for Submission	39
15. Session Differences on All Variables for Low Density	42
16. Session Differences on All Variables for High Density	43
17. Density Differences on All Variables for Session 1.	44
18. Density Differences on All Variables for Session 2.	45
19. Session Differences on All Variables for Both Densities	46
20. Analysis of Variance for All Variables for Session 1.	49-51
21. Correlational Matrix for All Variables	52

LIST OF TABLES AND FIGURES

Figure	Page
1. Diagram of Room	60

INTRODUCTION

The intent of this research study was to examine the behavioral effects of spatial density on young children. This area of study has attracted interest due to the current issue of population growth and the current ecological emphasis in the natural sciences. Very few psychologists, however, have shown an interest in population problems. Moreover, psychology has largely neglected to research the effects of ecological conditions on human behavior even though it is assumed that such conditions have profound effects on psychological dispositions and social interactions (Miller, 1963). In Wohlwill's words,

"Psychologists never tire to point out the importance of stimulus factors as determinants of behavior. Yet, as a group, they have had relatively little to say on the important problems relating to man's response to his physical environment..." (1966, p. 29).

Barker (1969) also notes that questions about the effects of the environment (such as high population density) upon human behavior and development are being asked with increasing urgency and the behavioral sciences, for the most part, do not have answers to them. Similarly, Winkle (1970) writes,

"We must give more attention to concepts like density, privacy, and territoriality, which have been exclusively studied in animals...there is little understanding of the place of density and privacy in shaping our adjustment (or non-adjustment) to our environment." (p. 746)

Ecologists have considered crowding to be a natural outcome of population growth and many of them have issued grave predictions about the devastating effects that crowding will produce. The empirical evidence used by these ecologists is based on animal research yet analogies are made to human behavior. Two such ecologists are Hardin (1964) and Calhoun (1970, 1971); both men point to similarities between the results of animal studies on crowding and the violence and childbeatings in the slums arising from the tensions of a high density condition.

While animal research can provide valuable leads for research on humans, some skepticism must be exercised in accepting analogies from mice to men without researching the effects of population density on humans themselves. It is assumed, after all, that man is a remarkably adaptive animal who can overcome stresses by mechanisms of mental discipline denied to other animals. Furthermore, man has the use of technology at his disposal which allows him to design his environment according to his needs.

In order to study the effects of crowding on humans, variables usually associated with crowding must be controlled. We cannot properly point to Calcutta or the slums of America and assume that

such poor living conditions are a direct and inevitable result of overcrowding. As Sommer (1966) points out, in none of the accounts of overcrowding in man can crowding be legitimately separated from associated phenomenon including low income, inadequate food, lack of education, social prejudice, etc. This criticism is more appropriate to naturalistic studies than to experimental studies.

The intent of this study was to analyze the effects of spatial density (low and high) on several social behaviors of the four and five year old in an experimental setting. Density is defined as the interaction between number of individuals and amount of space. Spatial density is distinguished from social density by the fact that the former involves observing same-sized groups in spaces of differing sizes while the latter involves groups of differing numbers in the same sized space (W. McGrew, 1970). The social behaviors chosen for study were largely guided by previous research and writings on population density both on animals and humans.

Aggression

There has been considerable interest in the effects of density on aggression. Clark (1962) found that voles placed in a high density condition have more scars from fighting. He contended that animals

will resort to aggression in order to maintain a certain amount of space necessary for their well-being.

According to Hall (1969), aggression normally leads to proper spacing of animals, lest they become so numerous as to destroy their environment and themselves along with it. However, it is not certain whether aggression serves this same function for humans in an experimental setting as it does for animals in their natural habitat.

Calhoun's study with Norway rats (1962) showed that many rats failed to suppress their aggression in the highly dense pens. With time, rats discovered ways to suppress tail biting in their fellow mice but the younger rats, who had not learned how to keep their tails from being bitten, were subject to extensive damage. After prolonged observation (1971), Calhoun finds his mice apathetic and without aggression. The younger and rejected mice are an exception. They become aggressive to reduce social contact.

In Hoffmann and Hoffmann (1964), Swift reviewed studies on the effect of amount of space upon incidence of aggressive behavior in the nursery. She concluded that in general, conflicts between children are more numerous where play space is more restricted. Examining her sources directly, however, suggests that Swift's conclusion

is suggested but not conclusive. The three studies cited were Green (1933), Murphy (1937), and Jersild and Markey (1935). The present author did not find that Green concluded any results pertinent to density. Murphy, however, did find that a group of children in a smaller play space (2,000 square feet on the roof of a building) had a greater number of conflicts (number of seizures of property and arguments about property) than a group of children in a larger play space (15,000 square feet on a playground). However, she also notes other differences between the two groups which would confound the variable of space. Ages of children were not equal for the two groups; the former had a 10 month age range while the latter had a 24 month age range. Murphy mentioned that the narrow age range may have resulted in the larger number of conflicts since children closer in age would compete over the same toys. Furthermore, hierarchical relationships would be more difficult to establish in similar aged children. Murphy noted that in the latter group, the presence of the youngest ones (2 year olds) stimulated a variety of "big-brother" behaviors, which would reduce the number of conflicts. Murphy also found that the number of attacks on others was the same for both groups.

Markey (1935) studied imaginative behavior of pre-school children while Jersild and Markey (1935) studied conflicts between these

same Ss. Their post-hoc finding that fewer fights and quarrels as well as more imaginative play occurred among a group of children who had greater play space made the authors infer that first, the relative amount of play space per child might be as important a factor in constructive forms of play as are factors of age and mental status, and second, that a smaller play area results in a greater frequency of conflicts. It should be noted however that the groups Markey was comparing were not matched with respect to age, age range, proportion of boys and girls, mental status, and amount of imaginative behavior evidenced. The group with the large play space that showed fewer fights also showed more imaginative play and had a higher IQ.

This leaves some intriguing and unanswered questions about the relationships among the variables of space, aggression, imaginative play, and intelligence.

Hutt and Vaizey (1966) compared five autistic, five brain-damaged, and five normals for effect of low, medium, and high density conditions on time spent in aggressive-destructive behavior. Ss were 3-8 year olds. A 27' X 17.5' playroom was used. The low density condition consisted of six or fewer Ss in the room; the medium density consisted of seven to eleven Ss in the room; and the high density condition consisted of twelve or more Ss in the room. Other children in the hospital formed the rest of the group while two or three of the Ss were present at any one session. Adults were present

in the free play sessions, two in the low or medium density and three in the high density. It is questionable whether the authors were really analyzing normal children since Ss were hospitalized. Even the normals are questionable since three had just recovered from a minor behavior disturbance. The remaining two were normal siblings of patients. The authors found that the brain-damaged Ss became more aggressive with increasing group density and that the normals became significantly more aggressive under the high group density.

Sommer (1969) pointed out that although some studies make it appear as though increased aggression results from high density conditions, there are instances in man in which this does not occur.

He presented the example of research teams in the Antarctica. Here grouping together in high density situations is a necessity, yet aggressive tendencies are inhibited and an increase in cooperation results. Sommer postulated that this may result from a cognitive awareness that aggression in such a precarious environment will lead to destruction for all.

It may be postulated that survival under high density conditions depends on an inhibition of aggression. Calhoun's finding (1962) that the rats that survived under the overcrowded conditions became less aggressive would support such a postulate. This raises a question

of what might cause members of a group to display less aggression assuming that increased aggression is a more natural consequence of a high density condition.

In the present study, aggressive behavior was defined as: physically attacking another person or toy serving as a person figure; being destructive with toys or equipment, aiming to inflict pain, discomfort, embarrassment, or frustration; being cruel, annoying, mean, criticizing; making another person suffer; being assertive in any hostile or threatening manner.

Because prior research strongly suggests that density has a significant effect on aggression, it was hypothesized that there would be a significant difference at the .05 level between the low and high density conditions on aggressive behavior.

Dominance

Although research on the effects of density on dominance is negligible, a few studies in related areas led the present investigator to suspect that there would be more dominant acts in a high density condition than in a low density condition. Sommer (1969) contended that the clearest dominance orders are found in closed communities with restricted movement and limited space. Elder and Bowerman (1963) had children report on the authoritarianism of their parents. The authors found that the authoritarianism of either parent increased as

the family size increased. Based on these writings, it was hypothesized that there would be a significant difference at the .05 level between the low and high density conditions on dominant behavior.

In the present study, dominance was defined as: aiming to boss, control, lead, direct, prohibit, discipline, pass judgment, give decisions, lay down principles; aiming to be imposing, assertive, authoritative, powerful; trying to command attention; "Do this" or "Don't do that" said in a commanding voice, with an implied "because I say so"; ordering others to do something. Dominance is still dominance whether the other person submits or not. Dominance is frequently verbal, aggression is frequently physical. Observers were instructed to (a) watch to see who eventually possesses a toy desired by more than one child; the child who gets it usually does so through dominance (or aggression), and (b) watch to see how a dispute is resolved; a child who tries to lay down rules or make decisions is being dominant.

Nurturance

Calhoun's research (1962) on Norway rats is perhaps the most noted research on the effects of density on nurturant behavior. Calhoun found that there was a decline in maternal care in high densities, which he maintained was a result of stresses from social interactions. The mortality of the young rats ranged from 80%-96% where density was high compared to 50% where density was low. In the

former case, mothers failed to build nests, protect and nurse their young, and cannibalism among some males was observed.

Relevant research on humans relates size of family to adequacy of infant care. Douglas (1964) found that infant care and infant management were less adequate in larger families in both middle and working classes. The findings of Calhoun and Douglas suggest that there would be less nurturant behavior in a high density condition and that differences due to density would exist. Thus it was hypothesized that there would be a significant difference at the .05 level between the low and high density conditions on nurturant behavior.

In the present study, nurturant behavior was defined as: initiating help or benefit; actively giving to or protecting another; being nice, forgiving, indulgent, kind, sympathetic. Typical behavior: feeding or caring for a doll, putting a moustache or hat on another, returning a toy to some unhappy child who had it taken away by some other child, protecting another from the aggressive blows of another, comforting physically.

Interruptions

It was from his studies on families of the slums that Minuchin (1967) came to hypothesize that overcrowded conditions in large families were probably related to a poorer development of self and identity due to lack of privacy and less individualized responses from

others. If privacy is sacrificed in high density conditions, it seemed likely to the present investigator that interruptions of a member's activities would be more frequent in a high density condition.

In Calhoun's latest unofficial report of his research (1971) he found that female mice in the high density situation could not complete natural behavior acts (sex and other acts of social intercourse) without being interrupted by another and that only the simplest behaviors were carried to completion (eating and drinking). This finding supports the present hypothesis that there would be a significant difference at the .05 level between the low and high density conditions for number of interruptions.

