5-1978

An attempt to identify moderators of complex task performance during and after crowding

Robert Harry Robinson
University of Nebraska at Omaha

AN ATTEMPT TO IDENTIFY MODERATORS OF COMPLEX TASK PERFORMANCE DURING AND AFTER CROWDING

A Thesis

Presented to the

Department of Psychology

and the

Faculty of the Graduate College

University of Nebraska

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

University of Nebraska at Omaha

by

Robert Harry Robinson

May 1978

THESIS ACCEPTANCE

Accepted for the faculty of the Graduate College, University of Nebraska, in partial fulfillment of the requirements for the degree Master of Arts, University of Nebraska at Omaha.

Thesis Committee

Name	Department
Richard L. Wikoff	Psychology
Glenn C. Fenda, PhD	Psychology
Maurice Conner	Foreign Languages

Carl A. Greenberg
Chairman

May 3, 1978
Date

Table of Contents

Acknowledgements

I gratefully acknowledge and appreciate the guidance and encouragement received from the following persons, without whom the present research would not have been made possible. First, Kenneth Nikels was perhaps the first person to introduce me to the rigors of science; to him I will be eternally indebted. My highest respect and thanks are extended to members of my thesis committee: Dr. Carl Greenberg (Chairperson), Dr. Maurice Conner, Dr. Clemm Kessler, and Dr. Richard L. Wikoff. These persons, together with the rest of the UNO Psychology Department have directed me in leveling, sharpening, and assimilating a good portion of the most precious communication, knowledge.

I have derived much emotional support from the continuous encouragement received from my family: Harry, Mary Ann, Tom, and Teresa. Finally, a special thanks is extended to Tokey, my loyal companion, sounding board, and often scapegoat.

Introduction

Future environments are being designed now and the psychologist must contribute his share to ensure that these environments are pleasant livable ones. As Ehrlich (1968) has elegantly pointed out, overpopulation is perhaps the most pressing problem modern man faces. Indeed, the world's population is growing rapidly. From 6,000 B.C. to 1650 A.D. the world's population grew from about 5 million to 500 million, doubling approximately every thousand years. By 1850 it had reached one billion (doubling in 200 years), by 1930 it had reached 2 billion (doubling in 80 years) and recently doubling time has been estimated at 35 years.

Questions concerning population limits are popular social issues, but as Krutch (1962) has pointed out perhaps the proper question is not how many people the earth can support but how many can live here happily. Invariably, such discussions lead to a concern about the physical, physiological, social and psychological effects of "crowding." Thus, questions such as "What is crowding?", and "How does crowding affect behavior" have become a primary concern of environmental psychologists as well as other social scientists.

The term crowding has many different connotations. It may imply positive, negative, or neutral affect (Altman, 1975; Stokols, 1976). It may also involve great numbers of people over great expanses of space or relatively few people in relatively small spaces. Although crowding has only recently become an area of concern in psychology a literature is accumulating in an attempt to specify, more fully, the critical determinants of the crowding experience. Several theoretical perspectives have been proposed as a basis for understanding the antecedent conditions, psychological experience and behavioral consequences of human crowding. The present research dealt specifically with two theoretical conceptions of crowding, the stimulus overload model and the personal space intrusion model. These two models will be reviewed and then implications concerning crowding and density, crowding and stress and crowding and task performance will be examined.

Crowding as Stimulus Overload

In an extension of earlier sociological observations of urban life (e.g., Simmel, 1903; Wirth, 1938; in Coser, 1971) Milgram (1970) has linked the concept of crowding to that of stimulus overload. The term stimulus overload is derived from systems analysis and refers to a system's inability to process excessive input from the environment. Overload may occur in either or both of the following ways: (a) if there are too many inputs for the system to cope with, or (b) if input rate exceeds the system's processing capacity. Thus, if social stimuli A, B and C all occur simultaneously a person may be incapable of dealing with this abundance of stimulation and feel stress which may ultimately be labeled crowding. Crowding may also be felt if these social stimuli occur one at a time but in rapid succession. Crowding, then, may be experienced in high density situations (e.g., on a subway during rush hour), or in situations involving relatively low density but a large number of encounters in rapid succession (e.g., on a busy metropolitan sidewalk).

