

THE EFFECTS OF SOCIAL AND SPATIAL DENSITY
UPON ATTRACTION, CROWDING, TASK PERFORMANCE, AND MOOD

by

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INTRODUCTION

Crowding in humans has not been studied extensively until relatively recently. During the 1960's however, a great deal of research began to be devoted to this topic which yielded many inconsistent results and, therefore, differential interpretations. Part of the difficulty in interpreting these results lies in the fact that researchers were manipulating an independent variable called "crowdedness", each in his own way. Operationalizations of "crowded" and "uncrowded" conditions were as varied as the number of different studies. Some authors manipulated the actual space available per subject by placing a constant number of subjects in rooms of varying sizes, while others manipulated both available space and the absolute number of subjects present by placing varying numbers of subjects in a room of fixed size. The theoretical and methodological confounding of spatial density, or available space per person, and social density, or the actual number of people present, which occurs in these latter studies is unfortunate. It is precisely these confounded studies which tend to show significant results. One of the prime objectives of the present study is to tease apart the effects of social density and spatial density through orthogonal manipulation.

Pertinent Research Literature

Increased population density has been correlated with many types of behavioral and physiological abnormalities in studies of animals. In a field study, Christian, Flyger, & Davis (1960) observed the effects of density on behavior in a herd of sika deer on an island in Chesapeake Bay. Released and allowed to breed freely in the absence of predation,

the herd size increased until the population reached a density of approximately one deer per acre. Suddenly, the mortality rate soared and herd size decreased rapidly. Food and water supplies were adequate, and disease was not in evidence. Subsequent examination of carcasses revealed a series of endocrinological disorders, including enlarged adrenal glands and reproductive system dysfunction. Deevey (1960) found similar evidence of endocrinological dysfunction, apparently mediated by the adrenal-pituitary axis, in lemmings and snowshoe hare living in densely populated environments. Deevey cites reaction to the stress created by excessive population density coupled with the demands of spring breeding as cause for the disorders and the subsequent die-offs.

Calhoun (1962) found that a breakdown in normal social behaviors occurred in laboratory rats if they were left in a freely breeding colony. Such problems as increased infant mortality (to 96%), hyperactivity, catatonia, homosexuality, incomplete or aberrant maternal activities (both pre-natal and post-partum), and cannibalism were typical of the behavioral dysfunctions that Calhoun observed. Similar results have been obtained with cats (Leyhausen, 1965) and with primates (Sugiyama, 1967; Southwick, 1967).

Research on human crowding falls roughly into three categories: (1) studies that are correlational in nature; (2) those that require the subject to imagine that he is experiencing the density manipulation; and (3) those that directly manipulate density.

Using correlational techniques, Winsborough (1965) found that population density correlated positively with infant death rate,

tuberculosis rate, rate of both overall and youth-oriented public assistance in the city of Chicago, but that such correlations tended to disappear or even to reverse polarity when socio-economic, housing, and migratory factors were removed. The rather startling results of partialling out the effects of modifier variables in the Winsborough study may not have occurred had other dependent variables been used. Although Winsborough's dependent variables were chosen to be analogous to those used by Calhoun (1962) above, all too often the choice of dependent variables used in crowding studies is based on intuition rather than on some theoretical framework. It is quite probable that the inconsistent results obtained to date are as much a reflection of these differences in dependent variable usage as they are of inconsistent manipulations of density.

In a more recent study, Galle, Gove, & McPherson (1972) found that population density in areas of Chicago is positively correlated with mortality rates, public assistance rates, and juvenile delinquency, and negatively correlated with fertility rate. However, these authors fail to partition the effects of the covariates that Winsborough (1965) did. McCulloch & Philip (1967) found a positive correlation between population density and attempted suicide in Edinburgh, Scotland, but Lester (1970) failed to find any such correlation in Buffalo, New York. Since correlation does not in any way imply causality, all of these correlational studies suffer from a failure to demonstrate mechanisms whereby density might have its effects.

While correlational research has its limitations, it does have one major advantage over the laboratory studies of crowding. It presumably

takes some time for the effects of density to occur, and correlational studies tap these time-dependent effects by using subjects who actually live in dense situations for long periods of time. They are not therefore open to the criticism that has been levelled at laboratory experiments; namely, that subjects realize that the stressful (i.e. dense) situation will be relatively short-lived.

Studies which require subjects to use their imaginations include those which evaluate the placement of felt figures on cloth (Kuethe, 1962) and scale models of situations requiring subjects to place dolls in the situation or to imagine that they themselves were in the situation (Baxter & Deanovich, 1970; Desor, 1972). Such studies indicate that seating arrangement of people in a room may play a crucial role in the nature of social interactions, specifically that interseat distances influence the amount of anxiety that subjects attribute to figures in a Make A Picture Story task (Baxter & Deanovich, 1970). Desor (1972) has shown that the placement of partitions and the variability of the linear dimensions of a scale model room are positively correlated with the number of figures placed in the room by subjects when told to "place as many people as you can here without overcrowding." The number of doors in the model room is negatively correlated with the same measure.

Studies that directly manipulate density indicate that many variables influence the nature of social interactions under such density manipulations. In a study of three to eight year old children, Hutt & Vaizey (1966) found that normal children, autistic children, and brain-damaged children respond differently to density manipulations. Specifically, mean percentage time spent in aggressive/destructive

behavior increased with group size for normals and brain-damaged children, but no difference was observed for autistic children. Mean percentage time spent in social interactions decreased with group size for normals and was curvilinear for both brain-damaged and autistic children. Time spent on the boundary of the room increased with group size for autistic children, decreased for normals, and was curvilinear for brain-damaged children. Since Hutt & Vaizey kept room size constant and varied the number of people present, they confounded spatial and social density. Thus it is difficult to determine exactly what is causing the observed effects. Any study which is similar to this one in terms of types of subjects used, but which fails to manipulate density in the same manner, may get different results and may even reach opposite conclusions to those of Hutt & Vaizey. For instance, Price (1971) found no effect of density on aggressiveness in children. A uniform manipulation of density may help to alleviate this difficulty.

Griffitt & Veitch (1971) found evidence of deteriorating social relations under conditions of high density and high temperatures, but the manipulation confounded social and spatial density. When the dependent variable was the amount of attraction to an anonymous stranger of the same sex, the data revealed that both density and temperature were negatively correlated with liking. This study is especially interesting in that the imaginary stranger who served as the recipient of the subject's feelings was presented as being either slightly similar or extremely similar in attitudes to the subject. In all conditions those persons who were represented as being more similar to the subject were liked more. That is, the particular effects of

increased density were not absolute (i.e. uniformly negative), but combined with attitudinal factors. This indicates that studies which fail to take these subjective factors into account, either by way of manipulating them or controlling them, may have overlooked a crucial variable in the situation. For this reason social interactions in the present study are highly controlled.

Freedman, Levy, Buchanan, & Price (1972) varies spatial density in two experiments. In experiment one, groups of four people of the same sex were assigned to either a small room (6.25 ft^2 /person) or a large room (18 ft^2 /person). They spent the first hour of the experiment getting acquainted, the second hour discussing various topics of interest, and the third hour playing a game requiring dyadic cooperation. These were all designed as filler tasks, a necessary feature if density effects do, in fact, require some time to operate. These were rather lengthy experimental sessions, and as yet it is not clear what the time course of density may be or upon what factors it is dependent. The assumption underlying the use of this lengthy segment prior to the recording of dependent variable data is that the longer subjects are in the situation, the greater is the magnitude of density effects. This may not, however, be the case, and the changes in reactions to density brought about by the passage of time need to be studied systematically. Finally, subjects played a modified form of the prisoner's dilemma game, completed a questionnaire, and were debriefed. Results revealed that neither room size nor sex of subject affected responses, but sex and room size interacted to affect the prisoner's dilemma game, a measure of competitiveness. Specifically, males were

more competitive in the small room than in the large room, while females were more competitive in the large room.

In experiment two, Freedman et al. used basically the same design and procedures, but the major dependent variable of interest was the severity of sentences handed down by subjects in a mock jury situation. Results revealed that males tended to be somewhat more severe than females, that there was no effect of room size, and that sex and room size interacted, with females being more lenient in the "crowded" than in the "uncrowded" room. Opposite results were obtained for male subjects. This is totally consistent with the results of experiment one above to the extent that competitiveness and severity of sentence are the same.

Altman & Haythorn (1967) used males in 12' x 12' isolation areas to test for the effects of personality variables on territoriality. Subjects were paired in dyads such that three levels of need achievement and three levels of dogmatism (both measured prior to the start of the study) were factorially combined. Members of experimental dyads remained in the room together for nine days, while controls were in the room for working periods only. Results indicate that isolated dyads exhibited more territoriality with respect to particular items of room furniture and areas within the room, and also a greater tendency to withdraw from one another. Those dyads which were composed of members at opposite ends of the dominance scale (i.e. heterogeneous dominance) exhibited a significant decrease in territorial behavior throughout the course of the experiment, while dyads having members who were homogeneous in their dominance scale scores at either end

tended to show gradually declining territoriality.

In a similar design, Smith & Haythorn (1972) found that small groups (two or three men) showed significantly more hostility in a large room (200 ft³) than in a small room (70 ft³). These findings are in opposition to those of Freedman et al. (1972). It is interesting to note that this study subjected participants to experimental conditions for twenty-one days and that the stress that subjects reported feeling in the experiment had a major peak at five days, and a lesser one at thirteen days. This clearly indicates that the effects of density manipulations on self-reports of stress may not be monotonic. These time-dependent results in some ways are consistent with the general time course mentioned in Selye's (1956) General Adaptation Syndrome, a time course for reactions to stressors. In Selye's theory there is an initial peak alarm reaction followed by a lessening of negative reactivity. If the stressor is not removed, there may be other peaks, and death may occur from prolonged stress. The great disparity in confinement lengths between Smith & Haythorn and the majority of laboratory studies of crowding makes application of their findings to studies which are limited in time to several hours difficult.

In 1971 Freedman, Klevansky, & Ehrlich attempted to determine the effects of density on human task performance. Using both a purely spatial density manipulation and a confounded social density and spatial density situation, these authors varied the complexity of tasks that subjects performed and found no significant relationship between density and task performance. This was true even though experimental sessions lasted for four hours at a time, and extended over two or

three consecutive days.

Using a purely spatial density manipulation, Stokols, Rall, Pinner, & Schopler (1973) varied the sex of group members, situational affect (i.e. cooperation vs. competition), and density to determine their effects upon subject's feelings and group interaction patterns. Results indicated that subjects felt more crowded in small rooms than in large ones, and there was a trend for this effect to interact with situational affect such that male subjects reported feeling more patient in the large rooms and more aggressive in the small rooms. There was also an effect of room size on physical comfort such that subjects reported being hotter and generally less comfortable in small rooms.

McCain, Paulus, Cox, & Schkade (1973) avoided the interpretative problems of correlational studies and the short-exposure problems of most laboratory studies by manipulating social and spatial density in a prison setting. These authors found only a slight positive relationship between social density and anxiety, and no effects of social or spatial density on any other dependent variables.