In the present study, interruptions were defined as: distractions or behavior by others which disrupts the activity of the child. Observers were instructed to: (a) watch for a change in the child's attention caused by another's activity, noise, or imposition, and (b) watch for a temporary or permanent shift in attention as evidenced in eye and head movements. The child must be engaged in an activity in order for him to be distracted from it and have it interrupted.

Social Interactions

Research on the effects of density on the frequency of social interactions seem to indicate that social interactions decrease in a high density situation. Calhoun (1962) found a tendency in some of

his male mice to withdraw socially as density increased. Furthermore this tendency seemed related to their survival. Hutt and Vaisey (1966) found that normal children showed progressively and significantly less social interaction with increasing group size although the brain-damaged children showed significantly more. This intriguing difference needs further explanation. Sommer (1969) felt that segregation was a defensive measure that people use to protect themselves from spatial invasions. He felt that segregation served the social function of reducing overt conflicts between members.

The present study examined the effect of density on two aspects of social interactions: first, the number of different children a S interacted with and second, the degree of social involvement of the S. The degree of social involvement was subdivided into three categories representing degrees of social interaction from none, to marginal, to considerable. These three variables were: solitary play (meaning no social involvement, Ss showed interest in his own activity and/or indifference or avoidance of others), onlooker (where S looked at the activity of others without having been an active member or target of others) and group involvement (where S was a functioning member of a group, either a leader or one who took directions from others).

If the frequency of social interactions would be less in a high density, it was expected that this would also be true for number of

children interacted with and degree of group involvement. Prior research suggests that frequency of social interactions declines in a high density condition. Yet, if aggression, dominance, and number of interruptions are greater in the high density condition the result would likely be an increase in social interactions.

It was hypothesized that there would be a significant difference at the .05 level between the low and high density conditions on number of children interacted with. It was further hypothesized that there would be a significant difference at the .05 level between the low and high density conditions in the amount of time spent in solitary play. It was also hypothesized that there would be a significant difference at the .05 level between the low and high density conditions in amount of time spent in group involvement.

In the present study, a social interaction was defined as a condition where the child shows he is aware of the presence of another (or others), as in playing with, talking with, observing. The child behaves with regard to another (others) and the other(s) has a direct effect on the child.

Appeal

There has been no research on the effect of density on appealing behavior. The present investigator assumed that if a high density condition was more stressful for its inhabitants, there would be more

complaining and appeals for help. Thus it was hypothesized that there would be a significant difference at the .05 level between the low and high density conditions for appeal.

In the present study, appeal was defined as: seeking help, guidance, affection, sympathy; indicating a need or making a personal request said in a dependent manner. Example: A child complains, "I feel awful. Will you tell the teacher I want to go home?"

Resistance and Submission

No research has been done on the effects of density on resistant and submissive behavior. Since initiated acts such as dominance, aggression, nurturance, and appeal were being examined, the variables of resistance and submission were included on the basis of their being reactive behaviors to the initiated ones. It was hypothesized that there would be significant differences at the .05 level between the low and high density conditions on resistance and on submission.

In the present study, resistance was defined as: being unyielding to dominance, aggression, appeal, or action of any kind which exerts social pressure; defending oneself physically or verbally; withholding compliance, actively ignoring demands or requests; refusing; being stubborn.

Submission was defined as: giving in to dominance, aggression,

appeal, or action of any kind which exerts social pressure; letting another have his way in order to ease the pressure on himself. Typical behavior: relinquishing toys to a child who demands or requests them; obeying another's directions; "taking" criticism. Submission is a response to another's behavior.

Statement of Hypotheses

Hypotheses I-X state that there will be a significant difference at the .05 level between the low and high density conditions on ratings of the following variables: (a) aggression, (b) dominance, (c) nurturance, (d) number of interruptions, (e) number of children played with, (f) solitary play, (g) group involvement, (h) appeal, (i) resistance, and (j) submission.

METHOD

Experimental Design

A repeated measures design was used in which Ss served as their own controls by undergoing both density conditions (low and high). This design was chosen because individual differences between Ss and differences between groups of Ss appeared great in the pre-test sessions. For example, one group was extremely aggressive due to the presence of one aggressive boy and the retaliative effect he had on others, while another group was quiet and cooperative. A repeated measures design controls for differences between Ss and between groups and increases sensitivity by reducing variance due to experimental error.

The order of administration of low and high density conditions was counter-balanced in order to prevent order effects from being confounded with treatments. Thus, order effects were spread over all treatment effects. Five groups underwent the low density condition on the first day and the high density condition on the second day; the other five groups underwent the high density condition on the first day and the low density condition on the second day. Where more than

one group came from the same school, density-order assignments were equally made.

A disadvantage of the repeated measures design is that if the effects of an immediately preceding condition affect the second condition, counter-balancing does not remove these effects. For instance, a group having first undergone the low density condition may find the high density condition more crowded relative to the first day than a group having first undergone the high density condition. Similarly, a group having first undergone the high density condition may find the low density condition more spacious than the group having first undergone the low density condition. In essence then, order effects would be confounded with density-change effects. Nevertheless, certain statistical analysis can indicate, to a limited extent, whether carry-over effects due to order and/or density-change are negligible or considerable. A t -test for density differences on session one compared to those on session two would suggest whether a density-change effect exists. A t -test for session differences for low density and a t -test for session differences for high density would uncover any great differences that might exist, even though it could not exactly be determined whether the differences are due to order effects or density-change effects. An analysis of variance for session one alone would remove such effects, although it would introduce greater

variance due to experimental error; in other words, differences between groups would mask treatment effects.

Apparatus

The setting for this research was a room which measured 15'X20' minus two insets (30'X19" and 45'X48") making a total area of 265.1 square feet. Portable wooden walls, painted and designed to match the walls of the room, were built, which when erected would reduce the room area to about 1/3 its original area or 90 square feet. The portable walls measured 7'-1/2"X12". The original room was used for the low density condition and the portable walls were installed for the high density condition. The room was equipped with a one-way mirror and microphones hanging from the ceiling, permitting the Ss to be seen and heard in the adjoining room.

The decorations and toys were identical for both room sizes. The wall decorations consisted of the following: (a) several cut-outs of space men and space equipment taped to the south wall, (b) two large felt sheets-red and yellow-taped from ceiling to floor on the west wall, (c) several cut-outs of family members leaning against the north wall, and (d) a clothes-line strung beneath the one-way mirror on the east wall.

All toys were located in a constant location for every session. The toys contained in the room were the following: one hoppity horse,

one rifle, one pistol, one play farm set, two plastic tubes, one baby doll set, one play house set, one dappity dan, one large raggedy ann, five finger puppets, one play camper, one large stuffed dog, two play telephones, one tea set, one make-up set, one nurse's kit, four small cars, one basket full of balloons, and several masks, leis, and hats (queen, bush, pirate, parade, etc.) hung to the clothes-line. In selecting the toys, preference was given to toys that accommodated the range of social behaviors being investigated, that permitted solitary or interaction play, and that were attractive and safe.

Subjects

Ss for this study were 60 children four and five years of age, 30 of whom were male and 30 of whom were female. Ss were designated as normal and from largely middle-class families by their teachers. All Ss were from schools in Columbus, Ohio; 12 Ss were in kindergarten and 48 Ss were in preschool.

Each group of Ss was comprised of six children, three girls and three boys. In order to hasten natural interactions, all Ss in each group were from the same classroom. This way, no S was a stranger to his group. There was a total of ten groups. Each group came for two sessions, one session per day for two consecutive days. Each session lasted 48 minutes for experimental time and approximately 1-1/2 hours including travel, preparation, and termination time.

The low density condition, in which six Ss occupy an area of 265.1 square feet, allowed 44.2 square feet per person. The high density condition, in which six Ss occupy an area of 90 square feet, allowed 15 square feet per person.

The Behavioral Rating Form

The behavioral rating form (see Appendix A) was revised several times during the practice sessions until it could be used by the raters in the most clear and efficient manner. Revisions were also made where items proved unsatisfactory. A degree of affect item, in which a S was rated on a scale comprised of points designated as "strongly positive," "mildly positive," "neutral," "mildly negative," and "strongly negative", was eliminated. Observations made indicated a lack of variation among the scale points; there was an excessive loading in the "mildly positive" category making the item less differentiating than desired. Another variable eliminated was "avoidance;" too few instances were found to justify raters' attention to that variable.

The degree of group involvement item was condensed from six to three categories. Two "no interaction" categories were condensed into one. Raters found it difficult to distinguish among "functioning member of a group," "joint leader," and "single leader." Conse-

quently these three categories were condensed into one, "group involvement."

Ratings of dominance, aggression, resistance, submission, nurturance, and appeal were made into a frequency count, indicated by hatch marks, rather than observational periods of one minute for two variables at a time. This allowed ratings of any of the six categories at any one time resulting in greater ranges of scores, longer observational time per variable, and more categories that simultaneously had to be kept in mind by raters. A degree of presence rating comprised of "not present", "slight", "moderate", and "strong" was also eliminated because of the ambiguity it caused.

Frequency indicated by hatch marks were also incorporated into items one and two (number of children interacted with and number of interruptions) since it required less time to rate than a multiple choice format. The rating form was condensed to two pages; page one required frequency counts while page two required one rating per minute.

Raters and Raters' Training

There were six observational raters, three male and three female. In addition, there were two substitute raters who alternately took the place of one of the female raters who had to terminate midway through the study.

All raters were trained for seven days, one session per day.

The training included observation and rating of children and a group discussion prior to or following the session. During the training observations, all raters observed the same S, although altering Ss frequently; this was done for reliability and comparative purposes.

The first day of training consisted of first, discussing the definitions form (see Appendix B) and rating form, and second, observing one S at a time. Raters also were designated specific responsibilities regarding experimental set-up; i. e., greeting and removing Ss' coats, attaching identification numbers to the Ss, setting up toys after each session, preparing rating forms for all raters, rewinding the tape recorder, and serving juice and crackers to the Ss at the end of each experimental session.

The second day of training consisted of having all raters observe for interactions and interruptions. Raters practiced using the rating form, discussed what they had observed, and reviewed the definitions.

On the third day of training, raters verbally identified social interaction variables when they occurred. Also, the E verbally labelled behavior as it was evidenced. All raters then rated Ss silently for the remainder of the time.

The next four days of training were pre-testing. Reliability measures were taken for each day, and feedback was given to the raters about their collective reliability for individual variables and any extremes in rating for individual raters. One group of Ss atten-

ded the first two days and a separate group attended the last two days. One S in the first group was sick on the second day.