Milgram maintains that when the possibility of overload is present adaptations occur in which the system must set priorities and make choices. For example, less time is allocated to each input, low-priority inputs are disregarded, reception is blocked off prior to entrance into the system and intensity of inputs is diminished by filtering or screening so that only relatively weak and superficial forms of involvement are allowed. Thus, in Milgram's analysis the individual must enact behavioral adaptations under conditions of overload if he is to operate effectively in the urban environment.

Desor (1972) has also applied the overload concept to the specific issue of crwoding. Desor postulated excess stimulation from social sources as the variable controlling human judgments of crowding, that is, crowding is the result of excessive social stimulation and not merely a lack of space.

Support for the stimulus overload model of crowding comes from several sources. Architectural features which serve to reduce or screen out excessive social stimulation (e.g., partitions, doors, etc.) have been found to reduce feelings of crowding (Baum, Riess & O'Hara, 1974; Baum & Valins, 1973; Desor, 1972). Exposure to high density results in attempts to withdraw from social stimulation. Engaging in less facial regard, less gesturing, reactions of flight and body movement away, and decreased involvement with others are considered to be withdrawal mechanisms (Baron, Mandel, Adams, & Griffen, 1976; Baum & Greenberg, 1975; Bickman, Teger, Gabriele, McLaughlin, Berger, & Sunaday, 1973; Greenberg, 1974; Ross, Erickson, Layton, &

Schopler, 1973; Stokols, Rall, Pinner & Schopler, 1973; Valins & Baum, 1973.

In short, an excess of social stimulation leads to felt crowding stress. Coping behaviors ensue as a means of dealing with this stress, however, the entire process entails negative consequences for the individual.

Crowding as Personal Space Intrusion

In addition to the stimulus overload model other theorists have adapted an interpersonal distance equilibrium (Argyle & Dean, 1965) model of crowding (Kaplan & Greenberg, 1976). This model evolves from conceptions of interpersonal distance (Hall, 1966), territoriality (Edney, 1974), personal space (Sommer, 1969), and privacy (Altman, 1975).

Hall (1966) identified four proxemic distances of social interaction and characteristic uses of these distances: (a) intimate distance (0 to 18 inches) is characterized by a high probability of physical involvement such as wrestling and love-making, (b) personal distance (1½ to 4 feet) is also used for interactions with intimates, although with less sensory involvement than at intimate distance, (c) social distance (4 to 12 feet) is used in interacting with friends and business associates, and (d) public distance (12 feet or more) is used to address groups and formal gatherings.

On a more molar level, Sommer (1969) has described personal space as a "portable territory" which the individual carries around with him wherever he goes. Sommer defines personal space as "an area with invisible boundaries surrounding a person's body into which intruders may not come" (p. 26), and notes that the violation of personal space is an intrusion into a person's self-boundaries which causes discomfort. Much of Sommer's research shows that the most common reaction to personal space intrusion is flight, i.e., leaving the scene.

In an attempt to explain interpersonal distance, territoriality and personal space Argyle and Dean (1965) proposed an interpersonal distance equilibrium model of intimacy. This formulation holds that intimacy is a function of such factors as interpersonal distance, eye contact, body orientation and verbal disclosure. Individuals set a standard value for intimacy according to the approach and avoidance forces inherent in a given interaction and maintain this equilibrium by compensation in various modalities. For example, if interaction distance decreases, compensatory adjustments in other modalities may be observed such as decreased eye contact (Argyle & Dean, 1965). Total pressure within the system is kept constant by differential distribution across modalities (Patterson, 1973). Thus, interpersonal distance is dependent upon the amount of intimacy desired by an individual in a specific situation and by the amount of stimulation occurring in that situation across various modalities.