Marshall & Heslin (in press) varied sexual composition of groups, group size, and room size in order to determine the effects of these manipulations on group cohesiveness and general feelings of subjects. They found that there is more group cohesiveness and more liking for other group members in small groups than in large ones, that this effect was more pronounced for males than for females, that mixed-sex groups were liked the most, and that people respond to spatially dense situations with generally negative feelings. They did not however attempt to directly assess feelings of crowdedness.

In summary, some studies of children have shown that density is related to aggression (Hutt & Vaizey, 1966), while others have found no such relationship (Price, 1971). Other studies have found more aggression or negativity in a large room than in a small room (Smith & Haythorn, 1972), while still others find the opposite to be true (Griffitt & Veitch, 1971; Marshall & Heslin, in press). These latter studies indicate that these observed effects may be interacting with and depend upon sex of subject, personality variables, and situational variables. Finally, some studies fail to demonstrate any significant effects of density at all (Freedman, Klevansky, & Ehrlich, 1971; McCain, Paulus, Cox, & Schkade, 1973). Table I presents a summary of the density manipulations and the dependent variables used in human studies to date.

Theoretical Considerations

These seemingly inconsistent findings may be reconcilable through close examination of the conceptual bases of the operationalization of "crowding" used. In 1972, Stokols made a distinction between the psychological experience of crowding and physical density, a distinction which helped to organize subsequent research and to avoid the problems which had arisen in the literature through the indiscriminate usage of these two terms. Stokols stated that while density should be defined in terms of purely spatial parameters, crowding was a subjective phenomenon brought about by the interaction of these parameters with cultural, situational, and personal variables.

Given the above distinction, it is obvious that while density can be directly manipulated as an independent variable in any study,

TABLE I

SUMMARY OF DENSITY MANIPULATIONS
USED IN HUMAN STUDIES TO DATE

Study	Density Manipulation	Dependent Variables	Room/Group Sizes
Hutt & Vaizey, 1966	Confound	Aggressive Behavior, Social Interaction, Time on Room Periphery	27' x 17.5' Room, Groups of ≤ 6 , 7-11, ≥ 12
Griffitt & Veitch, 1971	Confound	MACL, Evaluation of a Stranger, Semantic Differentials	7' x 7' x 9' Room, Groups of 3-5 and 12-16
Smith & Haythorn, 1972	Spatial	Hostility	3 3 70 ft and 200 ft Rooms, 2 or 3 Men
Freedman, Levy, Buchanan, & Price, 1972	Spatial	Prisoner's Dilemma, Mock Jury	2 2 6.25 ft and 18 ft per Person, Groups of 4
Stokols, Rall, Pinner, & Schopler, 1973	Spatial	Liking, Emotions, Group Task Performance, Behaviors	2 2 5.5 ft and 16.5 ft per Person, Groups of 8
Marshall & Heslin (in press)	Social, Spatial	Attraction, Mood, Group Evaluation, Desire to Remain in Group	2 2 4 ft and 18 ft per Person, Groups of 4 and 16
present study	Social, Spatial	Attraction, Task Perf- ormance, Mood, Emotions, Crowding, Behaviors	2 2 9 ft and 18 ft per Person, Groups of 4 and 8

crowding cannot. Even if one ignores the failure to draw a distinction between density and crowding in the literature, difficulties of interpretation of results still exist, since the term density itself is not clearly and consistently defined. Most studies to date in the literature can be classified into one of two categories according to the particular type of density manipulation made, categories originally defined by Loo (1973). Studies that keep the number of people present constant across conditions while varying room size can be said to have made a purely spatial density manipulation. On the other hand, those studies which keep room size constant but vary the number of people present, a fairly common design, have confounded social density, or the actual number of people in the situation, and spatial density, or the space available to each person. In order to manipulate only social density, it is necessary to keep the space per person constant while varying the number of people present. This would require the use of rooms of varying floor space.

There are at least two possible methods of measuring spatial density; using either the average space available per person (usually given in square feet per person), and the mean distance between people. The type of measure used can be crucial in an experimental situation, since the same situation may produce a large average space per person, but a small mean interpersonal distance. Figure 1 shows how this situation might come about. Predictions and results may be entirely a function of the type of measure employed.

Mean interpersonal distance and average space available measures are deliberately confounded in this study. That is, since subjects

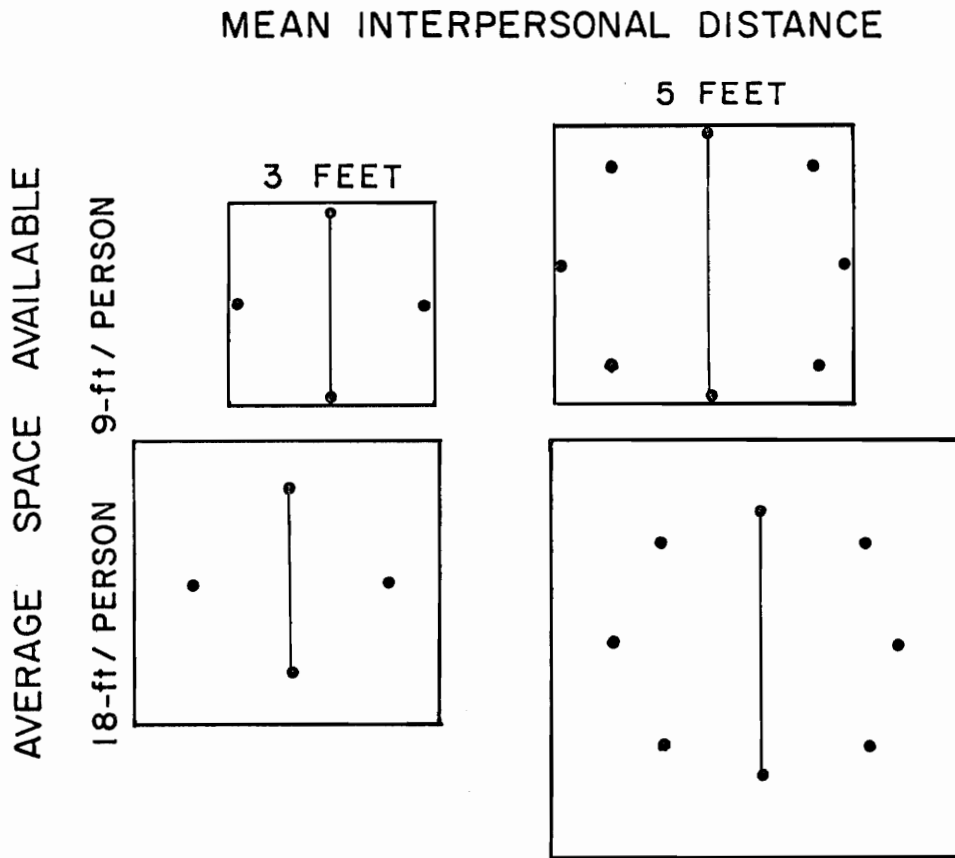


Figure 1. Mean interpersonal distance and average space available as two types of spatial density measures.

are not free to move about, as average space per person increases, so does the mean interpersonal distance. The question of which measure is more reliable for density manipulations must await further research, since its inclusion in the present study would make the project too unwieldy.

The difficulties of the cited studies may be due in part to differences in the type of density manipulation used, and to the assumption that density always results in perceptions of being crowded. The present study is an attempt to eliminate some of the confusion of the literature to date by removing the confound between social and spatial density that precludes meaningful comparisons of the above studies, and is designed in part to tease apart the difference between spatial and social density effects. Many studies employing purely spatial density manipulations have failed to obtain predicted effects (e.g. Freedman, Klevansky, & Ehrlich, 1971), while those studies that do find density effects tend to be those which confound social and spatial density (e.g. Hutt & Vaizey, 1966). The present study contains a purely spatial and a purely social density manipulation in order to assess any differential effects.

Through the use of repeated measures this study will also attempt to help define the time course of density effects. While this has been done to some extent on a large scale (i.e. to twenty-one days) by Smith & Haythorn (1972), it has not been studied on the smaller scale of the laboratory experiment of several hours duration. Results of Smith & Haythorn and of a pilot experiment reported by Marshall & Heslin (in press) indicate that these time-dependent effects may not be mono-

tonic.

Finally, this study will attempt to discover the nature of the relationship between density, both social and spatial, to feelings of crowdedness. Since crowding is a subjective phenomenon, there is little guarantee that any density manipulation will be effective in producing a sensation of crowding in any given subject. Still it is widely assumed (e.g. Stokols et al., 1973) that high density inevitably results in feelings of being crowded, and much research is designed under this assumption. Consequently, few researchers have attempted to measure crowdedness directly. Stokols et al. did so and found crowdedness to be positively related to spatial density. Theirs is a purely spatial density manipulation however, and the effects of social density on perceived crowdedness have yet to be assessed. The present study will attempt to discover the nature of the relationship of density and crowdedness.

METHOD

Subjects

Subjects were 64 male undergraduate students enrolled in several lower level psychology courses at Virginia Polytechnic Institute and State University. Subjects received classroom credit for their participation. The study utilized a factorial, between groups, 2×2^2 matrix in which two levels of spatial density (9 ft²/person and 18 ft²/person) and two levels of social density (4 and 8 people) were used (see Figure 2). All subjects were randomly assigned to one of the four conditions.

Apparatus

The experimental rooms had floor areas of 36, 72, and 144 square feet. Only three room sizes were actually constructed since the 72 ft² room served as both the large room in the four person group condition, and as the small room in the eight person group condition.

The experimental rooms were constructed using existing walls on two sides, and two moveable walls made from 8' x 4' panels of 3/8" plywood on the other two sides. The moveable walls were made free-standing by the use of backing support lumber (2" x 4"). Although these walls did not extend vertically to the ceiling, they did cover 2/3 of the 12' ceiling height. Rooms having this gap between the top of the walls and the ceiling have previously been used effectively in crowding experiments (Stokols, Rall, Pinner, & Schopler, 1973). The moveable walls were painted blue to match the existing walls. Since the experimental room was actually a room within a room, some means had to be provided to prevent subjects from seeing the remainder of the