Reliability of ratings on all variables was calculated using the intraclass correlation formula (Ebel, 1951) for the last two days of pre-training. The reliability coefficients were: aggression, $r=.58$; dominance, $r=.74$; nurturance, $r=.60$; number of interruptions, $r=.50$; number of children interacted with, $r=.56$; solitary play, $r=.91$; onlooker, $r=.71$; group member, $r=.87$, appeal, $r=.33$, resistance, $r=.80$; and submission, $r=.60$. The two items with the lowest reliabilities were the least frequently observed behavior (appeal) and the most frequently observed behavior (interruptions). Judging from the fact that the highest reliabilities occurred among the items that were rated on a specified timed basis (solitary play, onlooker, and group involvement) it seemed that continual ratings (as used on the other items) were more susceptible to rater differences, resulting in lower reliabilities.

Day to day variations in the reliability of each variable were noticeable. Furthermore, reliability was sensitive to agreement by all raters, so that differences by just one rater (due to physical discomfort or differences in perceptions) often caused the low reliabilities. This liability was partially offset by the fact that the score for a S on any variable was a sum of all raters' ratings, each S being rated an equal amount of time by each rater. Thus, any rater biases would be

equally distributed among Ss. A pin wheel was attached to the mirror in the adjoining room, with raters' names on the outer circle and Ss' numbers on the inner circle. Each rater observed the S under his name. After every eight minutes the inner circle rotated, thus re-assigning a new S to each rater.

Procedure

Ss were picked up at their school and driven to the experimental setting by the E or in a few cases by the director of that preschool. The preparation period consisted of greeting the Ss, removing their coats, and attaching a numbered tag on the front and back of each S. The E then took the Ss to the toilets while the raters prepared to rate behavior. The E then brought the Ss into the play room and gave the following instructions:

"This is your playroom and you can play with anything in this room. You will come to play here for two days, today and tomorrow. You will play for about an hour and when the time is up, I will come back to get you. Then we will go next door and have juice and crackers. OK? I will be right next door. Go ahead and play."

A tape recorder in the adjoining room gave instructions to the raters as follows:

"We are now ready to begin. Be sure S's number, rater's name, session number, and observational period are filled in on your rating form. The pin wheel indicates which S you are to be rating. A "beep" will sound after each minute. When you

hear a "beep", turn to page two and rate for "group involvement." When you have finished rating page two, return to page one and continue rating behavior. For each S you will hear a total of eight "beeps." After the eighth "beep" the pin wheel will rotate and you will rate the new S under your name. The pin wheel will rotate a total of six times, so that you will have rated each S once at the end of this session. Ready, begin."

The E oversaw the experiment and made general observation notes for each session. The general observations are listed in Appendix C. The E also watched for the safety of the Ss, rotated the pin wheel, and responded to Ss who opened the door. Since the door could be opened from the inside, Ss sometimes opened the door for information or to appeal for help. The E went to the door, quickly solved what problems arose in as non-interfering a way as possible, and told the S to stay in the room until their play time was up. If a S needed to go to the toilet the E took him; this reduced observational time for that S from one to three minutes.

Termination procedures consisted of serving Ss juice and crackers, reminding them that they would return tomorrow, and returning them to school. After the second day, thank you notes were sent home with the Ss.

RESULTS

Density and Sex Differences

The means and standard deviations of all variables for male, female, and all Ss and for low, high, and both densities are presented in Table 1.

TABLE 1

MEANS AND STANDARD DEVIATIONS OF ALL VARIABLES FOR
MALES, FEMALES, AND FOR BOTH DENSITY CONDITIONS

		LOW		HIGH		TOTAL	
		<u>X</u>	<u>σ</u>	<u>X</u>	<u>σ</u>	<u>X</u>	<u>σ</u>
No. Children Interacted With	F	21.60	4.65	20.33	4.05	20.97	4.402
	M	23.80	3.20	21.53	2.90	22.67	3.26
	All <u>Ss</u>	22.70	4.18	20.93	3.59		
No. Interrup- tions	F	35.30	9.64	39.36	6.83	37.33	8.60
	M	29.13	4.97	33.33	8.41	31.23	7.22
	All <u>Ss</u>	32.22	8.33	36.35	8.30		
Dominance	F	10.46	8.51	14.90	12.53	12.68	10.94
	M	15.63	10.96	14.93	7.09	15.28	9.23
	All <u>Ss</u>	13.05	10.23	14.92	10.26		
Aggression	F	5.76	5.51	5.26	4.01	5.52	4.83
	M	20.23	14.22	12.20	9.34	16.20	12.69
	All <u>Ss</u>	13.00	13.07	8.73	8.07		
Resistance	F	6.90	4.34	6.53	3.26	6.72	3.84
	M	7.50	3.99	7.63	3.62	7.57	3.81
	All <u>Ss</u>	7.20	4.21	7.08	3.52		
Submission	F	9.73	5.03	8.90	4.77	9.32	4.92
	M	9.50	5.02	9.40	4.56	9.45	4.80
	All <u>Ss</u>	9.62	5.07	9.15	4.72		

		LOW		HIGH		TOTAL	
		<u>X</u>	<u>o</u>	<u>X</u>	<u>o</u>	<u>X</u>	<u>o</u>
Nurturance	F	7.26	4.32	7.66	4.86	7.47	4.60
	M	4.30	4.21	4.13	2.91	4.21	3.62
	All <u>Ss</u>	5.78	4.55	5.90	4.41		
Appeal	F	4.20	3.22	4.26	3.32	4.23	3.27
	M	3.36	2.56	3.60	2.37	3.48	2.47
	All <u>Ss</u>	3.78	2.96	3.83	2.92		
Solitary Play	F	12.53	8.16	14.50	6.61	13.52	7.49
	M	11.16	7.19	14.00	6.72	12.58	7.10
	All <u>Ss</u>	11.85	7.79	14.25	6.72		
Onlooker	F	9.76	6.60	9.66	4.84	9.72	5.79
	M	7.86	4.27	8.50	5.27	8.18	4.81
	All <u>Ss</u>	8.82	5.69	9.08	5.14		
Group Involvement	F	25.13	10.20	23.70	8.63	24.42	9.47
	M	28.76	9.27	24.96	7.22	26.87	8.53
	All <u>Ss</u>	26.95	10.00	24.33	8.05		

F = 30

M = 30

A two-factor analysis of variance with repeated measures was carried out on density and sex for all variables. The analysis of variance for aggression is presented on Table 2. For aggression, both the main effects for density and sex were significant ($F=12.430$, $p < .001$; $F=26.508$, $p < .001$ respectively), as well as the interaction between density and sex ($F=9.688$, $p < .005$). There were significantly more aggressive acts in the low density condition than in the high density condition. This confirmed Hypothesis I which stated that there would be a significant difference between the low and high density conditions on aggressive behavior. Furthermore boys

displayed more aggressive acts than did girls. The correlation between sex and aggression was greater in the low density condition than in the high ($r=.56$ and $.43$ respectively).

TABLE 2
ANALYSIS OF VARIANCE FOR AGGRESSION

SOURCE	SS	DF	MS	F
BETWEEN SUBJECTS	10949.867	59		
Sex (A)	3434.700	1	3434.700	26.588***
Subjects within Groups	7515.167	58	129.572	
WITHIN SUBJECTS	3520.000	60		
Density (B)	546.133	1	546.133	12.430***
Interaction (A X B)	425.633	1	425.633	9.688**
B x Subjects within Groups	2548.233	58	43.935	

** $p < .005$

*** $p < .001$

To analyze the interactive effect between density and sex, a paired t -test was used to test for significant differences between mean ratings on aggression in the low and high density conditions for males and females separately. Table 3 shows that for boys, there was a significant difference in mean ratings of aggression in the low and high density conditions ($t=3.680$, $p < .001$). For girls, however, there was no significant difference in mean ratings of aggression in the low and high density conditions. Thus, while aggression in girls did not significantly differ between densities, aggression in boys sig-

nificantly increased in the low density condition and decreased in the high density condition (see Appendix D).

TABLE 3
DENSITY DIFFERENCES BETWEEN MEANS FOR AGGRESSION
FOR MALES AND FEMALES

FEMALES					
VARIABLE	DENSITY CONDITION	MEAN	STANDARD DEVIATION	<u>t</u>	<u>p</u>
Aggression	Low	5.766	5.605		
	High	5.266	4.076	.476	--
MALES					
Aggression	Low	20.233	14.421		
	High	12.200	9.539	3.689	.001
N = 30					
df = 29					

The analysis of variance for dominance is presented on Table 4. There was no significant main effect for density, thus failing to confirm Hypothesis II which stated that there would be a significant difference between low and high density conditions on dominant behavior. There was also no significant main effect for sex on dominance. There was, however, a significant interactive effect between density and sex on dominance ($F=4.219$, $p < .05$).

TABLE 4

ANALYSIS OF VARIANCE FOR DOMINANCE

SOURCE	SS	DF	MS	F
BETWEEN SUBJECTS	9474.967	59		
Sex (A)	202.800	1	202.800	1.269
Subjects within Groups	9272.167	58	159.865	
WITHIN SUBJECTS	3019.000	60		
Density (B)	104.533	1	104.533	2.232
Interaction (A X B)	197.633	1	197.633	4.219*
B x Subjects within Groups	2716.833	58	46.842	

* $p < .05$

A paired t -test was used to test for significant differences between mean ratings on dominance in the low and high density condition for males and females separately. Table 5 shows that for girls, there was a significant difference in mean ratings on dominance in the low and high density conditions ($t = -2.672$, $p < .025$). For boys, however, there was no significant difference between mean ratings on dominance in the low and high density conditions. Thus, while dominance in boys did not significantly differ between densities, dominance in girls significantly decreased in the low density condition and increased in the high density condition (see Appendix D).

TABLE 5
DENSITY DIFFERENCES BETWEEN MEANS FOR DOMINANCE
FOR MALES AND FEMALES

FEMALES					
VARIABLE	DENSITY CONDITION	MEAN	STANDARD DEVIATION	<u>t</u>	<u>p</u>
Dominance	Low	10.466	8.657	-2.672	.025
	High	14.900	12.739		
MALES					
Dominance	Low	15.633	11.143	0.372	--
	High	14.933	7.210		
n = 30					
df = 29					

Since the high density condition resulted in a decrease in aggression among males and an increase in dominance among females, a product-moment correlation was used to investigate whether an increase in dominance in females was related to a decrease in aggression in males. For each group, difference scores between low and high densities for girls and for boys in each group were correlated. The correlation between female dominance and male aggression was not significant ($r = .23$). A change in dominance among females was correlated with a change in dominance among males ($r = .80$, $p < .01$), and a change in aggression among females was correlated with a change in aggression among males ($r = .78$, $p < .01$).

The analysis of variance for nurturance is presented in Table 6. The main effect for density on nurturance was not significant, thus failing to confirm Hypothesis III which stated that there would be a significant difference between low and high density conditions on nurturant behavior. The main effect for sex, however, was significant ($F=15.219$, $p < .001$), indicating that girls were significantly more nurturant than boys. The correlation between sex and nurturance was greater in the high density condition than in the low ($r = -.40$ and $-.33$ respectively). There was no significant interactive effect for density and sex on nurturance.