Figure 1 shows Patterson's (1976) reformulation of Argyle and Dean's basic theory. According to Patterson a change in the intimacy of person A, if detected by person B, can be felt by B as either a positive or negative emotion. If the change in A's behavior evokes discomfort, anxiety or embarrassment in B, compensation will occur in the form of decreased eye contact, smiling, intimacy of topic and increased

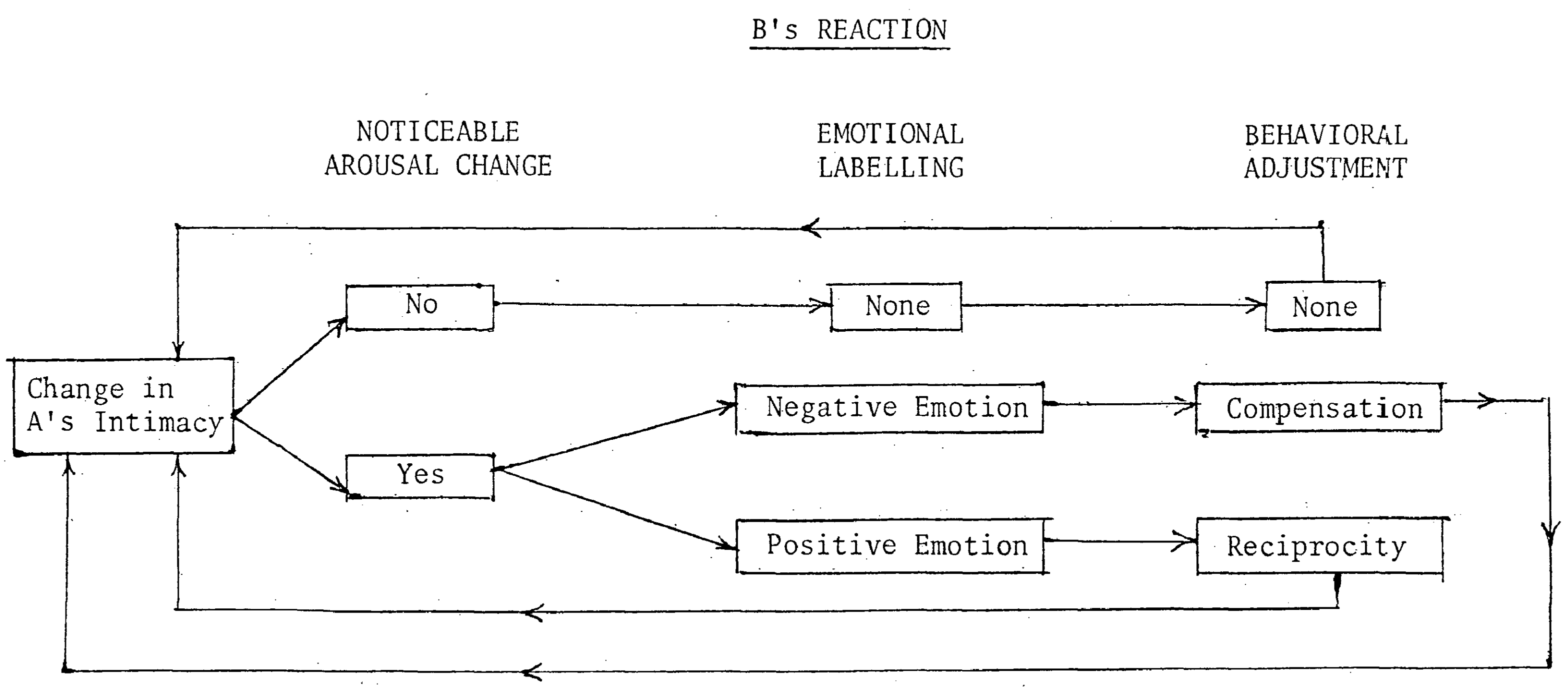


Figure 1

Diagram of the Arousal Model of Interpersonal Intimacy (Patterson, 1974).

interpersonal distance. On the other hand if the change of A's intimacy results in liking, loving, relief or some other positive emotion, B will reciprocate, that is, increase eye contact, smiling, intimacy of topic and decrease interpersonal distance. Compensation or reciprocity constitute changes in B's intimacy and, if detected by A, person A will go through the same process so that equilibrium is maintained. Thus, personal space intrusion is predicted to result in positive or negative affect and compensatory responses. In general, personal space invasion studies have confirmed this prediction (Argyle & Dean, 1965; Felipe & Sommer, 1966; Mehrabian & Diamond, 1971; Patterson & Sechrest, 1970).