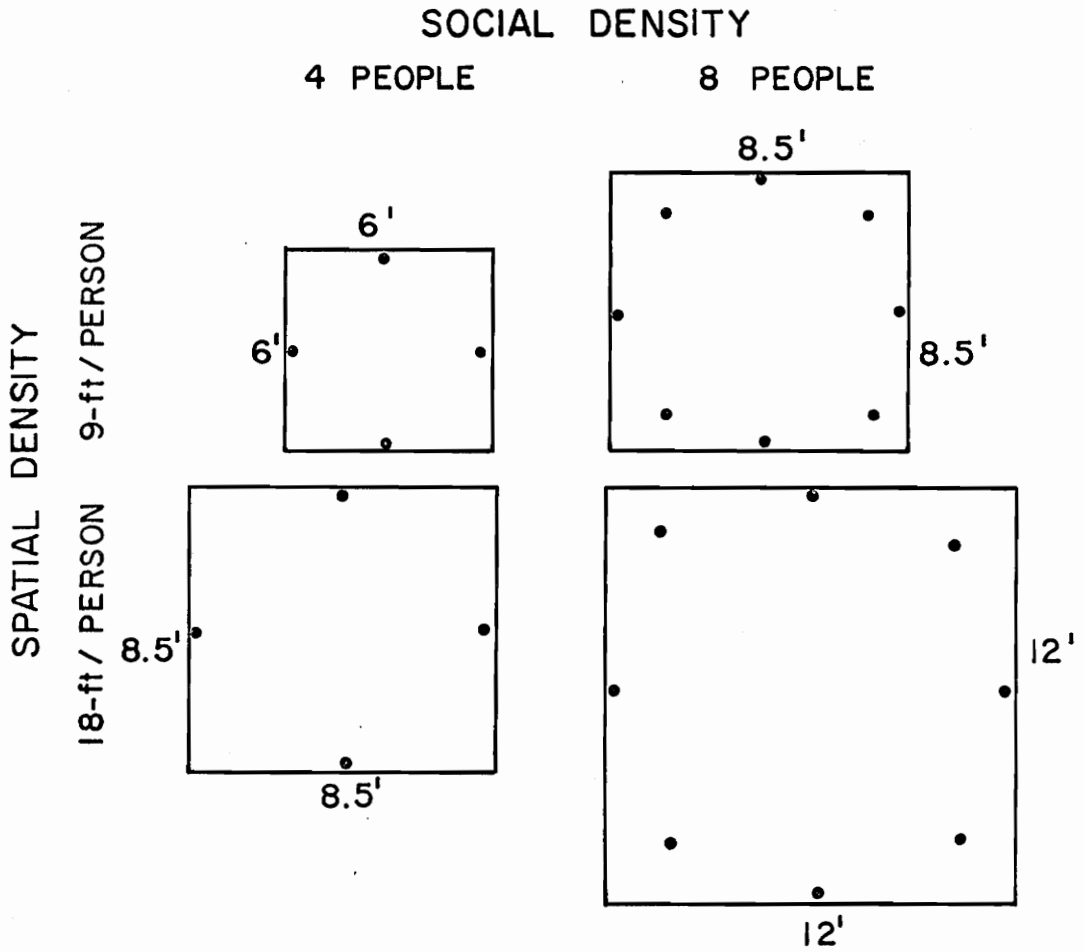


Figure 2. Room sizes and seating arrangements for spatial and social density manipulations.

large room as they filed in and out of the smaller experimental room. Consequently a hallway was constructed of additional free-standing panels which led subjects into the experimental room when the smaller rooms were in use. When the largest room was being used, these extra panels became part of the walls of the experimental room. A curtain served to cover the connection point between the hallway and the experimental room. The chairs used were straight backed and unpadded, and had no arm rests.

Procedure

All subjects were contacted via telephone by the experimenter several days in advance of the experimental session. They were told that a three-credit, 2 1/2 hour experiment was to be run on a given night, and were asked to participate. Once the subject had committed himself to participation, it was explained that the study was concerned with group processes and that the main focus was to find out how people acted in group discussion situations. Subjects were told that in the experiment they would be given several topics to discuss as a group, and that certain questionnaires would be distributed to which they would respond. The phone contact was terminated after subjects were told the date, time, and place of the experimental session.

Subjects were randomly assigned to groups of four and eight and to small or large rooms, and the experimental condition being run on any given night was randomly determined prior to contact of subjects. Except for the qualification that no two subjects in any given group could have the same first name or reside on the same dormitory floor, subjects were contacted at random from a list of volunteers from

several undergraduate psychology courses.

Upon arrival at the experimental building, subjects were met at the door and asked to take a seat in a hallway outside of the experimental room to await the arrival of the other group members. They were also told not to speak to one another before entering the experimental room. In order to make this request seem reasonable, it was pointed out that the experiment involved group discussions, and that it was necessary that subjects not know too much about each other at the outset. As soon as all subjects had arrived, the group was directed into the room and asked to take a seat in chairs placed halfway along each wall (group size of four), or in as large a circle as possible that would fit within the room (group size of eight)(see Figure 2).

After all subjects had taken a seat, the experimenter stepped into the experimental room and explained several general procedural rules that subjects would be expected to follow. Subjects were asked to postpone general questions concerning the experiment until after the experiment was over, but they were encouraged to ask questions that were specific to the clarification of directions of each part of the experiment as they arose. Subjects were also asked to answer all questions honestly, as they felt at the moment. It was explained that several questions and questionnaires would be given more than once, and subjects were told to feel free to change answers to these repeated measures if they felt differently the second time, or to put the same answer if they did not. Subjects were asked not to smoke in the experimental room, and told that a brief break would take place about

half-way through the experiment, during which they could leave the room, smoke, get a drink, etc. Room temperature was monitored and recorded throughout the experiment.

The experimenter then told the subjects of the purpose of the experiment, essentially repeating what had been said over the telephone when subjects had been contacted concerning participation. The experimenter said that the experiment was concerned with group processes and the nature of interactions in group discussions.

On each seat in the experimental room subjects found a clipboard and a pencil. These would be used to fill out the questionnaires. Subjects also found a black felt marker on their seats. It was explained that these were to be used to print their first name on name cards (5" x 8") which had been thumbtacked to the wall over their seat prior to their entry into the room, an act requiring subjects to stand and move about somewhat. Above each name card was another card (3" x 5") which indicated the seat number of each subject. The experimenter pointed these seat numbers out to the subjects and explained that they would become important later in the experiment. At this point subjects were given the first of the questionnaires (see Appendix A) designed to measure expectancies concerning the experiment, liking of group members, and general comfort. Each item on this questionnaire required subjects to respond along a scale of twenty-seven points. The same is true of the majority of the items on each of the self-report questionnaires.

Following the initial questionnaire, subjects were given a task which required them to form as many English words as possible from a

larger word by using only the letters contained therein (see Appendix B). It was assumed that task performance may be affected by the density manipulations and, as such, would be a measure of stress. The later administrations of task measures was intended to serve as a repeated measure in order to assess the presence of time-dependent effects. Subjects were given five minutes to work on the task.

Subjects were then told that they would have the opportunity to take part in a group discussion of the university grading system. Subjects were assigned a position to argue on the issue that was either pro or con, and a specific argument for their assigned position (see Appendices C through J). This was done in order to prevent rapid group consensus on the issue, an occurrence which would tend to terminate social interaction, and also to preclude the possibility of the discussion generating hostile feelings within the group which might affect the dependent variables. Half of the members of each group were given a pro position, and half a con position to support. Subjects were told to be imaginative in the defense of their assigned position, and were given two minutes to think of and jot down supporting arguments. At the end of the two minutes, the experimenter returned to the room, asked if there were any questions, and randomly selected a subject to begin the discussion. Fifteen minutes were allotted for the discussion itself.

The general purpose of the discussion was to force group members to interact with one another, and to avoid the sort of task which would allow them to withdraw into a cocoon. This would presumably give any effects of social density a chance to become manifest. Following the discussion, subjects filled out a questionnaire which served to evaluate

their performance in the discussion (see Appendix K).

Subjects were then given a questionnaire designed to measure group functioning and individual attraction (see Appendices L & M). Following this questionnaire, subjects performed the five minutes timed anagram task of creating English words whose letters were imbedded in a larger word once again. A new target word was used for this second task (see Appendix N).

Following task two, subjects filled out a self-report measure of current mood state, the Current State Check List, adapted from Davitz (1969) (see Appendix O). The CSCL was designed to measure positive and negative emotive responses in order to determine subject's emotional reactions to the manipulations. Later administrations of emotive response questionnaires were designed to test time-dependent effects of the density manipulations on emotions.

After the CSCL, subjects completed an adjective check list using a semantic differential taken from Mehrabian & Russell (1974) concerning the "information rate" of the environment (see Appendix P). At this point, the short break was announced. Subjects were allowed to leave the room, and the experimenter told them the location of the water fountain and the rest room.

Although the experimenter made no explicit reference to the matter unless asked, talking between group members was allowed during the break. It should be pointed out that up to this point in the experimental session, subjects had no verbal contact with one another that was not controlled to some degree by the experimenter. The incidence of spontaneous conversation occurring between group members during the

break was unobtrusively recorded at two different times by the experimenter. At the end of the break subjects were asked to reenter the experimental room and to take their original seats.

After the break, subjects engaged in a second controlled discussion, this one concerning the abolition of varsity sports at Virginia Tech. Once again each subject was given a position on the issue to support and to defend (see Appendices Q through X). Following this discussion, subjects filled out three questionnaires designed to evaluate their participation in the discussion (see Appendix K), their general state of mind (CSCL, see Appendix O), and their feelings towards the other group members (see Appendices L & M).

Subjects were then asked to imagine that they were part of a jury whose task it was to evaluate several hypothetical cases. They were told that they would read each case and discuss it as a group for about five minutes. At the end of the time allotted, the experimenter reentered the room and subjects then answered two questions concerning the case. The first question typically asked subjects to rate the degree of guilt they felt was associated with the person in the story. The second question asked subjects to determine the length of sentence of the defendant from the minimum the law allows to the maximum the law allows, given that he had been given a fair trial and found to be guilty (see Appendices Y through CC). The cases were taken generally from the Kohlberg Moral Development Scale (Kohlberg, 1958), but were modified to seem more ambiguous. This alteration was done in order to allow greater variability of responses than is typically found with this scale when the subjects are college students. The cases were used

in an attempt to create ambiguous situations which might serve as a measure of aggression, with the length of sentence being the principal dependent variable, and not in an attempt to measure moral development. There were five such cases.

Following the last of the mock jury cases, subjects were separated in rooms across the hall from the experimental room in an attempt to determine the extent to which Glass & Singer's (1972) data concerning stressful situations would apply to the current situation. These authors studied the effects of various stressors on task performance and found that while the presence of such stressors generally failed to produce response decrements, subjects did show such decrements in task performance once the stressor was removed. The rationale used by Glass & Singer to explain their results was that subjects performed the tasks in the presence of stressors at some "psychic cost" and that the expenditure of extra energy used to maintain performance levels under stress resulted in performance decrements once the stressor was removed. Thus the comparison of data collected in the present experiment after separation from the group and from the experimental room with that collected before separation reflects the operation of such effects in the present case.

Following separation, subjects engaged in a third word formation task (see Appendix DD), filled out a form of the Mood Adjective Check List taken from Nowlis (1970) (see Appendix EE), and completed a final questionnaire designed to evaluate the discussion of the mock jury cases and the general feelings towards the experimental situation (see Appendices FF & GG). Subjects were also asked to list all of the names

of other group members that they could remember, a measure designed to determine the extent to which deindividuation of others might operate in the experiment.

After completion of this final questionnaire, subjects were re-assembled and debriefed. Table II is a time line which presents the average amount of time taken by each component of the experimental procedure, as well as an average of the total experimental time.