TABLE 6
ANALYSIS OF VARIANCE FOR NURTURANCE

SOURCE	SS	DF	MS	F
BETWEEN SUBJECTS	1524.492	59		
Sex (A)	316.875	1	316.875	15.219***
Subjects within Groups	1207.617	58	20.821	
WITHIN SUBJECTS	849.500	60		
Density (B)	.408	1	.408	.028
Interaction (A X B)	2.408	1	2.408	.165
B x Subjects within Groups	846.683	58	14.598	

*** $p < .001$

The analysis of variance for number of interruptions is presented in Table 7. There was a significant main effect for density on number of interruptions ($F=9.090$, $p < .005$). There were significantly more interruptions of a S's activity in the high density than the low density condition. This result confirmed Hypothesis IV which stated that there would be a significant difference between low and high density conditions on number of interruptions. There was also a significant main effect for sex on number of interruptions ($F=17.169$, $p < .001$), indicating that girls were more frequently interrupted than boys. The correlation between sex and interruptions was the same in both densities ($r = -.37$). There was no significant interactive effect for density and sex on number of interruptions.

TABLE 7
ANALYSIS OF VARIANCE FOR NUMBER OF INTERRUPTIONS

SOURCE	SS	DF	MS	F
BETWEEN SUBJECTS	4887.367	59		
Sex (A)	1116.300	1	1116.300	17.169***
Subjects within Groups	3771.067	58	65.018	
WITHIN SUBJECTS	3783.000	60		
Density (B)	512.533	1	512.533	9.090**
Interaction (A X B)	.133	1	.133	.002
B x Subjects within Groups	3270.333	58	56.385	

** $p < .005$

*** $p < .001$

The analysis of variance for number of children interacted with is presented in Table 8. There was a significant main effect for density ($F=14.643$, $p < .001$), indicating that Ss interacted with significantly more children in the low density condition than in the high density condition. This result confirmed Hypothesis V which stated that there would be a significant difference between low and high density conditions on number of children interacted with. There was no significant main effect for sex and no significant interactive effect for density and sex.

TABLE 8

ANALYSIS OF VARIANCE FOR NUMBER OF CHILDREN
INTERACTED WITH

SOURCE	SS	DF	MS	<u>F</u>
BETWEEN SUBJECTS	1413.967	59		
Sex (A)	86.700	1	86.700	3.789
Subjects within Groups	1327.267	58	22.884	
WITHIN SUBJECTS	472.000	60		
Density (B)	93.633	1	93.633	14.643***
Interaction (A X B)	7.500	1	7.500	1.173
B x Subjects within Groups	370.867	58	6.394	

*** $p < .001$

The analysis of variance for solitary play is presented in Table 9. There was a significant main effect for density ($F=4.943$, $p < .05$), indicating that significantly more time was spent in solitary play in

the high density condition than in the low density condition. This result confirmed Hypothesis VI which stated that there would be a significant difference for low and high density conditions on amount of time spent in solitary play. There was no significant main effect for sex and no significant interactive effect for density and sex on time spent in solitary play.

TABLE 9
ANALYSIS OF VARIANCE FOR TIME SPENT IN SOLITARY
PLAY

SOURCE	SS	DF	MS	F
BETWEEN SUBJECTS	4213.700	59		
Sex (A)	26.133	1	26.133	.362
Subjects within Groups	4187.567	58	72.199	
WITHIN SUBJECTS	2206.000	60		
Density (B)	172.800	1	172.800	4.943*
Interaction (A X B)	5.633	1	5.633	.161
B x Subjects within Groups	2027.567	58	34.958	

* $p < .05$

The analysis of variance for onlooker is presented in Table 10. There was no significant main effect for density, no significant main effect for sex, and no significant interactive effect for density and sex on time spent as an onlooker.

TABLE 10

ANALYSIS OF VARIANCE FOR TIME SPENT AS ONLOOKER

SOURCE	SS	DF	MS	F
BETWEEN SUBJECTS	2782.700	59		
Sex (A)	70.533	1	70.533	1.508
Subjects within Groups	2712.167	58	46.761	
WITHIN SUBJECTS	683.000	60		
Density (B)	2.133	1	2.133	.183
Interaction (A X B)	4.033	1	4.033	.346
B x Subjects within Groups	676.833	58	11.670	

The analysis of variance for group involvement is presented in Table 11. There was a significant main effect for density ($F = 4.367$, $p < .05$), indicating that significantly more time was spent in group involvement in the low density condition than in the high density condition. This result confirmed Hypothesis VII which stated that there would be a significant difference between the low and high density conditions on time spent in group involvement.

TABLE 11
ANALYSIS OF VARIANCE FOR TIME SPENT IN GROUP
INVOLVEMENT

SOURCE	SS	DF	MS	F
BETWEEN SUBJECTS	7445.425	59		
Sex (A)	205.408	1	205.408	1.646
Subjects within Groups	7240.017	58	124.828	
WITHIN SUBJECTS	2602.500	60		
Density (B)	180.075	1	180.075	4.367*
Interaction (A X B)	31.008	1	31.008	.752
B x Subjects within Groups	2391.417	58	41.231	

* $p < .05$

The analysis of variance for appeal is presented in Table 12.

There was no significant main effect for density, thus failing to confirm Hypothesis VIII, which stated that there would be a significant difference for low and high density conditions on appealing behavior. There was also no significant main effect for sex and no significant interactive effect for density and sex on appeal.

TABLE 12
ANALYSIS OF VARIANCE FOR APPEAL

SOURCE	SS	DF	MS	F
BETWEEN SUBJECTS	549.092	59		
Sex (A)	16.875	1	16.875	1.839
Subjects within Groups	532.217	58	9.176	
WITHIN SUBJECTS	475.500	60		
Density (B)	.675	1	.675	.082
Interaction (A X B)	.208	1	.208	.025
B x Subjects within Groups	474.617	58	8.183	

The analysis of variance for resistance is presented in Table 13.

There was no significant main effect for density, thus failing to confirm Hypothesis IX, which stated that there would be a significant difference for low and high density conditions on resistant behavior.

There was also no significant main effect for sex and no significant interaction effect for density and sex on resistance.

TABLE 13

ANALYSIS OF VARIANCE FOR RESISTANCE

SOURCE	SS	DF	MS	F
BETWEEN SUBJECTS	1147.092	59		
Sex (A)	21.675	1	21.675	1.117
Subjects within Groups	1125.417	58	19.404	
WITHIN SUBJECTS	631.500	60		
Density (B)	.408	1	.408	.038
Interaction (A X B)	1.875	1	1.875	.173
B x Subjects within Groups	629.217	58	10.849	

The analysis of variance for submission is presented on Table 14.

There was no significant main effect for density, thus failing to confirm Hypothesis X, which stated that there would be a significant difference between the low and high density conditions on submission.

There was also no significant main effect for sex and no significant interactive effect for density and sex on submission.

TABLE 14

ANALYSIS OF VARIANCE FOR SUBMISSION

SOURCE	SS	DF	MS	F
BETWEEN SUBJECTS	1482.200	59		
Sex (A)	.033	1	.033	.001
Subjects within Groups	1482.167	58	25.555	
WITHIN SUBJECTS	1257.000	60		
Density (B)	12.033	1	12.033	.561
Interaction (A X B)	1.200	1	1.200	.056
B x Subjects within Groups	1243.767	58	21.444	

Session Differences

An analysis of the differences between the first and the second sessions was done for the low and high density conditions using an unpaired t-test. The data for the low density condition are presented in Table 15. There were no significant session differences for any of the variables, indicating that the behavior of Ss in the low density condition who had previously undergone the high density condition did not differ significantly from the behavior of Ss who had undergone the low density first. Possible carry-over effects, such as decreasing density or greater familiarity with the project or with each other, did not significantly alter behavior.

The data for session differences for the high density condition are presented on Table 16. There were no significant session differences

for number of children interacted with, number of interruptions, aggression, submission, nurturance, appeal, and onlooker behavior. There were, however, significant differences for solitary play and group involvement between the first and second sessions ($t = 4.091$, $p < .001$ and $t = -2.706$, $p < .01$ respectively). In the high density condition, the correlation between session and solitary play was $-.48$ and that between session and group involvement was $.34$. There was significantly more group play and less solitary play among the Ss who underwent the high density condition following the low density condition than among the Ss who first underwent the high density condition. Since the analysis of variance indicated that there was significantly more solitary play and less group involvement in the high density condition than in the low, and because there was less solitary play and more group involvement among the Ss who had first undergone the low density, the density differences were greater in the first session than in the second for these two variables.

In line with this finding, an unpaired t-test was used to analyze the density differences for each session separately. Table 17 presents the density differences on all variables for session one. In the first session, there were significantly more interruptions, more solitary play and less aggression in the high density condition than in the low ($t = -2.431$, $p < .05$; $t = 2.148$, $p < .05$; and $t = 2.241$, $p < .05$ respectively). Table 18, in comparison, presents the density differences

on all variables for session two and demonstrates that no significant differences were found between the high and low densities. This indicates that due to a density change and/or an order effect, differences in number of interruptions, aggression, solitary play, and group involvement in the high and low conditions were lessened. From these results it certainly cannot be argued that a density change would exaggerate the feeling of crowdedness or spaciousness relative to what had been experienced previously. Had that been so, the results would have demonstrated density differences to be greater in session two than in session one when in fact this was not the case.

Session differences on all variables for both densities were calculated using a paired t-test and are presented on Table 19.