Altman (1975) has incorporated the concepts of territorality, personal space and equilibrium into a privacy maintenance model of crowding. According to Altman the concept of privacy provides a key link between crowding, territorial behavior and personal space; the latter function to ensure desired levels of the former. Figure 2 shows Altman's privacy maintenance model of crowding. As can be seen in Figure 2 Altman postulates that personal characteristics, interpersonal characteristics and situational factors contribute to the desired level of privacy for a given situation. Coping behaviors ensue to provide the desired level of privacy and an assessment of the effectiveness of these boundary control mechanisms is made. If the achieved level of privacy is less than the desired level of privacy the situation is felt as crowded. Thus, according to Altman, crowding exists when the privacy regulation system does not work effectively.

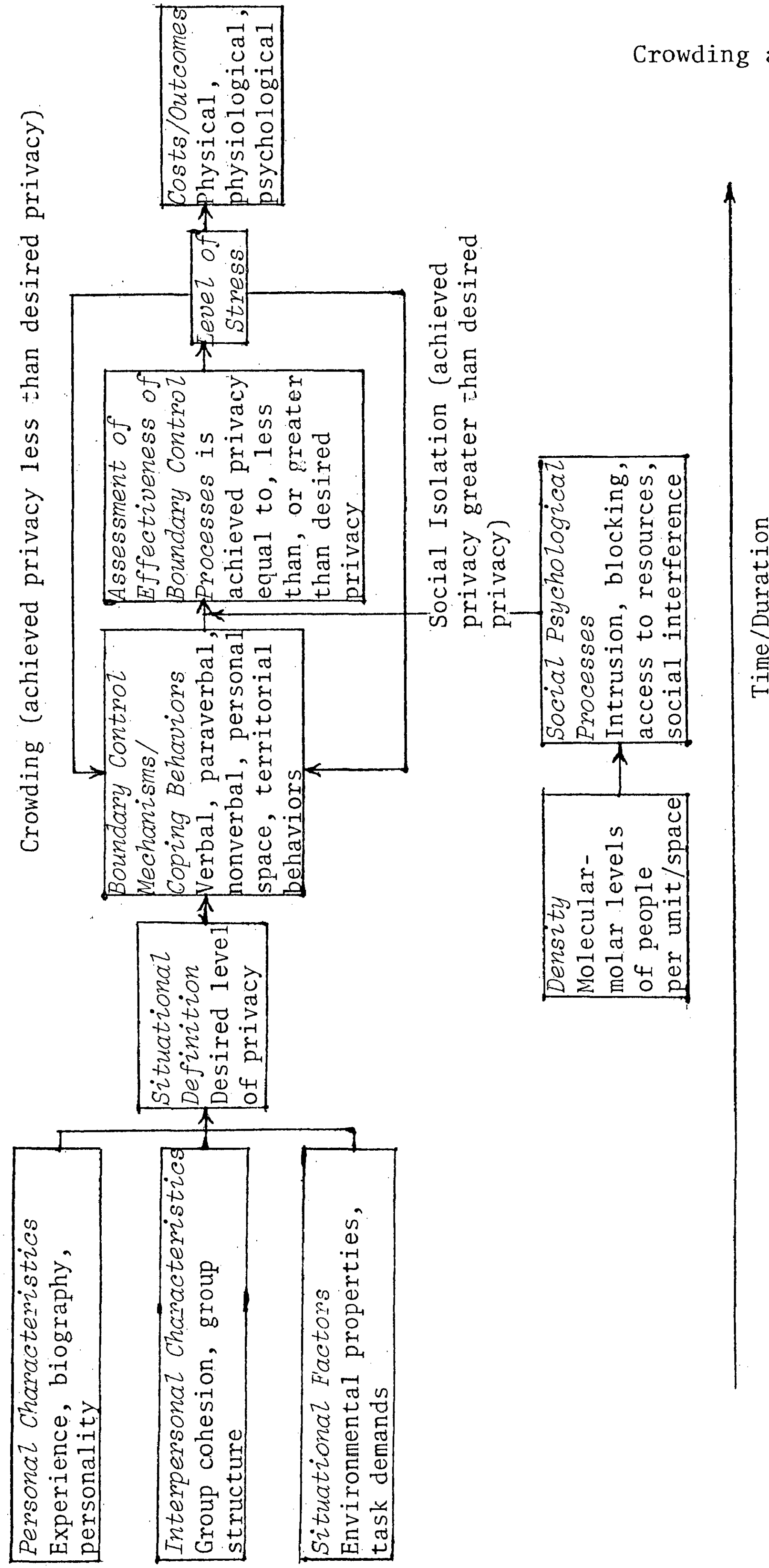


Figure 2

Altman's (1975) Privacy Maintenance Model of Crowding

Following Altman's theorizing, Worchel and Teddlie (1976) forwarded the idea that the experience of crowding occurs via a two step process. First, the individual becomes aroused by violations of his personal space, and then he attributes the cause of this arousal to other people in his environment. To test this hypothesis Worchel and Teddlie varied interaction distance (close and far) and density (high and low) and found that interaction distance was more closely related to crowding than was density. This finding has been replicated by Greenberg and Firestone (1977).

Characteristic spatial distance as a personality variable has also been shown to correlate with the crowding experience (Cosby, 1973). Subjects maintaining relatively close personal space preferred a high to a low density setting, while far personal space subjects generally displayed an opposite preference. Similar results have been obtained by Dooley (1974). Men in a high density situation with far personal space felt more crowded, restricted, uncomfortable and unfriendly than those with close personal space. Moreover, far personal space subjects perceived others to be more aggressive and manifested more task performance decrements after exposure to high density on an index of proofreading performance, than did subjects with close personal space.

Implications of the Two Theories

The difference between the personal space intrusion model and Altman's privacy maintenance model is that personal space intrusion is a special case of privacy violation. Also, personal space intrusion is a special case of stimulus overload. Both the stimulus overload and personal space intrusion theories of crowding have many implications, however, only three will be dealt with in the present text. First, both models make a distinction between crowding and high density. Second, both models see the crowding experience as stressful and adaptations are held to occur in an attempt to reduce the amount of stress felt. Third, both models predict that as a result of crowding stress certain "costs" should be manifested in the form of task decrements. In the following sections each of these implications will be examined.