TABLE II

Experimental Time Line

Real Time	Elapsed Time	Event
		Arrival
7:30	:00	
		Seating, Name Tags, Instructions, Like 1
7:35	:05	
		Task 1
7:40	:10	
		Discussion 1
7:57	:27	
		Role Playing Evaluation, Like 2
8:02	:32	
		Task 2
8:07	:37	
		CSCL-1
8:12	:42	
		Information Rate
8:17	:47	
		Break
8:25	:55	
		Discussion 2
8:45	1:15	
		Role Playing Evaluation, Like 3
8:50	1:20	
		CSCL-2, Cases A-E
9:15	1:45	
		Separation
9:20	1:50	
		Task 3
9:25	1:55	
		MACL
9:33	2:03	
		Final Report Questionnaire
9:45	2:15	
		Debrief

RESULTS

Traditionally, there are two ways to analyze data from an experiment such as this one which involves a nested design (i.e. groups of four and eight are nested within condition). One way is to ignore the possible effects that may accrue from a subject's being part of a given group rather than being part of a given treatment condition. This type of analysis was performed by Marshall & Heslin (in press). However, such a treatment of the data artificially inflates the probability of obtaining significant results, and has recently been called into question (Schiffenbauer, in press). Where F values are enormously high, such an analysis has little detrimental effect. However, for those results which reach lower significance levels, there is always the danger of obtaining falsely significant results.

A more conservative method is to use group mean data rather than individual scores as the unit of analysis. While this method produces accurate alpha levels, it does require the use of large numbers of subjects in order to obtain a sufficiently large number of degrees of freedom.

The analysis used in the present study represents a compromise between these two methods. In this study individual data was the unit of analysis, but preliminary analysis was performed on all data in order to determine the extent to which separate replications in a given experimental condition differed from one another. Where such group effects were not statistically significant, analyses of variance were performed on the data. Those dependent variables which reflected significant group effects were also analyzed, but the presence of such

group effects will be noted. A note of caution must be sounded in the case of these latter variables. Where group effects were found, any reported effects due to treatment must be viewed with caution.

Unless otherwise specified, the data consist of individual scores and not group means. Individual scores were used because (1) while each subject was a member of a group, the great majority of the data collected involved reports from individual subjects, and not a joint effort on the part of group members, and (2) it was felt that the great numbers of subjects necessitated by the use of group means data would be prohibitive. The results for each of the major classes of dependent variables will be reported separately.

Emotion Self-Reports

The emotion self-report measures included the two administrations of the Current State Check List (CSCL) and the single administration of the Mood Adjective Check List (MACL). Table III presents the means for positive and negative emotions of CSCL-1 and CSCL-2. Analysis of variance reveals that for CSCL-1 there was a social density x spatial density interaction, $F(1,60)=4.03$, $p < 0.05$, for negative emotive feelings such that subjects in groups of four report feeling more negative emotions in small rooms ($\bar{X}=104.6$) than in large ones ($\bar{X}=80.4$), while subjects in groups of eight report feeling more negative emotions in large rooms ($\bar{X}=102.6$) than in small ones ($\bar{X}=60.0$). For CSCL-2 there was a main effect due to social density, $F(1,60)=4.63$, $p < 0.05$, for positive emotive feelings, with subjects in groups of four reporting more positive emotions than subjects in groups of eight ($\bar{X}=187.2$ and $\bar{X}=152.0$, respectively).

TABLE III

MEAN POSITIVE AND NEGATIVE EMOTION RATINGS
(CURRENT STATE CHECK LIST)

Positive Emotions

	CSCL-1			CSCL-2	
	Small Group	Large Group		Small Group	Large Group
Small Room	194.00	146.37	Small Room	206.81	156.25
Large Room	150.25	154.94	Large Room	167.69	147.81

Negative Emotions

	CSCL-1			CSCL-2	
	Small Group	Large Group		Small Group	Large Group
Small Room	104.56	60.00	Small Room	75.93	50.81
Large Room	80.37	102.56	Large Room	67.44	76.12

Table IV presents the means for the various scales of the MACL. Results of analyses of variance performed on MACL data indicate that while the three positive scales were not influenced systematically as a result of treatment condition, four of the five negative scales did show significant results. For the aggression scale there was a main effect due to spatial density, $F(1,60)=13.15$, $p < 0.001$. The same is true of the anxiety scale, $F(1,60)=5.55$, $p < 0.05$, the sadness scale, $F(1,60)=7.50$, $p < 0.01$, and the egotism scale, $F(1,60)=6.52$, $p < 0.05$. These effects are in the same direction with subjects reporting increased feelings of aggression and egotism in large rooms than in small rooms. For the egotism scale however there was a significant group effect, $F(8,52)=4.56$, $p < 0.001$, and therefore this result must be viewed with some caution. The situation is somewhat more complex for the anxiety and sadness scales since they also had significant social density x spatial density interactions, $F(1,60)=6.35$, $p < 0.05$, and $F(1,60)=4.07$, $p < 0.05$, respectively. Subjects in groups of eight reported being more anxious in large rooms than in small rooms, while this increase in anxiety was not descriptive of the reports of subjects in groups of four. The significant interaction found in the sadness scale is also produced mainly by the subjects in groups of eight and in the large rooms. Subjects in this group reported being much sadder ($\bar{X}=128$) than did their counterparts in groups of eight in small rooms ($\bar{X}=95$). Subjects in groups of four showed only slightly more feelings of sadness in large rooms than in small ones ($\bar{X}=101$, $\bar{X}=96$, respectively).

Table V presents the correlations of positive and negative items of CSCL-1 and CSCL-2 with the various scales of the MACL. The cor-

TABLE IV

MEAN POSITIVE AND NEGATIVE EMOTION RATINGS
(MOOD ADJECTIVE CHECK LIST)

		Small Group		Large Group	
		Small Room	Large Room	Small Room	Large Room
Positive	Surgency	11.74	12.19	11.62	11.94
	Elation	9.37	8.69	8.94	8.00
	Affection	23.12	21.87	22.19	21.06
Negative	Anxiety	8.75	8.62	8.18	11.87
	Sadness	6.00	6.31	5.94	8.00
	Aggression	8.62	10.56	8.69	13.62
	Egotism	4.19	4.87	4.12	5.75
	Fatigue	18.06	18.00	15.50	20.00

MACL
SCALE

TABLE V
CORRELATIONS AND PROBABILITIES
OF CSCL AND MACL ITEMS

1

		MACL Scale							
		Positive				Negative			
		Surgency	Elation	Affection	Aggression	Anxiety	Sadness	Egotism	Fatigue
CSCL Scale	Positive	.595 (.0001)	.601 (.0001)	.539 (.0001)	-.122 (-.6624)	-.199 (-.1099)	-.096 (-.5435)	.190 (.1285)	-.063 (-.6271)
	Negative	.036 (.7740)	.090 (.5153)	-.013 (-.9119)	.410 (.0049)	.454 (.0011)	.268 (.0004)	.349 (.0300)	.274 (.0267)

1. Values in parentheses represent probability levels.

relation matrix indicated a very significant relation between those CSCL items designated as being representative of "positive" emotions and the three positive scales of the MACL, and a somewhat lower one between those CSCL items designated as being "negative" emotions and the five negative scales of the MACL. This statistical equivalence indicates that the three emotion self-report measures may be considered to be repeated measures.

Using only the two administrations of the CSCL as repeated measures, there were no trials effects for reports of positive emotions. However, there was a significant trials effect, $F(1,60)=12.51$, $p < 0.001$, for negative emotions such that subjects reported less negative emotive feelings on the later CSCL administration ($\bar{X}=67.6$) than they do on the first CSCL administration ($\bar{X}=86.9$), regardless of treatment condition.

Task Performance Measures

Table VI presents the group means for the three task measures. The tasks consisted of anagram problems and were given at three different points during the procedure. Subjects worked alone on the solutions. Analysis of variance performed on the tasks individually and on the combined performance scores revealed no significant differences due to treatment conditions.

Analysis of task performance as a repeated measure however revealed a significant trials effect, $F(2,120)=85.59$, $p < 0.001$. There are at least three possible reasons for this finding: (1) practice effects are in operation, (2) the anagrams may have been presented in descending order of difficulty, or (3) the results may reflect a

TABLE VI

GROUP MEANS FOR TASK PERFORMANCE

		Small Group		Large Group	
		Small Room	Large Room	Small Room	Large Room
	Task 1	16.7	17.3	17.2	18.3
Task Number	Task 2	24.8	26.2	24.8	25.1
	Task 3	22.7	25.5	25.7	27.1

general decline in stress throughout the course of the experiment.

There was also a significant trials x social density interaction, $F(2,120)=3.20$, $p < 0.05$, due totally to the results of the third task. Subjects in groups of eight did steadily better on the three tasks, while the performance of subjects in groups of four fell off sharply on the final task. It should be pointed out that this crucial difference between group performances occurred on that task which was presented after the group members had been separated.

Liking

The data on liking for group members was collected and analyzed in three ways. First, subjects were asked at four different points in the procedure to indicate how much they liked the group as a whole. Secondly, subjects were asked at three different times to indicate their willingness to participate in another experiment with the same group members if such an experiment were run. Positive responses to these questions were assumed to reflect more positive feelings towards group members. Finally, subjects were asked at three different times to indicate how much they liked each individual member of the group. This last set of questions was intended to reveal the extent to which interpersonal distance (i.e. the distance between the seats of members) influenced liking for group members.

Liking Of The Group As A Whole

Table VII presents the group means for the "liking of group" measure. Analysis of variance performed on the group liking data revealed a main effect of social density on group liking the third time that subjects were asked to respond to this question (Like 3),

TABLE VII

GROUP MEANS FOR THE "LIKING OF GROUP" MEASURE

	Small Group		Large Group	
	Small Room	Large Room	Small Room	Large Room
Like 1	16.69	16.06	17.00	15.06
Like 2	20.25	20.19	19.40	19.06
Like 3	22.25	22.12	20.69	18.31
Like 4	20.44	19.63	19.19	16.13

Like
Number

but no significant effects for Like 1, Like 2, or Like 4. The significant effect for Like 3, $F(1,60)=7.20$, $p < 0.01$, indicated that for this trial at least, subjects in groups of four liked their groups more than did subjects in groups of eight ($\bar{X}=22.3$ and $\bar{X}=19.5$ respectively). It should be pointed out that the Like 4 measure was taken following group separation.

Since this measure was taken four times, analysis for repeated measure (i.e. trials) effects was performed. Results of analysis of variance indicated that there was a highly significant trials effect, $F(3,180)=92.37$, $p < 0.01$, with subjects in all groups reporting more liking of group members as the experiment progressed. There was also a significant trials x social density interaction, $F(3,180)=3.69$, $p < 0.05$, indicating that while liking of other group members increased with time, this was true to a greater extent for groups of four than for groups of eight.

Willingness To Participate Again

Table VIII presents the group means for the future participation items. Analysis of variance performed on the future participation data indicate no differences due to treatment conditions the first and third time this question was asked, but a significant social density x spatial density interaction for the second trial, $F(1,50)=6.69$, $p < 0.05$. For this item, subjects in groups of four report a greater willingness to participate again with the same group members in a large room than in a small room, while the reverse is true for subjects in groups of eight. It should be pointed out that there was a significant groups effect found for the third trial in preliminary analysis,

TABLE VIII

GROUP MEANS FOR FUTURE PARTICIPATION ITEMS

		Small Group		Large Group	
		Small Room	Large Room	Small Room	Large Room
	1	18.88	19.81	18.00	19.57
Trial	2	17.81	19.15	20.63	13.22
	3	22.19	21.06	22.19	21.37

an indication that there is some measure of uncontrolled variability on this measure.