TABLE 15

SESSION DIFFERENCES ON ALL VARIABLES
FOR LOW DENSITY

Variable	Session	Mean	Standard Deviation	t	p
Aggression	1	13.566	15.622	0.329	---
	2	12.433	10.146		
Dominance	1	11.966	7.356	-0.808	---
	2	14.133	12.506		
Nurturance	1	5.066	4.363	-1.210	---
	2	6.500	4.703		
No. Interruptions	1	32.433	8.358	0.197	---
	2	32.000	8.444		
No. Children Interacted With	1	22.166	4.148	-0.977	---
	2	23.233	4.217		
Solitary Play	1	13.333	8.376	1.473	---
	2	10.366	6.981		
Onlooker	1	8.533	4.117	-0.379	---
	2	9.100	6.974		
Group Involvement	1	25.700	9.854	-0.956	---
	2	28.200	10.148		
Appeal	1	3.533	3.170	-0.643	---
	2	4.033	2.773		
Resistance	1	6.266	4.136	-1.725	---
	2	8.133	4.150		
Submission	1	8.366	3.909	-1.933	---
	2	10.866	5.806		

n_x = 30n_y = 30

df = 58

TABLE 16

SESSION DIFFERENCES ON ALL VARIABLES
FOR HIGH DENSITY

Variable	Session	Mean	Standard Deviation	t	p
Aggression	1	6.900	6.171	-1.750	---
	2	10.533	9.387		
Dominance	1	13.200	10.655	-1.288	---
	2	16.633	9.729		
Nurturance	1	5.933	4.563	0.057	---
	2	5.866	4.337		
No. Interruptions	1	37.866	8.739	1.411	---
	2	34.833	7.680		
No. Children Interacted With	1	20.300	3.931	-0.924	---
	2	21.233	3.795		
Solitary Play	1	17.433	5.277	4.091	.001
	2	11.066	6.571		
Onlooker.	1	8.533	4.805	-0.817	---
	2	9.633	5.474		
Group Involvement	1	21.633	7.195	-2.706	.01
	2	27.033	8.054		
Appeal	1	3.233	2.514	-1.593	---
	2	4.433	3.213		
Resistance	1	6.800	3.438	-0.612	---
	2	7.366	3.635		
Submission	1	9.666	4.072	0.837	---
	2	8.633	5.301		

$n_x = 30$

$n_y = 30$

$df = 58$

TABLE 17

DENSITY DIFFERENCES ON ALL VARIABLES FOR
SESSION 1

Variable	Density Condition	Mean	Standard Deviation	t	p
Aggression	Low	13.566	15.622	2.148	.05
	High	6.900	6.171		
Dominance	Low	11.966	7.356	-0.515	---
	High	13.200	10.655		
Nurturance	Low	5.066	4.363	-0.743	---
	High	5.933	4.563		
No. Interruptions	Low	32.433	8.358	-2.431	.02
	High	37.866	8.739		
No. Children Interacted With	Low	22.166	4.118	1.545	---
	High	20.633	3.420		
Solitary Play	Low	13.333	8.376	-2.241	.05
	High	17.433	5.277		
Onlooker	Low	8.533	4.117	0.000	---
	High	8.533	4.805		
Group Involvement	Low	25.700	9.854	1.804	---
	High	21.633	7.195		
Appeal	Low	3.533	3.170	0.401	---
	High	3.233	2.514		
Resistance	Low	6.266	4.136	-0.537	---
	High	6.800	3.438		
Submission	Low	8.366	3.909	-1.246	---
	High	9.666	4.072		

n_x = 30n_y = 30

df = 58

TABLE 18
DENSITY DIFFERENCES ON ALL VARIABLES FOR
SESSION 2

Variable	Density Condition	Mean	Standard Deviation	t	p
Aggression	Low	12.433	10.146	0.732	---
	High	10.566	9.350		
Dominance	Low	14.133	12.506	-0.854	---
	High	16.633	9.729		
Nurturance	Low	6.500	4.703	0.536	---
	High	5.866	4.337		
No. Interruptions	Low	32.000	8.444	-1.343	---
	High	34.833	7.680		
No. Children Interacted With	Low	23.233	4.217	1.910	---
	High	21.233	3.795		
Solitary Play	Low	10.366	6.981	-0.395	---
	High	11.066	6.571		
Onlooker	Low	9.100	6.974	-0.325	---
	High	9.633	5.474		
Group Involvement	Low	28.200	10.148	0.487	---
	High	27.033	8.054		
Appeal	Low	4.033	2.773	-0.510	---
	High	4.433	3.213		
Resistance	Low	8.133	4.150	0.752	---
	High	7.366	3.635		
Submission	Low	10.866	5.806	1.537	---
	High	8.633	5.301		

$n_x = 30$

$n_y = 30$

$df = 58$

TABLE 19
SESSION DIFFERENCES ON ALL VARIABLES
FOR BOTH DENSITIES

Variable	Session	Mean	Standard Deviation	t	p
Aggression	1	10.233	12.246	-0.898	---
	2	11.500	9.718		
Dominance	1	12.583	9.098	-2.230	.01
	2	15.383	11.179		
Nurturance	1	5.500	4.447	-0.991	---
	2	6.183	4.496		
No. Interruptions	1	35.150	8.907	1.192	---
	2	33.416	8.128		
No. Children Interacted With	1	21.400	3.845	-1.649	---
	2	22.233	4.101		
Solitary Play	1	15.383	7.241	4.980	.001
	2	10.716	6.729		
Onlooker	1	8.533	4.435	-1.355	---
	2	9.366	6.221		
Group Involvement	1	23.666	8.796	-3.523	.001
	2	27.616	9.102		
Appeal	1	3.383	2.840	-1.672	---
	2	4.233	2.982		
Resistance	1	6.533	3.779	-2.106	.01
	2	7.750	3.886		
Submission	1	9.016	4.010	-0.882	---
	2	9.750	5.625		

n = 60

df = 59

A two-factor analysis of variance with no repeated measures for session one was performed for comparative purposes with the analysis of variance with repeated measures for sessions one and two combined.

An analysis of variance for session one alone would provide the advantage of removing order or density-change effects but introduce the disadvantage of greater differences between groups, thus masking treatment effects. The analyses of variance for all variables for session one are presented in Table 20.

The analysis of variance for aggression in session one was consistent with that done for both sessions; there was a significant main effect for density ($F = 6.17$, $p < .025$), for sex ($F = 14.08$, $p < .001$), and for density-sex interaction ($F = 5.69$, $p < .025$).

The analysis of variance for dominance in session one differed from that done for both sessions in that the interactive effect for density and sex was not significant. This is likely due to the greater density differences in dominance in session two and to the greater incidence of dominance in session two.

The analysis of variance for nurturance in session one was consistent with that done for both sessions. There was a significant effect for sex ($F = 11.33$, $p < .005$).

The analysis of variance for interruptions in session one yielded results which were consistent with those found for both sessions;

there was a significant main effect for density ($F=6.52$, $p < .025$) and for sex ($F=6.05$, $p < .025$).

The analysis of variance for number of children interacted with in session one differed from that done on both sessions. The main effect for density in both sessions was not significant for session one alone. Furthermore, there was a significant effect for sex in session one ($F=4.324$, $p < .05$), indicating that boys interacted with more children than did girls. There was no significant effect for sex in both sessions combined.

The analysis of variance for solitary play in session one was consistent with that performed for both sessions; there was a significant effect for density ($F=5.354$, $p < .025$).

The analysis of variance for onlooker in session one differed from that in both sessions combined. There were no significant effects for both sessions whereas sex and the interactive effect were significant for session one ($F=4.003$ and $F=4.003$, $p < .05$ respectively). Girls were more frequently onlookers. In the low density condition no difference existed between boys and girls regarding time spent as an onlooker. In the high density condition, however, girls spent more time as onlookers while boys spent less time.

The analysis of variance for group involvement in session one did not indicate a significant effect for density, contrary to the results from both sessions. This is likely due to the increase in group in-

volvement in session two. In session one there was a significant effect for sex ($F = 4.474$, $p < .05$); boys played in groups more frequently than girls. This effect was not significant for both sessions combined.

The analysis of variances for appeal, resistance, and submission for session one were consistent with those for both sessions.

TABLE 20
ANALYSIS OF VARIANCE FOR SESSION ONE

AGGRESSION				
SOURCE	SS	DF	MS	F
Density	666.663	1	666.663	6.173*
Sex	1520.066	1	1520.066	14.076***
Interaction	614.399	1	614.399	5.689*
Error	6047.606	56	107.993	

* $p < .025$

*** $p < .001$

DOMINANCE				
Density	22.817	1	22.817	0.274
Sex	156.817	1	156.817	1.885
Interaction	46.816	1	46.816	0.563
Error	4658.137	56	83.181	

NURTURANCE				
Density	11.267	1	11.267	0.657
Sex	194.400	1	194.400	11.327**
Interaction	0.266	1	0.266	0.016
Error	961.067	56	17.162	

** $p < .005$

INTERRUPTIONS

SOURCE	SS	DF	MS	F
Density	442.816	1	442.816	6.517*
Sex	410.816	1	410.816	6.046*
Interaction	22.809	1	22.809	0.336
Error	3805.250	56	67.951	

* $p < .025$

NO. OF CHILDREN INTERACTED WITH

Density	35.270	1	35.270	2.542
Sex	60.000	1	60.000	4.324*
Interaction	0.063	1	0.063	0.005
Error	777.074	56	13.876	

* $p < .05$

SOLITARY PLAY

Density	252.149	1	252.149	5.354*
Sex	84.017	1	84.017	1.784
Interaction	120.413	1	120.413	2.557
Error	2637.606	56	47.100	

* $p < .025$

ONLOOKER

Density	0.002	1	0.002	0.000
Sex	72.600	1	72.600	4.003*
Interaction	72.599	1	72.599	4.003*
Error	1015.734	56	18.138	

* $p < .05$

GROUP INVOLVEMENT

SOURCE	SS	DF	MS	F
Density	248.068	1	248.068	3.496
Sex	317.400	1	317.400	4.474*
Interaction	26.667	1	26.667	0.376
Error	3973.203	56	70.920	

* $p < .05$

APPEAL

Density	1.350	1	1.350	0.160
Sex	1.350	1	1.350	0.160
Interaction	0.812	1	0.817	0.100
Error	472.667	56	8.441	

RESISTANCE

Density	4.267	1	4.267	0.289
Sex	5.400	1	5.400	0.365
Interaction	5.400	1	5.400	0.365
Error	827.867	56	14.783	

SUBMISSION

Density	25.349	1	25.349	1.557
Sex	12.150	1	12.150	0.747
Interaction	0.018	1	0.018	0.001
Error	911.469	56	16.276	

Correlation Matrix

A correlation matrix was performed on all variables for the low density condition (LDC) and the high density condition (HDC) and is presented on Table 21. The levels of significance were .01 and .001.

TABLE 21:

CORRELATION MATRIX FOR ALL VARIABLES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
(1)	-.04	.45**	.29	.33*	.09	-.04	.22	-.33*	-.37*	.49**	.58**	-.46**	.35*	.25	.30	-.03	-.11	.09	-.27	-.17	.33*
	(2)	-.12	-.22	.01	.05	.19	.10	.17	.11	-.20	.06	.20	-.20	-.44**	.02	.02	.23	.05	-.14	.16	.01
		(3)	.32	-.08	-.11	.19	.25	-.36*	-.45**	.60**	.34*	-.22	.53**	.31	-.04	-.19	-.13	.11	-.15	-.41*	.36*
			(4)	.41*	-.05	-.09	.03	-.27	-.13	.31	.27	-.36*	.32	.64**	.06	-.13	-.19	-.11	.27	-.06	.25
				(5)	.26	.02	-.05	-.03	-.05	.04	.20	-.26	.05	.04	.30	.04	-.15	.13	.10	.13	.01
					(6)	.15	.22	-.04	-.01	.04	.25	-.25	.06	-.03	-.03	.14	-.00	.07	.07	.01	.06
						(7)	.13	-.05	-.05	.10	-.05	.19	.09	.19	.01	-.08	.29	.11	.15	-.00	-.11
							(8)	-.33*	-.07	.30	.06	-.02	.09	.14	-.11	-.02	.06	.07	-.07	.03	.02
								(9)	-.06	-.78**	-.29	.15	-.20	-.32	-.02	.02	.13	-.29	.35*	.10	-.34*
									(10)	-.57**	-.44**	.11	-.39*	-.27	-.21	.13	-.04	-.22	-.03	.61**	-.34*
										(11)	.52**	-.19	.41**	.42**	.12	-.10	-.08	.38*	-.27	-.48**	.50**
											(12)	-.56**	.40*	.36*	.29	.31	-.03	.42**	-.53**	-.33*	.62**
												(13)	-.27	-.36*	-.28	-.24	.22	.14	.29	.21	-.34*
													(14)	.47**	.14	-.23	.10	.09	-.41*	-.43**	.59**
														(15)	.04	.04	-.20	.04	-.27	-.25	.37*
															(16)	.16	-.04	-.03	-.19	-.13	.21
																(17)	-.08	.24	-.34*	.08	.21
																	(18)	.03	.02	-.09	.09
																		(19)	-.42	-.08	.21
																			(20)	.03	-.80**
																				(21)	-.61**

High Density

Low Density

* P < .01

** P < .001

There was consistency between the LDC and the HDC for the following variables: aggression, dominance, number of children interacted with, solitary play, onlooker, and group involvement.