Crowding and density. Many authors (Altman, 1975; Knowles, 1976; Milgram, 1970; Stokols, 1972, 1976; Sundstrom, 1978) make a distinction between density and crowding, the former is considered a physical concept concerned with the number of people per unit of space while the latter is held to be a psychological concept with an experiential, motivational base. According to this distinction crowding is viewed as a subjective state often involving stress as a motivational component which drives a person toward minimizing stress produced discomfort. Density is merely a measure of people per unit of space, a physical quantity, with no inherent psychological meaning. For example, Stokols (1972) recognized that crowding could be caused by the physical aspects of an environment (i.e., feelings of inadequate space) as well as by an excess of people. Both forms were noted to involve either psychological or physiological stress. Thus, according to Stokols density is a necessary condition for crowding although density *per se* is not always a sufficient condition for the feeling of being crowded.

Correlational research (e.g., Galle, Gove & McPherson, 1972) has tended to use a number of different density measures which have included number of people per city, number of people per census tract or geographic area, number of people per dwelling unit, number of dwelling units per apartment building, number of buildings per city, etc. (Altman, 1975). As Altman notes, although many factors such as race and social economic status are often confounded, correlational research points toward a more differentiated approach to the concept of density. Altman proposes a distinction between micro or interpersonal levels of density and macro levels of density. Operationally this may take the form of inside density (i.e., the number of people per unit of space within a residence) versus outside density (i.e., the number of people per unit of space in a larger spatial unit). Altman hypothesizes that micro levels relate more closely to interpersonal, social and psychological outcomes than macro measures of density.

Similar distinctions between types of density have been offered by others. McGrew (1970) has distinguished between _spatial density_ which refers to variations in the amount of space available for each person in a constant sized group, and _social density_ which refers to variations in the number of persons in a constant sized area. Since an increase in social density involves a decrease in the available space _and_ an increase in the potential number of interaction partners manipulations of social density are usually confounded with spatial density.

Recently it has been shown that density is not even a necessary condition for the perception of crowding (Baum & Greenberg, 1975; Greenberg & Firestone, 1977; Greenberg & Baum, in press; Worchel & Teddlie, 1976). Greenberg and Firestone (1977), for example, produced pronounced feelings of crowding in a low density environment when subjects' personal spaces were intruded upon while being interviewed on moderately intimate topics with two other people present. These findings were held to be supportive of the personal space intrusion model of crowding, however, since decreased physical proximity involves increases of information rate (stimulus input; Hall, 1966) they are not unpredicted by the stimulus overload model.