Liking Of Individuals

The data analysis of individual liking scores was performed in order to determine the extent of operation of interpersonal distance as a variable. In groups of four there are two individual distances, a short one to a subject's nearest neighbors, and a longer one to the subject seated directly opposite. These have arbitrarily been labeled distances a and b respectively. In groups of eight however there are four such distances, one to each of the other subjects (disregarding symmetry). These have been labeled distances A, B, C, and D. It is clear that distance a is not equivalent to distance A. The data analysis for groups of four and for groups of eight are therefore kept separate.

Table IX shows group means for the liking of individual group members. Results indicate that for groups of four there is a significant trials effect, $F(2,60)=7.08$, $p < 0.01$, such that subjects report liking other group members more as the experiment proceeds. This result coincides with an identical finding on the liking for the group as a whole measure. For these groups there is also a significant distance x spatial density interaction, $F(1,30)=6.50$, $p < 0.05$. This occurred mainly because subjects in large rooms report liking other group members who are sitting across from them (distance b) more than those sitting nearer to themselves (distance a), while subjects in small rooms like other members who are close to them more than those sitting across.

TABLE IX

GROUP MEANS FOR THE "INDIVIDUAL LIKING"
MEASURE FOR FOUR-MAN GROUPS

	Small Room		Large Room		
	Distance a	Distance b	Distance a	Distance b	
Individual Liking Number	Like 1	21.06	20.44	18.84	19.81
	Like 2	21.19	21.13	21.00	22.25
	Like 3	21.66	21.75	21.56	22.44

Table X shows group means for the liking of individual group members for the eight man groups. For these groups there are no significant trials or distance effects. There is however a significant main effect for spatial density, $F(1,30)=4.69$, $p < 0.05$, such that subjects in small rooms like other group members more than do subjects in large rooms. This result appears despite the fact that there were no spatial density effects on reports for liking of the group as a whole.

Cases

The cases were intended to measure aggression via the degree of guilt and length of sentence questions. Results showed however a tremendous amount of variability, and little consistent data was obtained.

Table XI presents the group means for the guilt questions and the length of sentence questions for the five mock jury cases. There was a significant spatial main effect for the guilt question of Case A, $F(1,60)=11.78$, $p < 0.01$, with subjects in small rooms assigning a greater degree of guilt to the defendant than subjects in large rooms. There was also a significant social density x spatial density interaction for the guilt question of Case D, $F(1,60)=5.69$, $p < 0.05$, such that subjects in groups of four assigned more guilt in small rooms, while subjects in groups of eight assigned more guilt in large rooms.

There was a significant main effect due to social density on the guilt question of Case B, $F(1,60)=4.41$, $p < 0.05$, a significant main effect due to spatial density on the neighbor's decision to turn in the defendant in Case C, $F(1,60)=6.53$, $p < 0.05$, a main effect due to social density on the sentence of Case E, $F(1,60)=8.50$, $p < 0.01$, and a social

TABLE X

GROUP MEANS FOR THE "INDIVIDUAL LIKING"
MEASURE FOR EIGHT-MAN GROUPS

Individual Liking Number	Small Room				Large Room			
	Distance				Distance			
	A	B	C	D	A	B	C	D
Like 1	20.75	21.50	19.87	21.87	18.94	19.03	18.44	18.37
Like 2	19.75	20.56	19.56	20.81	17.69	18.00	16.28	17.06
Like 3	18.91	19.94	18.59	19.87	17.78	18.37	17.59	17.62

TABLE XI

GROUP MEANS FOR GUILT AND SENTENCE ITEMS
OF MOCK JURY CASES

	Small Group		Large Group	
	Small Room	Large Room	Small Room	Large Room
A Guilt	26.06	22.44	25.87	19.50
A Sentence	6.94	8.19	13.00	9.12
B Guilt	22.62	24.75	18.25	21.19
B Sentence	12.12	8.31	11.87	8.50
Case C Guilt	8.50	17.62	10.87	13.81
Item C Sentence	15.81	12.37	13.31	12.75
D Guilt	6.81	5.37	4.37	11.62
D Sentence	2.12	1.62	3.31	5.87
E Guilt	16.69	21.44	20.87	10.37
E Sentence	10.31	15.75	8.56	7.00

density x spatial density interaction on the decision to turn in the defendant in Case E, $F(1,60)=13.54$, $p < 0.001$. These four effects are not elaborated upon because each of these measures, as well as all other case sentence and case guilt measures not mentioned above, had significant groups effects. Very little in the way of systematic results emerges from the analysis of the case data except a conviction that other noncontrolled factors were active on these measures.

Physical Factors

Subjects were asked to indicate how hot they felt the room was, how stuffy the room was, how adequate the room was for the experiment, how comfortable they felt in the room (taken twice), how crowded the room was, how anxious they were in the room, and how, if at all, the room size should be changed if the experiment were run again. The actual temperature of the experimental room was monitored at four points during the procedure.

Table XII shows the group means for physical factor data. Analysis of variance revealed a main effect of social density for perceived room temperature, $F(1,60)=5.69$, $p < 0.05$, and for perceived stuffiness of the room, $F(1,60)=8.51$, $p < 0.01$. Specifically, subjects in groups of eight felt the room to be significantly hotter and stuffier than did subjects in groups of four. The perceived room temperature and perceived stuffiness measures correlated positively with the actual room temperature ($r=0.56$, $p < 0.01$; $r=0.52$, $p < 0.01$) for all subjects, regardless of condition. It should be pointed out however that the thermometer which allowed for unobtrusive monitorings was located on the outer wall of the experimental room. While the walls of the room

TABLE XII

1

GROUP MEANS FOR PHYSICAL FACTOR DATA

	Small Group		Large Group	
	Small Room	Large Room	Small Room	Large Room
Perceived Temperature	16.37	13.37	20.31	17.69
Perceived Stiffness	15.81	12.06	19.69	18.75
Item Comfort 1	14.78	16.56	12.20	15.87
Crowded	17.31	9.87	14.50	11.81
Change Room Size	+3.12	+1.19	+3.44	-0.50

1. Positive valence on the "change room size" item indicates a desire to make the experimental room larger, while a negative valence indicates a desire to make it smaller.

did not extend completely to the ceiling and thus allowed for some measure of ventilation and dissipation of room heat, it may have been the case that the temperature inside the experimental room may not have been accurately reflected by the thermometer readings. While no differences were found in actual room temperatures for groups of four and groups of eight, the internal room temperature may have varied systematically with room size and with group size. The perceived temperature and perceived stuffiness measures then may accurately reflect actual room temperature. It should also be pointed out that preliminary analysis indicated the presence of significant groups effects for both of these measures.

There was a significant main effect due to spatial density on the first comfort of the room measure, $F(1,60)=4.66$, $p < 0.05$, with subjects in large rooms reporting being more comfortable than subjects in small rooms. This effect is not in evidence the second time the question is asked however, and it may not persist through time. This first comfort measure also correlated negatively with actual room temperature ($r=-0.36$, $p < 0.01$).

While there are no significant effects due to treatment on the adequacy of room measure, there was a significant main effect due to spatial density when subjects were asked to rate how crowded they had felt in the room, $F(1,60)=6.13$, $p < 0.05$. Predictably subjects in the small rooms reported feeling more crowded than did subjects in large rooms. This finding indicates that the room size manipulations were effective in the achievement of the desired objective, to act differentially on the groups. The crowded measure did not correlate with

actual room temperature, and there was no effect due to social density reflected by the crowdedness measure.

When asked how, if at all, the experimental room should be changed if the experiment was to be run again, subjects in the small rooms felt that the room should be made larger to a greater extent than did subjects in the large rooms, $F(1,60)=16.75$, $p < 0.001$. In fact, subjects run in the large room and in groups of eight felt that the room should be made slightly smaller. The judgements about changing room sizes was not related at all to actual room temperature.

Information Rate

Table XIII presents the group means for the information rate questionnaire. The information rate measure may be seen as an indication of the information content of a setting or situation. Analysis of variance revealed a spatial density main effect, $F(1,60)=4.27$, $p < 0.05$, with more information being contained in small rooms than in large ones. There was no significant effect due to social density.

Behavioral Measures

Table XIV presents the percent of subjects engaged in conversation at two minutes and at five minutes into the break. Results of the two minute monitoring revealed no differences in the number of conversations as a function of treatments. There were some differences due to treatment on the number of subjects involved in conversations, but since groups contained different numbers of members across conditions, it was felt that percentage scores would more accurately reflect the participation in conversations during the break. These percentage scores showed an effect for social density with a greater percentage of subjects

TABLE XIII

MEAN RESULTS OF THE
INFORMATION RATE QUESTIONNAIRE

		Social Density	
		Groups of Four	Groups of Eight
Spatial Density	Small Room	54.12	59.62
	Large Room	49.18	52.75

TABLE XIV

PERCENT OF SUBJECTS INVOLVED IN CONVERSATIONS
AT TWO MINUTES AND FIVE MINUTES INTO THE BREAK

	Small Group		Large Group	
	Small Room	Large Room	Small Room	Large Room
Two Minutes	68.75	56.25	75.00	43.75
Five Minutes	93.75	75.00	68.75	68.75

in groups of four willing to enter into conversations with their group-mates than subjects in groups of eight. There was also an effect of spatial density such that subjects in small rooms were more talkative than subjects run in large rooms.

These initial findings were repeated at the five minute monitoring, with the addition of a trials effect. That is, a greater percentage of subjects were engaged in conversation at five minutes than at two minutes.

Statistical analysis was not performed on these data since (1) it is not clear that groups of eight can be compared to groups of four, even after raw data has been converted to percentage scores, a consequence of the unequal N of the two groups, and (2) these data are group means and not individual scores, and therefore the N is quite small.

DISCUSSION

One of the major purposes of the present experiment was to find out if the effects of social and spatial density could be teased apart, and it has been demonstrated that this can be done, since both types of main effect occurred in the absence of the other. In answer to the original question then, it may be seen that both social and spatial density may individually serve to mediate observed density effects, since social and spatial density differentially affected many dependent variables. The conclusions drawn concerning the operation of these two variables in any crowding study will depend upon the types of dependent variables used.

It was suggested that the inconsistent results of density manipulations found in the crowding literature may be due in part to confounding between social and spatial density, and to differences in the type of density manipulation used. Results of this study indicate that this might very well be the case, since they demonstrate effectively that social density and spatial density are simply not the same variable.

It is difficult to compare these results with those of studies that confound social and spatial density, since it is impossible to tell which factor(s) is causing observed results in the latter studies. However, where dependent variables coincide with those of the present study, an effort will be made to compare results.

Spatial Density Effects

Marshall & Heslin (in press) found that subjects demonstrated more liking for other group members in small rooms than in large ones.

Results of the present study again provide partial confirmation, but the presence of significant interactions makes interpretation somewhat more difficult. There was a social density x spatial density interaction on the second trial of the future participation measure (see Social Density Effects below). For liking of individual group members in groups of eight, there was a main effect for room size, with subjects in small rooms liking their fellow subjects more than those in large rooms. For groups of four on this latter measure there was a spatial density x interpersonal distance interaction such that subjects in large rooms report liking other group members who are sitting across from them more than those sitting nearer to themselves, while subjects in small rooms like other members who are close to them less than those sitting across.