Correlations also indicated that number of Ss interacted with, group involvement, and dominance were all positively correlated with each other and that these three indexes of social interaction were each negatively correlated with onlooker and solitary play (two indexes of un-social behavior). These correlations were significant for within and between densities except for solitary play in the LDC which was not significantly correlated with group involvement in the HDC and solitary play in the HDC which was not significantly correlated with number of children interacted with in the LDC.

Solitary play was negatively correlated with several other social variables; in the HDC solitary play was negatively correlated with appeal, in the LDC solitary play was negatively correlated with submission.

The three interrelated indexes of social interaction (number of children interacted with, group involvement, and dominance) were each correlated with aggression in the LDC. Aggression and resistance were correlated in the HDC. Aggression in the LDC was negatively correlated with interruptions in both densities and aggression in the HDC was negatively correlated with interruptions in the LDC.

Interruptions were negatively correlated with several social behaviors (number of children interacted with, aggression, group involvement) in the LDC.

In the LDC both aggression and appeal (two initiating social behaviors) were correlated with group involvement in the HDC. Appeal and number of children interacted with were correlated in the LDC. Nurturance, another initiating social behavior, was not significantly correlated with any other variables. In the HDC, resistance was correlated with aggression and number of children interacted with but was not correlated with any variables in the LDC.

Mobility and Zone of Activity

In addition to studying the effects of spatial density, the present research attempted to examine mobility and zone of activity by utilizing electronic equipment. The room was divided into 20 blocks, each equipped with an electronic grid beneath the carpeted floor, as diagramed in Figure 1. Each S wore a transmitter on his back which emitted a distinct radio frequency indicating his block location. The equipment was set up to scan 20 grids for six Ss every 0.256 of a second.

Mobility was defined as the amount of traveling movement of the S operationally measured by the number of changes in floor block locations traversed by the S over time.

FIGURE 1: DIAGRAM OF THE ROOM

ONE-WAY MIRROR

Zone of activity was investigated in order to determine whether a S had a preferred area of occupancy, measured by the percentage of time he occupied each block. The LDC utilized all 20 blocks while the HDC utilized blocks 13, 14, 15, 17, 18, and 19. In the low density condition, a S was considered to have a zone of activity if he occupied 4 or fewer adjoining blocks 80% of the time. In the high density condition, a S was considered to have a zone of activity if he occupied 1 block 80% of the time. Besides determining whether or not a S had a zone of activity it was desirable to investigate whether his zone of activity was central or peripheral. In the low density condition the peripheral blocks were those which bordered the room (1, 2, 3, 4, 5, 6, 9, 12, 13, 16, 17, 18, 19, 20); the central blocks were those within (6, 7, 10, 11, 14, 15). In the high density condition, the peripheral blocks were the corner blocks (13, 15, 17, 19); the central blocks are those between (14, 18).

The present study was designed to examine the effects of density on mobility and zone of activity and to examine the relationship between the social behavior variables and the variables of mobility and zone of activity. It was hypothesized that: (a) there would be significantly less mobility in the HDC than in the LDC, even when mobility scores in the LDC were reduced 33% to equal area/S allowed in the HDC, (b) fewer zones of activity would be established in the LDC than

in the HDC, (c) a peripheral zone of activity would be positively correlated with avoidance and negatively correlated with group involvement and number of children interacted with, (d) dominance would be positively correlated with a central zone of activity, (e) mobility would be positively correlated with dominance, aggression, nurturance, number of interactions, and group involvement and negatively correlated with resistance, solitary play, submission, avoidance, and interruptions.

The above hypotheses were not answered due to equipment difficulties which rendered unreliable the measurements of mobility and zone of activity. A test tape was run to check out the program and reliability of the equipment. Six persons were given directions to move about the room in set patterns. They walked from one block to another in one minute intervals. From the computer print-out of these patterns, it was discovered that three grids were not working (grids 9, 11, and 19) and two transmitters (1 and 5) interfered with each other.

The electric static in the room may have caused transistors 9, 11, and 19 to blow out. Transmitter #5 did not register accurately due to insufficient KC differences between it and transmitter #1. Only seven KCs separated the two transmitters when 10 KCs would have been a safer distance. Since transmitter #1 was strong, the S wearing

transmitter #5 was erroneously registered as shadowing the S wearing transmitter #1.

Another unsolved problem was that the tapes showed a "kangaroo effect," in which people jumped back and forth from one block to another when it was known that they were standing still. Some of these jumps spanned several blocks in .256 seconds. In an attempt to eliminate this error, the data were programmed to ignore movement to a block when the S moved from block A to B to A again and had stayed on block B for only .256 seconds. This eliminated some but not all of the errors.

It was also found that sometimes Ss were not picked up at all or were picked up for a shorter time than they were actually there. A zero grid was added to indicate when there were 160 counts in the scan but the S could not be located. 160 counts represented 0.256 seconds or one scan; ordinarily the program ignored any scan which did not have exactly 160 counts. The addition of the zero grid accounted for most of the unregistered time but still did not account for all of the time the S was located on a certain block.

In instances where a S appeared on more than one block at a time, the data were programmed to choose the first grid he appeared on, unless he was on one of the other grids during the last scan.

Finally, grid 99 was added to indicate "bad data," represented by any scan that did not have 160 counts. Approximately 50% of the

data was "bad" and could not be explained by the electronics technician.

Further use of the tapes was abandoned because of the problems in the electronic equipment.

DISCUSSION

The present study sought to investigate the effects of crowding on the social behavior of children. Results of this study demonstrated that children's activities are significantly more interrupted in a high density condition than in a low density condition. Moreover, those who were aggressive and played in groups (the boys in particular) were least likely to have their activities interrupted while those who were non-aggressive (the girls in particular) were most susceptible to being interrupted. There are clear implications for this result to crowded conditions in the home and school; with less privacy and more intrusions and distractions children are less likely to complete tasks. The greater the number of aggressive children present, the harder it is for the non-aggressive ones to concentrate on a task and complete it without interruption.

The effect of a high density condition on interruptions of children's activities in this study is consistent with Calhoun's findings on mice. Calhoun found that females suffered most from interruptions occurring in the high density condition.

This study also found that Ss interacted with significantly fewer children and spent more time in solitary play (versus group play) in

the high density condition. This finding is consistent with the findings of Hutt and Vaizey (1966) and Calhoun (1962) and the trend found by P. McGrew (1970), adding support to Sommer's belief that "segregation" serves to reduce conflict. Enforced isolation may be the child's way of blocking out or reducing stimulation which is too physically encroaching. Playing in solitude may be the child's way of increasing psychological distance from others when physical distance is limited. A personal distance or "body-buffer" zone, as studied by Horowitz (1968) and Kinzel (1964), may be operating in such an explanation.

The present finding that increased density causes more solitary play raises the question of what effects density might have on constructiveness of play and maturity of social behavior since lack of group play may well have a direct bearing on these variables. Age of Ss may also be an important variable to consider given Freedman's finding (1971) that boys organize themselves into large groups and develop dominance hierarchies at the age of six.

One of the questions that arises in considering this result is whether increased solitary play results from the restriction of movement which is a factor in the high density condition. It was true that some of the group games (such as "chase", "fort", and "fencing") were more easily played with more space but since group games (such as "nurse", "raise your hand if you like the vegetables I call out", and "intimidation by pistol-point") were also played in the high density

condition, it is unlikely that restricted movement in itself is responsible for less group play, although it may have been a contributing factor. Then too, it may have determined the kinds of group play that were constructed.

Since aggression and solitary play were negatively correlated, further study is needed to determine whether a high density affects one of these variables, which in turn affects the other and if so, which of the two variables is more directly affected by a high density.

The finding that boys were significantly more aggressive than girls was not surprising. Jersild and Markey (1935) found that in conflicts, boys were more aggressive and girls were more likely to be the victims of aggression. What was surprising, however, was the finding that there was significantly less aggression in the high density condition than in the low density condition. This effect was only significant for boys. Such a finding is not consistent with the findings of Hutt and Vaizey, (1966) or Clark, (1962) which found aggression to be greater in a high social density.

In considering this difference, it is postulated that the effect of spatial density on aggression differs from the effect of social density. In a condition where space remains constant while people increase, the cause for discomfort is accountable to the intruding members, thus encouraging competition and aggression between members. On the

other hand, when number of people remain constant while space decreases, members do not see each other as causes for their discomfort; rather they are all pawns to something greater than themselves, their physical environment. In such a condition where the discomfort is caused by an uncontrollable force outside themselves, it is postulated that aggression between members would be significantly less. The validity of such a postulate must await further research which would compare the effects of spatial and social density.

Whiting's findings (1970) are largely consistent with the research on social density, with the added dimension of a lower limit on number of children in a group (seven) under which the effect of increased aggression does not occur. Her theory is that increased aggression results from a child's frustrated attempts to influence others and that the more children there are (over six) the harder it is for any one S to organize and manipulate the behavior of others. If number of children present is an important variable, as Whiting suggests, it behooves the investigator to emphasize that the present results were on groups of six children only and that further research on the effects of density must consider number of children as well as space per child.

A further distinction must be made between the experimental and the naturalistic setting. It may be very adaptive for animals to become aggressive under crowded conditions in their natural habitat, but it may be very non-adaptive for humans to be aggressive in a crowded

experimental setting. Aggression and competition within an animal specie enhances the selectivity of that specie and provides more food and space for the stronger in the long run. However, in an experimental setting, there are no long run consequences due to its short-term and atypical nature. The consequences of aggression among children in an experimental setting are quite unlike those experienced by animals. The possible consequences of aggression for the children were that the teacher may not have allowed their return the next day if something drastic occurred and was reported to the teacher or that bad feelings incurred in the experiment would continue in the classroom (since they were all from the same class and returned there after the session). The experimental setting has the definite disadvantage of not dealing with people in real-life situations. More information is needed on how social behavior in various settings such as school, home, neighborhood, and experimental situation compare with each other.