Crowding and stress. Stress is held to be of extreme importance in both models of crowding, perhaps the factor which determines whether a situation will be felt as crowded or not (Altman, 1975; Desor, 1972; Milgram, 1970; Stokols, 1976; Sundstrom, 1978; Wohlwill, 1972). In fact, with the exception of Freedman (1975), a majority of researchers concerned with crowding postulate the subjective experience of being crowded as being one form of stress. Freedman maintains that high density and crowding are analogous. Research with animal populations depicts density as a stressor variable that impedes functioning of the individual and the community by placing severe constraints on important social activities such as mating, raising of the young and food allocation (Calhoun, 1962; Davis, 1971). Findings of these animal studies suggest that prolonged exposure of animal communities to conditions of high density results in social disorganization and a variety of physiological abnormalities.

Although these animal studies are suggestive, detrimental effects of density on human populations are considerably less clear (Altman, 1975; Stokols, 1976; Sundstrom, 1978). Perception of and adjustment to crowding stress in humans may be mediated and offset by cultural norms (Hall, 1966; Sommer, 1969) or attributions made by the individual as to the source of the stimuli producing the felt stress (Stokols, 1976). For example, people experiencing high spatial density tend to attribute crowding stress to physical factors (too small a room, etc.) while persons in high social density attribute crowding stress to interpersonal closeness (Baron et al., 1976; Baum & Koman, 1976).

Lazarus (1966) extended the notion of physiological stress to a related construct, psychological stress. According to Lazarus, psychological stress is a cognitive process where the difference between perceived environmental demand and perceived ability to cope is assessed. Stokols (1972) extended Lazarus' theorizing to crowding by maintaining the discrepancy between a person's desire for space and the amount of space available leads to cognitive inconsistency which contributes to psychological aspects of crowding stress. Other aspects of psychological crowding stress were held to come from feelings of encroachment which creates an emotional imbalance. Increases in blood pressure and other signs of internal disequilibria were said to be associated with psychological aspects of crowding stress. In a similar vein, Esser (1971) described crowding as a subjective mental state with a definite link between psychological and physiological levels of stress. According to Esser a disharmony between the central nervous system and stimulus conditions produce feelings of crowding. This can involve either the neocortex (e.g., reactions to novel stimuli) or the biologically older reticular system (e.g., when territorial needs are frustrated).

As stated previously, both the stimulus overload and personal space intrusion models of crowding postulate attempts toward adaptation to or coping with the stressful situation. This has often been viewed as a dynamic, sequential process (Altman, 1975; Stokols, 1976; Sundstrom, 1978). That is, soon after the individual feels crowded he either begins to adapt to the stressful situation or begins coping with the crowding stress to reduce the impact of the aversive condition. This may be done physically, for example, by actually leaving the situation or cognitively by "shutting the others out."

Sundstrom (1978) has distinguished between adaptation and coping responses to crowding. Adaptation is postulated to be a kind of habituation to aversive conditions, and excludes alteration of the conditions. It has been known for many years that both behavioral and physiological indices of response alter when the same stimulus is repeatedly presented to an individual (Sokolov, 1963). When a stimulus is repeated at regular intervals, orienting responses to that stimulus slowly and steadily decline until no observable response is seen to the occurrence of the stimulus. The individual has habituated, or in Sundstrom's words, adapted to the stimulus, in such a way that the stimulus itself has not been altered, it is the individual's responsivity to the stimulus that has changed.

Sundstrom notes that a similar approach to adaptation to crowding is the notion that, on the basis of cumulative experience, individuals tend to establish an adaptation level for social stimulation. The adaptation level hypothesis maintains that people with a history of intense or frequent social interaction are less likely to experience crowding at a given level of density than are people with a history of relative isolation (Wohlwill & Kohn, 1973). Furthermore, this adaptation level or threshold for crowding should remain relatively constant across settings. Adaptation then refers to a kind of state or process while adaptation level refers more to a trait or characteristic level of toleration for intense social contact.