It should be pointed out that according to self-reports, the large room for groups of eight is really overly large, and may be too large for proper group functioning to occur. This room size required subjects to talk in a louder-than-normal voice in order to be heard by all other members of the group, and while the available space per person is large, it may be the case that subjects feel too spread out for proper group interaction. That is, the subjects may feel that the available space, while large, is inappropriately used, and that their goals of effective communication are being blocked. This may easily have depressed liking and affect scores for this condition relative to those recorded for the more comfortable small room sizes, since this goal-blocking would then lead to generally negative feelings (Stokols, 1972b), and this is precisely what occurred, as evidenced by CSCL-1, CSCL-2, and MACL data.

This fact should be recalled anytime groups of eight in large rooms are the cause of significant interactions.

Marshall & Heslin (in press) report depressed general feelings in small rooms relative to large ones, a finding which conflicts with those of Smith & Haythorn (1972). For CSCL-1 of this study, subjects in groups of four reported feeling more negative emotions in small rooms, while those in groups of eight felt more negative emotions in large rooms. For CSCL-2 subjects in groups of four reported feeling more positive emotions than subjects in groups of eight. On the MACL measures, subjects reported feeling more aggression, sadness, and egotism in large rooms than in small ones. Thus, results of the present study show some agreement with each study. It should be pointed out that the MACL, that measure which shows results similar to those of Smith & Haythorn, was taken after group separation, and thus may tap time-dependent effects. It will be recalled that the stress experienced by the subjects of Smith & Haythorn was also time-dependent. Earlier in the study however, the CSCL-1 data agrees with the findings of Marshall & Heslin. It is interesting to note that the CSCL-1 measure was taken at approximately forty-five minutes of elapsed experimental time, or at a point well before separation, and it is quite probable that reactions of males to spatial density may change through time. Such findings mesh nicely with a theory concerning time-dependent effects of density proposed by Marshall & Heslin. These authors report that males may be concerned with maintaining their territories, asserting their independence, and maintaining proper interpersonal distances early in an experiment, but that these feelings may change to a "we" feeling and a

team spirit that would make the density positive through devotion to a common task (i.e. getting through the experiment in this case).

Baxter & Deanovich (1970) found that subjects seated at a close distance to the experimenter felt more anxiety than those sitting further away. On the MACL of the present study, there was a significant spatial density x social density interaction on the anxiety scale items. Subjects in groups of eight reported being more anxious in large rooms than in small rooms, while this increase in anxiety was not descriptive of the reports of subjects in groups of four. Thus, once again subjects in the 12' x 12' room were responsible for interaction effects.

Freedman et al. (1972) report that in a mock jury situation they found more negative responding under spatially dense conditions. Some confirmation of these results was obtained in the present experiment since subjects in small rooms assigned a greater degree of guilt in Case A than did subjects in large rooms. Spatial density interacted with social density in the guilt question of Case D in that subjects in groups of four assigned more guilt in small rooms, while subjects in groups of eight assigned more guilt in large rooms. Subjects in small rooms were also more likely to turn in the escaped convict in Case C than were subjects in large rooms, but this finding is contaminated by the presence of significant groups effects.

The failure of the cases in the mock jury situation of the present experiment to yield consistent data is disappointing. Although effects due to treatment did occur, these were usually overshadowed by significant groups effects due to the variability of responding. In addition, each case seemed to tap some idiosyncratic nerve in the groups

such that a group might deal severely with the defendant on one case, and let him off lightly because of a technicality on the next. In all, the cases did not turn out to be an effective measure of aggression. It should be remembered that they were originally constructed for a different purpose, and that they had been greatly modified in an attempt to provide for the variability of responding which eventually rendered them ineffective.

The original proposal of Stokols (1972a) which differentiated between density and crowding stated that crowding was a psychological phenomenon which came about by the presence of some sort of density which acted as a stressor. The fact that subjects reported feeling more crowded in small rooms than in large ones, but did not report differential feelings of crowdedness as a result of social density manipulations, indicates that crowding in the sense implied by Stokols is responsive to available space (i.e. spatial density) and not due to social density factors. This in turn means that the observed effects of social density, both in the present study and in that of Marshall & Heslin (in press) cannot be mediated by crowding.

Additional effects of spatial density are that subjects reported being less comfortable in small rooms than in large ones, and subjects in small rooms felt that the rooms should be enlarged if the experiment were ever run again. Subjects also reported that they received more information from the environment in small rooms than in large ones. This last finding is interesting in that social density had no significant effect on the rate of information that subjects report gaining from the environment. This has implications for Milgram's (1970) theory

of crowding, since he states that the important factor in the production of stress that is found in cities is sensory overload. Clearly in this experiment stressful sensory overload is not brought about by social factors, but does occur as a result of reduced room size. It may be of course that the addition of even more people would have produced such a social effect.

Social Density Effects

Analysis of results indicates that social density effects did occur, both as main effects and in interaction with spatial density and trials effects. Marshall & Heslin (in press) report that their subjects liked group members more in small groups than in large ones. Results of the present study provide partial confirmation of this finding since they indicate that subjects in groups of four report having generally more positive feelings than the more dense groups of eight, at least late in the experiment, and like their groups better just prior to separation (i.e. Like 3). On the second future participation measure, there was a social density x spatial density interaction with subjects in groups of four reporting a greater willingness to participate again with the same group members in a large room than in a small room, while the reverse is true for subjects in groups of eight.

Griffitt & Veitch (1971) demonstrated that both high "density" and high temperatures resulted in more negative feelings being expressed by subjects towards an anonymous stranger. To the extent that this measure can be considered a reflection of aggression, the effect fails to materialize in the present study. While the jury cases offer a better parallel between the two studies, the results are highly inconsistent.

Results of the MACL however indicate that more aggression, sadness, and egotism is felt by subjects in large rooms than in small ones (i.e. in the less dense situation). The most significant result of social density on these measures is that this trend is most characteristic of groups of eight in large rooms. Furthermore, perceived temperature and perceived stuffiness failed to correlate significantly with any of the negative emotive measures. This indicates that temperature as it was perceived by the subjects had no effect on the emotive self-report measures. It is true however that the two studies are difficult to compare since (1) the present study made no attempt to manipulate temperature, merely to monitor it, and (2) density in the Griffitt & Veitch study is a confounded variable relative to the present study.

In general it would seem that subjects respond more favorably in the least dense experimental situation (i.e. groups of four and large rooms), and less so in the more dense situations, although this is not entirely the case. There is evidence that this relationship holds at least early in the experiment, and then may reverse itself. Social density x spatial density interactions cloud the issue somewhat however.

The eight-man groups in the large room accounted for a great number of reliable interaction effects. These subjects showed generally more negative responses than the remainder of the subjects; the most evidence of negative emotions on CSCL-1, the least positive emotions on CSCL-2, and the most anxiety and sadness on the MACL. They were also least willing to enter into conversations with their group-mates during the break, and the least willing of all of the groups to participate again in a future experiment with the same group members. It appears that

for these subjects at least, the large room was too large, and that it engendered generally negative feelings among group members. Intuitively it would seem that this largest room forced artificially large interaction distances on the subjects, and it is probable that the spatial relationships of the group members was inappropriate. It is interesting that previous investigators have talked about the deleterious effects of "inappropriate crowding" as they pertain to high density conditions (Desor, 1972; Stokols, 1972b), but these results would seem to indicate that rooms may be overly large for the task at hand, and that any non-normative spatial arrangement may be seen by subjects as inappropriate and cause negative effects which are usually associated with high density situations. Clearly more work is needed in this area.

Time Effects

Since it presumably takes time for density effects to become manifest, and since one of the original purposes of this experiment was to help map out the time course of density effects, the experiment was designed to last for approximately two and one-half hours. Marshall & Heslin (in press) had sessions of one and one-half hours and Freedman et al. (1972) sessions of three hours. This latter study included two hours of filler tasks prior to the recording of dependent variables in two experiments. Smith & Haythorn (1972) have the longest laboratory experiment to date. The subjects in their experimental groups were together for twenty-one days.

Very few studies in the crowding literature bother to record and report time-dependent effects. While Altman & Haythorn (1967) did so, their independent variable manipulations are such that their study is

not directly comparable to the present one. Freedman et al. (1972) assume the operation of a time course for density effects, but make no attempt to monitor it, preferring instead to collect all data after such effects have presumably become manifest. Marshall & Heslin (in press) report only that a pilot study indicated a general "lightening of the subject's mood" as the experiment neared completion. The present study used repeated measures throughout.

The present experiment found a general lessening of the expressed feelings of negative emotions as the experiment progressed. This is totally in line with the contentions of Marshall & Heslin. However, these authors administered their main dependent measures at the end of one and one-half hours in an attempt to tap more accurately group interactive feelings and avoid the end-of-experiment effect. Analysis of differences between CSCL-1 and CSCL-2 data indicate that such a lightening of mood has already occurred at the one and one-half hour mark, at least in the present experiment. This is the case if one assumes that fewer reported negative feelings is the equivalent of mood lightening.

Both the liking of group as a whole measure and the liking of individual group members where group size is four indicate a very significant time effect, with consistently higher ratings being given to the group and its members as the experiment progresses. While this trend also holds true for the individual group member liking measure for groups of eight, it fails to reach statistical significance, $F(2,60) = 2.96$, $p > 0.05$. The effect of time on group liking is complicated by the presence of a significant social density by trials interaction.

While nearly all subjects report liking their groups more with the passage of time, this is true to a greater extent for groups of four than groups of eight.

There is a practice effect for the repeated task measure, with subjects forming more words on later trials. Since the task variable was used as a measure of stress, the increase in word output across the task measures, as well as the increased liking of the group with time found above, may indicate a progressive reduction in stress which may be related to the "mood lightening" effect reported by Marshall & Heslin (in press). There is also a significant trials x social density interaction caused by a sharp decrease in word production for subjects in groups of four on the last task administration. Since this trial came after separation, it may reflect the operation of a Glass & Singer (1972) style rebound effect.

Mechanisms

The mechanism by which a density manipulation produces its effects on the dependent variables used has been called into question. The traditional view is that density is positively correlated with arousal, and that high density increases arousal to the point of discomfort, an effect which may become manifest in several ways. A relatively recent theory states that the effects of density interact with the ongoing affect of a situation in such a way as to intensify this affect. That is, subjects will report more liking or more dislike of others, depending on the predisposition of the subject, or the type of situation provided by the experimenter, in a dense situation than in a less dense one. Exactly such effects were obtained by

Schiffenbauer & Schiavo (in press), and the susceptibility of density effects to modification by experimenter-imposed conditions such as attitudes of a person being evaluated (Griffitt & Veitch, 1971) or type of social interaction (Stokols et al., 1973) has been demonstrated.