Several aspects of aggression should be considered in relation to the present finding. Speculations based on the investigator's general observations in this study are that aggression is encouraged by aggressive toys, by spatial conditions that allow enough room to attack and retreat, and by a high excitation level. Considering the selection of toys, the rifle was a highly desired toy and closely associated with

aggressive behavior in the sense of shooting and intimidating. The rifle was predominantly used by the boys and when used was usually accompanied by much bodily activity such as running, chasing, etc. The high density condition made gross motor activity (running, swinging arms, etc.) difficult or else highly uncomfortable for both the S and others. There appeared to be more sitting in the high density condition than in the low density condition. It is quite possible, then, that a restriction on movement discouraged the use of the rifle or plastic tubes for attack and retreat or for fencing purposes, thus reducing the incidence of that particular mode of aggression. We may well be witnessing evidence that children adapt their play to the physical requirements of their environment. It would be preferable to indicate the specific mode of aggressive expression displayed, as in differentiating between aggression via inanimate objects(toys), aggression via direct physical attacks, and aggression via verbal abuse. Exclusion of the rifle may reduce aggression to direct physical attack and verbal abuse. Finally, it should be noted that all of the toys could have been used in either condition, but it was the children's choice which determined greater or lesser frequency of use of each toy.

Furthermore, the level of excitement was observed to be lower in the high density condition. The extreme crowdedness may have resulted in less aggression by:(a) discouraging the use of a highly aggressive toy which seemed best used in a spacious area, (b) minimi-

zing the excitation level of the children by making gross motor activity difficult, and (c) making the children aware of the restraints of the environment, thereby making them more cautious and restrained in their play.

In interpreting the finding that dominance in girls significantly increased in the high density condition it is postulated that girls may be more sensitive to and frustrated by a crowded condition since they are more susceptible to being interrupted by the aggressiveness of the boys. The girls then became verbally dominant in trying to control or impose order on a situation which is frustrating and disruptive for them. The investigator suspects that these effects are applicable to the mother of a large family that dwells in an over-crowded home. Spacious homes or fewer children limit the amount of physical and verbal intrusions upon all members of the household. The spacious home with its many rooms imposes order by allowing segregation of the house members and by organizing specific areas for specific activities. The lower socioeconomic family, which has neither a spacious home nor fewer children, lives in an environment which is most stressful for its members and for the mother, the focus of the family at home.

Several suggestions are offered for future research. There is a need for research to be done on many densities, rather than just two. By examining two densities, it is not known whether the effects of den-

sity on social variables are linear or curvilinear. The high density condition in the present study represented a crowdedness more extreme than any of the densities in other studies on children. It is possible that as density increases, aggression may first increase and then decrease.

The second suggestion for further research deals with the duration of the stimulation. The present findings represent behavior exhibited within 48 minutes per session. The short-term nature of the study does not provide information on what the long-term effects of crowding would be. Ss in the present study seemed very motivated to attend the experimental sessions; whether such enthusiasm affected their behavior significantly is not known. An aversive stimulation such as crowding may produce negative effects only after it has had time to build up. For example, aggression, if inhibited, may not remain so over a longer period of time. One hypothesis is that adaptation to a stressful situation (in its extreme form, survival) requires an inhibition of aggression. Humans, due to their greater cognitive capacities and ability to plan, should be able to inhibit behavior which would be costly to the whole group. This hypothesis assumes that a high density condition is stressful and that aggression is a natural social outcome of stressful human conditions, two assumptions which need further study.

This study also does not explain the consequences of frequent interruptions on the child over a long period of time. It is postulated that frequent interruptions would hinder a child's sense of mastery and sense of completion, resulting in frustration, apathy, and an unfulfilled sense of accomplishment. Frustration would be demonstrated by poorer coping skills and less perseverance when faced with frequent distractions. Apathy would be demonstrated by a lack of drive to initiate or complete tasks.

Regarding the experimental design, inclusion of two density-same groups would have provided a control from which carry-over effects, if operating, could be assessed.

One of the greatest difficulties in the present study was getting total agreement from all six raters on the behavioral measures. Further revisions in the rating form which would incorporate ratings on a timed basis and fewer variables to keep in mind (without seriously limiting observation time) would likely improve rater-reliability.

With regards to the negative findings for resistance, submission, nurturance, appeal, and onlooker, all of the above variables were perceived less frequently than the variables which proved significant. Two factors were probably accountable: (a) these behaviors were displayed infrequently and (b) some of these behaviors (resistance and submission) may have been more difficult to recognize because they are more

subtly displayed and are responsive rather than initiated acts. Initiated acts are more obvious than responsive acts. Finally, questions about the effect of density on children's mobility and zones of activity are still unanswered due to equipment difficulties, although no less worthy of continued pursuit.

The present study demonstrated that the amount of space provided for a child has a significant influence on his behavior and on the quality of his social relationships with others around him. Secondly, this study demonstrated that the effects of density are not simple; they are complicated by many factors and conditions. As more work is being done on the effects of density, different definitions, different methods, and different populations are being used. Density differences have been studied by comparing urban with rural communities, by varying space while keeping number of Ss constant, by varying number of Ss while keeping space constant, by comparing world (country, city) populations over time, and so forth. Such variations behoove researchers to resolve how these various definitions, methods, and populations compare and relate to each other. Such an understanding may be valuable in explaining discrepancies in results of studies using different methods.

One very appropriate example of a contrast in findings is found in comparing the results of the present study, an experimental study of spatial density, with those of Whiting, a naturalistic study of

social density. In the latter research, larger groups led to greater interaction, which resulted in increased distractibility and aggression. In the former case, smaller space per child led to less interaction (fewer children interacted with, less group and more solitary play), less aggression, and more interruptions. Such similarities and differences in findings are valuable leads for further research in population studies.

The complexity of studying the effects of density were demonstrated in the consideration of various factors: spatial versus social density, number of children in the group, area per child, experimental versus naturalistic settings, characteristics of the sample (age, sex, degree of normality, family make-up and background, species) the physical setting and the equipment within, motivation of the Ss, and duration of the experimental session. Understanding of these factors will contribute to a more comprehensive conceptual framework from which to study population density and the complex relationship between man and his environment.

SUMMARY

The present study sought to investigate the behavioral effects of spatial density on normal children of ages four and five in an experimental setting. The specific behaviors investigated were aggression, dominance, nurturance, number of interruptions, number of children interacted with, time spent in solitary play, time spent as onlooker, time spent in group involvement, appeal, resistance, and submission. A repeated measures design was used in which the same sized groups (ten groups of six Ss each) were observed in two spaces of differing sizes (265.1 square feet in the low density condition and 90 square feet in the high density condition). Each group consisted of three girls and three boys. Six raters observed the individual Ss through a one-way mirror. Each S's scores were a sum of the ratings of all raters. A rating form was designed for observational purposes. Each experimental session consisted of 48 minutes of free play with no adults present. Analyses of variance were performed to yield effects for density, sex, and interaction.

In the high density condition as compared with the low density condition, there was less aggression ($p < .001$), more interruptions of Ss' activities ($p < .005$), more time spent in solitary play ($p < .05$), less

time spent in group involvement ($p < .05$), and fewer children interacted with ($p < .001$). There were no significant effects for density on nurturance, onlooker, appeal, resistance, submission, and dominance. There was a significant effect for sex on aggression, nurturance, and interruptions at the .001 level of significance. Boys were more aggressive than girls, girls were more nurturant than boys, and girls were more frequently interrupted than boys.

There were significant interactive effects for aggression and dominance at the .05 level of significance and above. While aggression in girls did not significantly differ between density conditions, boys became more aggressive in the low density condition and less aggressive in the high density condition. In terms of dominant behavior, dominance in boys did not significantly differ between density conditions while girls became more dominant in the high density condition and less dominant in the low density condition.

The relationship between density, mobility, zone of activity, and the behavioral variables was sought but difficulties with the electronic equipment used to measure mobility and zone of activity prevented further investigation.

It was concluded that physical settings have a significant influence on children's behavior. The amount of space allowed each child at play affects the way he behaves with others. A crowded condition cre-

ates great physical and psychological restraints on the child by causing interruptions of his activity and causing him to isolate himself in order to reduce the social pressures and encroaching stimulation. Several complexities in researching and explaining the effects of density were discussed.

APPENDIX A
RATING OF BEHAVIOR FORM

S's number _____
Rater's name _____
Session Number _____
Observational
period _____

Item #1 (to be marked continually throughout the 8 minute session)
Number of different children the S interacted with. Make a hatch
mark each time the S interacts with a new person. If he plays by
himself without interacting with anyone, make no hatch marks. The
maximum number of hatch marks will be 5.

Item #2 (to be marked continually throughout the 8 minute session)
Number of interruptions of the S's activity by others. Make a hatch
mark each time the S's activity is interrupted by others.

Item #3 (to be marked continually throughout the 8 minute session)
Place a check mark each time you see the S demonstrating any of
the following behavior in one action.

Dominance

Aggression

Resistance

Submission

Nurturance

Appeal

Item #4 (to be rated once every minute when you hear the beep tone)
 The degree of group involvement demonstrated by the S. Place a
 check mark next to the appropriate description. If more than 1 des-
 cription is evidenced, mark the most recent.

Minutes								
1	2	3	4	5	6	7	8	
								NO INTERACTION due to <u>S</u> 's interest in own activity and/or indifference or avoid- ance of others.
								ONLOOKER. <u>S</u> looks at the activity of others without being an active member or target of others
								FUNCTIONING MEMBER OF A GROUP (2 or more)

APPENDIX B

DEFINITIONS FORM

Item 1: Interactions. A social interaction is a condition where the S shows he is aware of the presence of another (of others), as in playing with, talking with, observing. The S behaves with regard to another (others) and the other(s) has a direct effect on the S.

Item 2: Interruptions. Interruptions are distractions or behavior by others which disrupts the activity of the S. Observations: watch for a change in S's attention caused by another's activity, noise, or imposition. The S must be engaged in an activity in order for him to be distracted from it and have it interrupted. Watch for a temporary or permanent shift in attention as evidenced in eye and head movements.

Item 3: Not all activities, verbalizations, or actions are going to fit into any of the classifications. Don't feel forced to check every behavior you see; many will not be appropriate (i. e., ordinary play activity or ordinary conversation). Check a behavior as belonging to those listed only when it obviously occurs according to the definitions given.

Dominance. Dominance is defined as: aiming to boss, control, lead, direct, prohibit, discipline, pass judgment, give decisions, lay down principles; aiming to be imposing, assertive, authoritative, powerful; trying to command attention; "Do this" or "Don't do that" said in a

commanding voice, with an implied "because I say do"; ordering others to do something. Observations: watch to see who eventually possesses a toy desired by more than one S; the S who gets it usually does so through dominance (or aggression). Watch to see how a dispute is resolved; a S who tries to lay down rules or make decisions is being dominant. Dominance is still dominance whether the other person submits or not. Dominance is frequently verbal; aggression is frequently physical.

Aggression. Aggressive behavior is defined as: physically attacking another person or toy serving as a person figure; being destructive with toys or equipment, aiming to inflict pain, discomfort, embarrassment, or frustration; being cruel, annoying, mean, criticizing, making another person suffer; being assertive in any hostile or threatening manner.

Resistance. Resistance is defined as: being unyielding to dominance, aggression, appeal, or action of any kind which exerts social pressure; defending oneself physically or verbally; withholding compliance, actively ignoring demands or requests; refusing; being stubborn.

Submission. Submission is defined as: giving in to dominance, aggression, appeal, or action of any kind which exerts social pressure; letting another have his way in order to ease the pressure on himself. Typical behavior: relinquishing toys to a S who demands or requests them; obeying another's directions; "taking" criticism. Submission is

a response to another's behavior.

Nurturance. Nurturant behavior is defined as: initiating help or benefit; actively giving to or protecting another; being nice, forgiving, indulgent, kind, sympathetic. Typical behavior; feeding or caring for a doll, putting a moustache or hat on another, returning a toy to some unhappy S who had it taken away by some other S, protecting another from the aggressive blows of another, comforting physically.

Appeal. Appeal is defined as seeking help, guidance, affection, sympathy; indicating a need or making a personal request said in a dependent manner. Example: A S complains, "I feel awful. Will you tell the teacher I want to go home? "

APPENDIX C

GENERAL OBSERVATIONS

L11: Ss recognize raters behind mirror "nah, nah, nah, nah, nah".

Boxes played with. Door: toilet.

H12: E entered: safety, Ss giving rectal temperatures. E entered: safety, Ss pulling down boy's pants.

H21: All Ss sit most of the time. Calm, non-aggressive group.

Very little gun play compared to other groups. Ss notice portable walls can be shaken.

L22: All Ss cooperate in cleaning up the room when they sense their time to play is nearing its end. Playroom is spotlessly in order.

L31: Door: S 13 needs to go to toilet. Door: S 15 needs to go to toilet. Very aggressive group due to two boys (S 17 and S 18)

H32: E entered: S 13 crying. E entered: S 15 crying. They discover large playroom is behind the portable walls, they precede to shake walls. S 17 and S 18 still aggressive. Door: girls show broken toy to E. (appeal to authority). Door: S 13 informs E that S 17 is breaking the toy (appeal to authority). S 17 throws toys around. More Ss sitting on the floor than yesterday. E enters: S 16 crying over lost gun in fight with S 17. Door: S's finger hurt. "Teacher!" (appeal to authority).

Door: S got hit in the eye. Comes out almost crying (appeal to authority). Door: S 16 needs help replacing his shoe (appeal to authority).

L41: Door: female S wanted her snack now (appeal to authority).

Door: girls tell on rough boys(appeal to authority). Ss discover small closet; S19, 20, and 24 play in it from 1-5 minutes.

H42: "In the bigger room, it was more nice." Ss discover portable walls but quickly forget about them. Door: S20 comes to tell on someone; E doesn't respond; S closes door (appeal to authority).

Door: girls complain boys making too much noise.(appeal to authority). Girls think E peaks over the walls to see them. S throws plastic tubes over the wall. Ss begin pushing the wall in vain. S23 pulls off space pictures from wall. Ss express hunger.

H51: This group dances a lot. Talks softly, whispers. Complain of being hot. Transmitter seems to bother S30. Door: S29 to bathroom (5 minutes).

L52:Lots of running around by all. Door: E responds (appeal to authority-1 minute).

L61: E enters to replace fallen tag. Door: S31 informs E that Ss are breaking balloons (appeal to authority). Door: S34 asks when they are going to eat (information). Door: S34 informs E that someone pulled his shirt(appeal to authority). Door: S32 crying because finger was pinched(appeal to authority). Door: S34 shows me his neck which was hit by S36. Door: S31 needs to go to the toilet.

H62: Non-aggressive, lots of talking. Door:S34 asks E to remove lei

from transmitter(appeal to authority). S34 peaks through portable wall.

S35 tries to peep out the door. Segregation of sexes in play. Door:

S34 informs E that S32 is crying (appeal to authority). Door: S35

informs E that S36 is crying(appeal to authority).

H71: Very quiet, well-behaved group. Mobility restricted, non-aggressive, less gun play than other groups, more play with small objects. Door: S40 needs to go to the bathroom.

L72: Door: S37 informs E that boys are playing rough(appeal to authority). Door: S38 needs shoe tied(appeal to authority).

H81: Teacher present next door. Door: S43 asks if they can wear the hats(information). Door: S47 relates an incident(appeal to authority).

Door: S43 asks about a toy(information). Door: S43 tries to sneak out the door for fun. Ss push portable walls, peak behind walls.

Door: S47 needs to go to the toilet.

L82: Teacher not present next door. Ss play with curtain, try to see through curtains. Door: S47 informs E his transmitter "talked"

(appeal to authority). Ss 46 and 48 set up a play ship in the corner, excluding others. Ss more aggressive today; play pirates, hats determining roles. Door: S43 asks E to fix broken hat (appeal to authority). Ss make fun of S45, call her "ugly sister", restricting her from ship. Door: S47 informs E his "radiator is smashed" (appeal to authority).

L91: -

H92: Ss shock themselves in play by rubbing feet on carpet floor and touching metal on the door. Lots of running around the room especially S54 and S52. Ss hide behind the red drape. Play with it.

H101: Door: S59 opens, then closes door. Door: S60 exits, then closes door. Door: S56 and 59 go outside. Door: S57 cries.

L102: Door: S58 reports that someone knocked down the farm (appeal to authority). Not much verbalization among Ss. S57, the youngest girl, cries when tube taken away from her. S59 and 60 climb on boxes. S57 cries again when S59 takes her hoppity horse away. E enters to replace S60's name tag. E enters again to replace name tag. E enters to tell boys to play nicer: boys are hitting each other very hard with tubes (safety). E enters again for safety reasons (S59 hit S60 in the head with tube).

INTERACTIVE EFFECTS FOR DENSITY AND SEX ON
DOMINANCE AND AGGRESSION

BIBLIOGRAPHY

- Barker, R. G. Wanted: an eco-behavioral science. In Williams, E. P. and Rausch, D. L. (Eds.) Naturalistic Viewpoints in Psychological Research. U.S.A.: Holt, Rinehart and Winston, 1969.
- Calhoun, J. B. The social use of space. In Mayer, W. V. and Van Gelder, R. G. (Eds.) Physiological Mammalogy. Vol. 1, N.Y: Academic Press, 1963.
- Calhoun, J. B. Population density and social pathology, 1962 in Hardin, G. (Ed.) Population, Evolution, and Birth Control. S.F: W. H. Freeman and Co., 1964, 80-85.
- Calhoun, J. B. The small satonic world of John B. Calhoun. Smithsonian, April, 1970.
- Calhoun, J. reported by T. Huth, Of mice and men: colony overpopulates to extinction. The Washington Post, 114, March 29, 1971.
- Clarke, J. R. Proc. Roy. Soc. Bulletin, 144, 68, 1955.
- Douglas, J. W. B. The home and the school: a study of ability and attainment in the primary school. London: MacGibbon and Key, 1964.
- Ebel, R. L. Estimation of the reliability of ratings. Psychometrika, 16(4), December 1951, 407-424.
- Elder, G. H., Jr. and Bowerman, C. E. Family structure and child-rearing patterns: the effects of family size and sex composition. Am. Socio. Review, 1963, 28, 891-905.
- Freedman, D.G. The impact of behavior genetics and ethology. In Rie, H. (ed.) Perspectives in Child Psychopathology. Chicago: Aldine-Atherton, Inc. 1971.
- Green, E. H. Group play and quarreling among preschool children. Child Development Monog. 4, 1933, 302-307(b).

- Hall, E. T. The Hidden Dimension. New York: Doubleday, 1969.
- Hardin, G. Should we treat the symptoms or the disease? In Hardin, G. (Ed.) Population, Evolution, and Birth Control. S. F: W. H. Freeman and Co. 1964, 78-80.
- Horowitz, M.J., Duff, D.F. and Stratton, L. Body-buffer zone. Archs. Gen. Psychiat., 1964, 651-656.
- Hutt, C. and Vaizey, M. J. Differential effects of group density on social behavior. Nature, 209 (5030), 1966, 1371-1372.
- Jersild, A. T. and Markey, F. V. Conflicts between preschool children. Child Development Monog. No. 21, 1935.
- Kinzel, A.F. Body-buffer zone in violent prisoners. Paper presented to Am. Psychiat. Assos. Annual Meeting, Miami, Florida, 1969.
- Markey, F. V. Imaginative behavior of preschool children. Child Development Monog. No. 18, 1935.
- McGrew, P. L. Social and spatial density effects on spacing behavior in preschool children. J. Child Psychol. Psychiat., 1970, 11, 197-205.
- McGrew, W. C. An ethological study of social behavior in preschool children. Unpublished D. Phil. Thesis, University of Oxford, 1970.
- Miller, D. R. The study of social relationships: situation, identity, and social interaction. In Koch, S. Psychology: A Study of a Science. Vol. 5, N.Y: McGraw-Hill, 1963.
- Minuchin, S., Montalvo, B., Guerney, B. G., Rosman, B. L. and Schumer, F. Families of the Slums. N.Y: Basic Books, 1967.
- Murphy, L. B. Social Behavior and Child Personality. New York: Columbia University Press, 1973.
- Sommer, R. Man's proximate environment. Journal of Social Issues, Vol. XXII, No. 4, Oct. 1966, 59-70.
- Sommer, R. Personal Space: The Behavioral Basis of Design. Prentice-Hall, 1969.

Swift, J. Effects of early group experience: the nursery school and day nursery. In Hoffman, M. and L. Hoffman(eds): Review of Child Development Research, 1, N. Y:Russell Sage, 1964.

Whiting, B. B. The effect of urbanization on the behavior of children. Mimeographed report, January 1970.

Winkle, G. H. The nervous affair between behavior scientists and designers. Psychology Today, 3:10, March, 1970, 31-35.

Wohlwill, J. F. The physical environment: a problem for a psychology of stimulation. Journal of Social Issues, Vol. XXII, No. 4, Oct. 1966, 29-38.

Wright, H. F. Recording and analyzing child behavior. N. Y: Harper and Row, 1967.