It is clear that such intensification effects cannot be explained in terms of any current theories dealing with density. Milgram (1970) has suggested that sensory overload accounts for the negative effects of high population density on behavior, but this theory does not explain the facilitation effect of high density on liking found by Schiffenbauer & Schiavo (in press), the fact that Griffitt & Veitch's (1971) subjects liked similar people more than dissimilar ones, or Stokols et al (1973) finding that quality of social interaction (i.e. competition or cooperation) influences aggressive feelings. In fact, the present experiment showed that sensory overload, as reflected by the information rate measure, does not operate via social density, at least not with groups of four and eight people, and that a sensory overload theory cannot explain the observed effects of social density in the present study.

Stokols' (1972b) theory that situations which tend to block group goals because of their high density are viewed negatively by subjects may account for the findings which show that high density has a depressant effect on moods, behavior, and task performance, but again says nothing concerning facilitation effects. This theory is able to incorporate effects for both spatial and social density however.

The finding that the most spacious room of all (12' x 12') produced the greatest amount of negative feelings and caused most of the reliable social density x spatial density interactions indicates

that there may be normative spatial arrangements which vary with the task at hand, and that violation of these norms, in either direction, may be aversive. The subjects in the present study were college students, and as such were used to talking to other students, even in highly artificial situations. It is not too surprising then that spatial norms may exist for these subjects, norms for both the amount of overall space required (i.e. spatial density), and for the number of people that can reasonably take part in a group discussion (i.e. social density). The non-normative spatial arrangements in the largest room of the present study may combine with affect to produce observed results.

CONCLUSION

From the results of this experiment and that of Marshall & Heslin (in press), it is clear that density is a compound variable and that social density and spatial density are not the same variable. The two are empirically different, and this fact has implications for experimental manipulations and research methodologies. Where the two types of density are confounded it is impossible to determine which of them, or both, are operating to cause observed effects, and therefore such designs should be avoided.

Since Stokols et al. (1973) found a main effect due to spatial density on a crowdedness measure which the present study replicated, and since this study ruled out social effects on this measure, crowding in the Stokols (1972a) sense of the word is not to be defined in terms of social density, but rather is a purely spatial phenomenon. Therefore statements about crowding which are clear references to purely social situations are inappropriate.

There seems to be a nonmonotonic time course for density effects, both short and long term. It is not true that density effects get progressively worse over time until some asymptote is reached, but rather they may increase for some time and then diminish. This may be partly a function of personality variables.

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APPENDIX A

Name _____

Seat Number _____

Sex _____

Number of Brothers _____

Number of Sisters _____

I was the _____ of _____ children (e.g. 3rd of 4)

Do you know anyone else in this group? _____ If so, give their
seat number(s) _____

How much do you expect to enjoy this experiment?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
at all much

How much do you now like the other group members as a whole?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
at all much

How much do you expect to like the other group members after this
experiment is over?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
at all much

Later in this experiment you will be involved in a group discussion.
How much do you expect the opinions of other group members to be sim-
ilar to your own?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
at all much

How hot is the room?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
hot hot

How stuffy is the room?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
stuffy stuffy

How comfortable are you right now?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
comfortable comfortable

APPENDIX B

Name _____

Make as many English words as you can (not including proper nouns, contractions, or words that are plural) from the word:

I N D U S T R I O U S

(example: in)

APPENDIX C

Topic:

Whether or not the university should abandon its present policy of assigning grades for courses.

Your position:

Yes, I think that grades should be done away with because the divisions between the grades are arbitrary and artificial. How can you give someone with an 80 a "B" and someone with a 79 a "C"? Only one point separates them.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX D

Topic:

Whether or not the university should abandon its present policy of assigning grades for courses.

Your position:

Yes, I think that grades should be done away with because grades should not be competitive. Everyone should be evaluated on how much they know, not on how well they do compared with someone else.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX E

Topic:

Whether or not the university should abandon its present policy of assigning grades for courses.

Your position:

Yes, I think that grades should be done away with because grades have become inflated and don't mean anything anymore. "C" used to be average, now it's a poor grade.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX F

Topic:

Whether or not the university should abandon its present policy of assigning grades for courses.

Your position:

Yes, I think that grades should be done away with because most grades are based on too little information anyway. Usually there is only a mid-term and a final.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX G

Topic:

Whether or not the university should abandon its present policy of assigning grades for courses.

Your position:

No, I do not think that grades should be done away with because the elimination of grades would mean a loss of incentive, and people would stop working.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX H

Topic:

Whether or not the university should abandon its present policy of assigning grades for courses.

Your position:

No, I do not think that grades should be done away with because grades are an accurate reflection of ability and work, and are therefore useful.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX I

Topic:

Whether or not the university should abandon its present policy of assigning grades for courses.

Your position:

No, I do not think that grades should be done away with because grades help determine who should go on to graduate school, medical school, etc.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX J

Topic:

Whether or not the university should abandon its present policy of assigning grades for courses.

Your position:

No, I do not think that grades should be done away with because grades help pinpoint those areas in which a student is deficient, something employers who are going to train their workers need to know.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX K

Name _____

How much did you participate in the group discussion?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 at all much

How much did other group members listen to you in the discussion?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 at all much

How often did other group members respond or reply directly to your comments in the discussion?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 often often

How much did you influence others in the discussion?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 at all much

How much control do you feel you had over the general tone, direction, and resolution of the discussion?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 none great
 deal

How much do you really agree with the position you took?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 very not
 much at all

How similar were the opinions of other group members in the discussion to your own?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 at all similar

How often were you interrupted in the discussion?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 often never

If you were interrupted, how angry did it make you?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 very not
 angry angry

APPENDIX L

Name _____ Seat Number _____

How much do you like the group members as a whole so far?
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
at all much

How much are you enjoying the experiment so far?
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
at all much

How well do you think the group is functioning as a group?
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
very not
well well

How similar do you feel the group members are, in general?
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
similar similar

How much do you like the person sitting in seat number:
(do not rate your own seat number; 1 = not at all, 27 = very much)

Seat number 1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 3
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 4
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

As of now, would you be willing to participate in another experiment with
the same group (rate your willingness)?
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
very not
willing willing

APPENDIX M

Name _____	Seat number _____
How much do you like the group members as a whole so far?	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
not	very
at all	much
How much are you enjoying the experiment so far?	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
not	very
at all	much
How well do you think the group is functioning as a group?	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
very	not
well	well
How similar do you feel the group members are, in general?	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
not	very
similar	similar
How much do you like the person sitting in seat number:	
(do not rate your own seat number; 1 = not at all, 27 = very much)	
<u>Seat number 1</u>	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
<u>Seat number 2</u>	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
<u>Seat number 3</u>	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
<u>Seat number 4</u>	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
<u>Seat number 5</u>	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
<u>Seat number 6</u>	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
<u>Seat number 7</u>	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
<u>Seat number 8</u>	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
As of now, would you be willing to participate in another experiment with the same group (rate your willingness)?	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	
very	not
willing	willing

APPENDIX N

Name _____

Make as many English words as you can (not using proper nouns, contractions, or words that are plural) from the word:

W O R K M A N S H I P

(example: work)

APPENDIX O

Name _____

Will you please indicate how strongly you are feeling each of the sensations listed below. To indicate this, you write a number from 0 to 27 in the space provided. 0 = not at all, and 27 = very strongly

- _____ 1) I feel wound up.
- _____ 2) I feel effervescent, bubbly.
- _____ 3) I feel bouncy, springy.
- _____ 4) My whole body is tense.
- _____ 5) I want to touch, hold, and be close to another.
- _____ 6) I am irritated, ready to snap.
- _____ 7) I am excited, keyed up.
- _____ 8) I feel optimistic, cheerful.
- _____ 9) I feel jumpy, jittery.
- _____ 10) I feel that I have no sense of control.
- _____ 11) I feel the desire to give of myself to another.
- _____ 12) My body has sped up.
- _____ 13) My blood pressure is up.
- _____ 14) My heart is beating fast.
- _____ 15) I feel an inner warm glow, a radiant sensation.
- _____ 16) I feel harmony and peace within.
- _____ 17) I have an impulse to hurt.
- _____ 18) I feel like smiling.
- _____ 19) I have a sense of well being.
- _____ 20) I feel loose, relaxed.
- _____ 21) I have a sense of belonging.
- _____ 22) My teeth are clenched.
- _____ 23) I feel an inner bouyancy.
- _____ 24) I feel gripped by the situation.
- _____ 25) My face and mouth are tense, set.
- _____ 26) I feel a sense of trust and appreciation.
- _____ 27) I feel peaceful, tranquil, quiet.
- _____ 28) My pulse has quickened.
- _____ 29) I feel like being gentle and tender with another.

Please go back and make sure that each statement has a number from 0 to 27 placed to the left of it in the space provided.

APPENDIX P

Name _____

Please use the following pairs of adjectives to describe your feelings about the experiment so far. Each of the following adjective pairs helps define the situation or the relation among the various parts of the situation. Put a check mark somewhere along the line to indicate what you think is an appropriate description.

- | | | |
|--------------|-------|-------------|
| varied | _____ | redundant |
| simple | _____ | complex |
| novel | _____ | familiar |
| small-scale | _____ | large-scale |
| similar | _____ | contrasting |
| dense | _____ | sparse |
| intermittent | _____ | continuous |
| usual | _____ | surprising |
| uncrowded | _____ | crowded |
| immediate | _____ | distant |
| common | _____ | rare |
| patterned | _____ | random |

APPENDIX Q

Topic:

Whether or not the athletic department at Tech should be done away with.

Your position:

Yes, I think that the athletic department should be done away with because the university and the state spend too much money on varsity athletics. The money could be better spent.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX R

Topic:

Whether or not the athletic department at Tech should be done away with.

Your position:

Yes, I think that the athletic department should be done away with because it has too much control in the university. Jocks always get better treatment than regular students.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX S

Topic:

Whether or not the athletic department at Tech should be done away with.

Your position:

Yes, I think that the athletic department should be done away with because the return on our money is too small. Our athletic teams are not competitive on a national level, and we get little recognition from them.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX T

Topic:

Whether or not the athletic department at Tech should be done away with.

Your position:

Yes, I think that the athletic department should be done away with because it is hypocritical. Varsity athletes are professionals, and not really students like the rest of us.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX U

Topic:

Whether or not the athletic department at Tech should be done away with.

Your position:

No, I do not think that the athletic department should be done away with because the program does bring in some money and some recognition for the school. It is economically the soundest part of the university.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX V

Topic:

Whether or not the athletic department at Tech should be done away with.

Your position:

No, I do not think that the athletic department should be done away with because the program supports lots of sports besides basketball and football. Some people couldn't go to school without athletics.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX W

Topic:

Whether or not the athletic department at Tech should be done away with.

Your position:

No, I do not think that the athletic department should be done away with because varsity athletics provides a rallying point for student morale. It sometimes gives students a unity of purpose.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX X

Topic:

Whether or not the athletic department at Tech should be done away with.

Your position:

No, I do not think that the athletic department should be done away with because varsity athletics is a tradition and a big part of college life. Athletic rivalries help our school become known throughout the state.

Argue the position you have been given logically and convincingly. Elaborate on the position you have been given, and try to persuade others to support your "point of view".

Remember, the position that you have been given is not necessarily the same as what you really believe. Naturally, the same is true for the other members of the group.

APPENDIX Y

Name _____

Case Number 1

A woman was near death from a special kind of cancer. There was one drug that the doctors thought might save her. It was a form of radium that a druggist in the same town had recently discovered. The drug cost \$2,000 for one small dose. The sick woman's husband, John, went to everyone that he knew to borrow the money, but he could get together only \$1,000, which was half of what the drug cost. Although he pleaded, he was unable to get the druggist to sell it cheaper or to let him pay later.

John, in his desperation, decided to rob a store in order to get the money. He bought a gun to commit the robbery, went to the store, and walked in. John was nervous, and as he was just about to get the money, a customer came in. The sudden movement scared John and he turned and fired his gun, killing the customer.

John was caught and charged with murder. Rate John's guilt (circle one).
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
definitely
not
guilty
definitely
guilty

John was given a fair trial and found guilty. You must sentence John (circle one).
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
minimum
law
allows
maximum
law
allows

APPENDIX Z

Name _____

Case Number 2

At Harvard University, a group of students, called the Students for a Democratic Society (SDS), believe that the university should not have an army ROTC program. SDS students are against war, and the army training program helps send men to fight in wars. The SDS students demanded that Harvard end the army ROTC training as a university course. This would mean that Harvard students could not get army training as part of their regular course work and not get credit for it towards their degrees.

The students of the university and some faculty members voted to end the ROTC program as a university course, but the President of the university stated that he wanted to keep the army program on campus as a course. The SDS students felt that the President was not going to pay any attention to their demands to remove ROTC, so one weekday in April, two hundred SDS students walked into the university's administration building, and told everyone to get out. They said they were doing this to get rid of the army training program as a course at Harvard.

Along with the others, the leader of the SDS students was arrested.

The student leader was charged with trespassing and unlawful assembly. How guilty was he (circle one)?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
definitely definitely
not guilty guilty

The leader was given a fair trial and found guilty. You are to determine his sentence (circle one).

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
minimum maximum
law law
allows allows

APPENDIX AA

Name _____

Case Number 3

A man had been sentenced to prison for 10 years. After one year, however, he escaped from prison, moved to a new area of the country, and took a new name. For 8 years he worked hard, and gradually he saved enough money to buy his own business. He was fair to his customers, and he gave his employees top wages. Then one day an old neighbor recognized him as the man who had escaped from prison, and whom the police had been looking for. The neighbor then turned him in to the police.

The police investigation revealed that two years after the man bought his own business, some members of a criminal organization recognized him and began to blackmail him. In order to prevent them from telling the police of his whereabouts, the man allowed them to use his business as a front. From this base of operations, the criminals ran a series of rackets that occasionally included physical violence to other people in the town. The man was sorry that people were getting hurt because of his compliance with the criminals, but he was afraid that he would go back to prison for a long time.

How strongly do you agree with the neighbor's decision to tell the police of the whereabouts of the man (circle one)?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
strongly disagree strongly agree

The man was retried and found guilty of several additional charges. You are to determine his sentence (circle one).

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
minimum law maximum law
allows allows

APPENDIX BB

Name _____

Case Number 4

A lady was dying of cancer which could not be cured, and she had only about six weeks to live. She was in terrible pain, but she was so weak that a good dose of pain-killer like morphine would make her die sooner. She was sometimes delirious and almost crazy with pain, and often she would ask the doctor to give her enough morphine to kill her. She said she couldn't stand the pain and that she was going to die soon anyway. The doctor didn't want to, but finally gave in to her pleading and administered the fatal dose of morphine.

Do you think the doctor was guilty of murder (circle one)?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
definitely absolutely
not

The doctor was arrested, given a fair trial, and found guilty. You are to determine his sentence (circle one).

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
minimum maximum
law law
allows allows

APPENDIX CC

Name _____

Case Number 5

Johnny Rocco was the fifth born of eight children. His family lived in a tenement in a large city. His father constantly beat his mother, and eventually died in a knife fight in a bar. Although his mother tried, she could just not work at her job and properly care for her kids. Consequently, Johnny spent most of his time on the street. He slept in a bed with three other boys, and rarely had enough to eat.

When it came time for Johnny to go to school, he tried to be a good student, but he found that the reputation of his older brothers had preceeded him. Everyone expected him to be a trouble-maker and teachers wouldn't let him participate in class activities. Consequently, Johnny became boisterous and disrupted class. He was kicked out of school after school, and finally was put in a juvenile home.

Johnny responded to his life by rebelling. He led a gang of boys in several local robberies in order to seem important. He was caught several times and was in and out of jail. One night, while on probation, he was caught robbing a liquor store. The owner who caught him knew that if he turned him in, things could go bad for Johnny.

How strongly do you believe that Johnny should be turned in (circle one)?
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not at all very strongly

Johnny was turned in and tried. He was found guilty of violation of probation and attempted robbery. You are to determine Johnny's sentence (circle one).
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
minimum law allows maximum law allows

APPENDIX DD

Name _____

Make as many English words as you can (not including proper nouns, contractions, and plural words) from the word:

F L O U R I D A T I O N

(example: flat)

APPENDIX EE

Name _____

Each of the following words describes feelings or moods. Please use the list to describe your feelings at the moment you read each word. If the word definitely describes how you feel at the moment you read it, circle the double check (vv) to the right of the word. If the word only slightly applies to your feelings at the moment, circle the single check (v). If the word is not clear to you or if you cannot decide whether or not it applies to your feelings at the moment, circle the question mark (?). If you decide that the word definitely does not apply to your feelings at the moment, circle the word "no".

Work rapidly. Your first reaction is best. Work down the first column, then go on to the next. Please mark all words. This should take only a few minutes. Please begin.

fed-up	vv	v	?	no	defiant	vv	v	?	no
weary	vv	v	?	no	clutched up	vv	v	?	no
affectionate	vv	v	?	no	drowsy	vv	v	?	no
tired	vv	v	?	no	dull	vv	v	?	no
good-natured	vv	v	?	no	fatigued	vv	v	?	no
lively	vv	v	?	no	understanding	vv	v	?	no
lighthearted	vv	v	?	no	on edge	vv	v	?	no
sad	vv	v	?	no	witty	vv	v	?	no
sleepy	vv	v	?	no	sluggish	vv	v	?	no
elated	vv	v	?	no	furious	vv	v	?	no
egotistic	vv	v	?	no	forgiving	vv	v	?	no
upset	vv	v	?	no	nervous	vv	v	?	no
rebellious	vv	v	?	no	cooperative	vv	v	?	no
angry	vv	v	?	no	self-centered	vv	v	?	no
friendly	vv	v	?	no	tense	vv	v	?	no
helpless	vv	v	?	no	talkative	vv	v	?	no
warmhearted	vv	v	?	no	kindly	vv	v	?	no
refreshed	vv	v	?	no	jittery	vv	v	?	no
sorry	vv	v	?	no	lonely	vv	v	?	no
grouchy	vv	v	?	no	pleased	vv	v	?	no
fearful	vv	v	?	no	playful	vv	v	?	no
annoyed	vv	v	?	no	carefree	vv	v	?	no
boastful	vv	v	?	no					
regretful	vv	v	?	no					

APPENDIX FF

Name _____

How much did you participate in the discussion of the jury cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
at all much

How much did other group members listen to you in the discussion of the jury cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
at all much

How often did other group members respond or reply directly to your comments in the discussion of the jury cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
very not
often at all

How much did you influence others in the discussion of the jury cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
at all much

How much control do you feel you had over the general tone, direction, and resolution of the cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
none great
deal

How fair did your group seem to be in discussing these cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
very not
fair at all

How much do you like the other members of your group as a whole?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
very not
much at all

How much would you be willing to participate in a follow-up experiment with the same group members if one is run?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not very
willing willing

APPENDIX FF (continued)

How much did you like the person sitting in seat number: (do not rate your own seat number: 1 = not at all, 27 = very much)

Seat number 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 2

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 3

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 4

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

How crowded did you feel in the room?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 crowded crowded

How comfortable did you feel in the room?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 very not
 comfortable comfortable

How anxious did you feel in general when you were in the group?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 anxious anxious

How similar were the other group members to you?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 very not
 similar similar

How adequate was the room size for this experiment?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not more than
 adequate adequate

If the experiment is run again, how should the room size be changed?

+10 +9 +8 +7 +6 +5 +4 +3 +2 +1 0 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10
 made kept made
 much same much
 larger size smaller

Are you a member of the ROTC program at VPI? No _____ Yes _____

On the back of this sheet list all of the names of other group members that you can recall.

APPENDIX GG

Name _____

How much did you participate in the discussion of the jury cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 at all much

How much did other group members listen to you in the discussion of the jury cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 at all much

How often did other group members respond or reply directly to your comments in the discussion of the jury cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 very not
 often at all

How much did you influence others in the discussion of the jury cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 at all much

How much control do you feel you had over the general tone, direction, and resolution of the cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 none great
 deal

How fair did your group seem to be in discussing these cases?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 very not
 fair at all

How much do you like the other members of your group as a whole?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 very not
 much at all

How much would you be willing to participate in a follow-up experiment with the same group members if one is run?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 willing willing

APPENDIX GG (continued)

How much did you like the person sitting in seat number: (do not rate your own seat number: 1 = not at all, 27 = very much)

Seat number 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 2

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 3

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 4

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 5

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 6

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 7

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Seat number 8

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

How crowded did you feel in the room?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 crowded crowded

How comfortable did you feel in the room?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 very not
 comfortable comfortable

How anxious did you feel in general when you were in the room?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 not very
 anxious anxious

How similar were the other group members to you?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
 very not
 similar similar

APPENDIX GG (continued)

How adequate was the room size for this experiment?

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
not more than
adequate adequate

If the experiment is run again, how should the room size be changed?

+10 +9 +8 +7 +6 +5 +4 +3 +2 +1 0 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10
made kept made
much same much
larger size smaller

Are you now a member of VPI's ROTC program? No _____ Yes _____

List all of the names of other group members that you can recall in the space below.

VITA

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Publications and Papers:

Poe, D. B., & Crovitz, H. F. Measurements of Troxler's effect.
Psychonomic Science, 1968, 11, 123-124.

Donald B. Poe, Jr.

THE EFFECTS OF SOCIAL AND SPATIAL DENSITY
UPON ATTRACTION, CROWDING, TASK PERFORMANCE, AND MOOD

by

Donald Bryce Poe, Jr.

(ABSTRACT)

Males placed in one of two room sizes and one of two group sizes engaged in several group discussions, performed anagrams tasks, and served as members of a mock jury. Results indicated that subjects liked each other more in small groups than in large groups, that subjects in large rooms reported feeling more negative emotions than those in small rooms, that subjects felt more crowded in small rooms than in large ones, and that small rooms contained more information than large ones. Subjects performed better on the anagrams tasks, liking for group members increased, and reports of negative emotive feelings decreased as the experiment progressed.

Results have theoretical and methodological implications since (1) social density is shown to be different than spatial density, (2) there are time-dependent effects, (3) "crowding" as an intervening variable cannot mediate observed effects of social density, and (4) subjects in the large group, large room condition showed the greatest number of deleterious effects of treatment. Various theoretical mechanisms and their applicability to the present study are discussed.