In general, research based upon repeated measurements of responses to high density in both brief (e.g., Aiello, Epstein & Karlin, 1975) and prolonged exposures (e.g., Smith & Haythorn, 1972) has failed to show adaptation. On the other hand, research related to a person's cumulative experience with crowding has provided support for the development of an adaptation level for social stimulation (e.g., Wohlwill & Kohn, 1973). Adaptation to crowding stress may be partially clouded by an individual's coping responses to the aversive conditions and it is to this concern that our attention is now directed.

Moreover, Sundstrom (1978) maintains that in response to crowding, coping behaviors are aimed at reducing aversive social stimulation. Coping behaviors may take two forms: (a) avoidance of or withdrawal from interaction, or (b) decreases in immediacy with others. Where adaptation refers to changes to constant stimuli within the individual, coping refers to changes of the stimulus by the individual. Failures to show adaptation may be due to successful coping, that is, people may initially feel some crowding stress then successfully employ coping responses designed to reduce the stimulation to tolerable levels before adaptation can occur.

In commenting on coping reactions to crowding Stokols (1972) notes, "Where the limitation of space is extreme, and restraints against direct alteration of spatial variables are low, the prepotent mode of response to crowding will be a behavioral one . . . . In situations where either normative or physical constraints inhibit overt behavioral adjustments of spatial variables, perceptual and cognitive modes of reducing the salience of restricted space will be more likely to occur" (p. 276). Stokols' observation is in accord with intrusion reactions or reactions to stimulus overload. There may also be culturally based methods of coping with crowding stress (Altman, 1975; Hall, 1966). For example, the Japanese reduce the impact of density by the use of movable walls and separators in homes, by miniaturizing aspects of the environment and by fostering an emphasis on quality and arrangement of spaces (Canter & Canter, 1971).

That coping responses to crowding stress occur before adaptation can occur has been shown by Baum and Greenberg (1975). These researchers have shown that anticipation of crowding can produce perceptual and behavioral effects similar to those associated with high density crowding. Subjects were convinced that high density was imminent using various deceptive techniques (e.g., checking their name off a list of ten other names) and were assessed as to their discomfort, perceptions of the experimental setting and interpersonal attraction. It was found that subjects anticipating three other subjects indicated that they felt less crowded than did subjects expecting nine others. More discomfort was experienced by subjects expecting crowding and their attraction to others was also significantly less. Most important for the present discussion is the fact that people "waiting for a crowd" tend to avoid interaction and are therefore coping before the density stress occurs. Coping responses using the anticipated crowding paradigm have included lower facial regard, choice of less central seating position and greater interpersonal distance. In a further study of anticipated crowding Greenberg and Baum (in press) confirmed the above findings and provided evidence which suggests that disconfirmation of anticipated crowding reduces perceptions of crowding, discomfort and coping behaviors.

Finally, support has been shown for longer term patterns of coping in response to crowded conditions (Baron et al., 1976; Valins & Baum, 1973). Behavioral styles of coping which included avoiding contact with others (in a waiting room situation) have been observed among residents of crowded dormatories.

Crowding and task performance. If crowding is indeed stressful, performance of tasks during crowding should follow the general pattern of performance during other stressful stimuli. Glass and Singer (1972, 1973) have conducted an extensive series of research investigating the relationship between noise as a stressor and simple and complex task performance. Glass and Singer's tasks for their first investigation were three standardized tests of cognitive performance: (a) Number

Comparison, in which the subject inspected pairs of multidigit numbers and indicated whether the numbers in each set of the pair were the same or different, (b) Addition, in which the subject added columns of one and two digit numbers, and (c) Finding A's, in which the task was to check the words in each column having the letter "a" in them. Using these tasks and white noise as a stressor Glass and Singer found: (a) noise does not produce substantial task degradations, and (b) the few errors that do occur during noise tend to wane with physiological adaptation.

In a second study Glass and Singer (1972, 1973) used periodic and aperiodic noise bursts as stressor stimuli and recorded errors in primary and subsidiary tasks. Assuming an overload model, performance of a subsidiary task should be impaired during stress if an individual attempts to maintain a constant level of primary task performance. Glass and Singer's primary task required tracking a vertical line displayed on an oscilloscope mounted atop a sports car steering wheel. While performing the primary task subjects were asked to repeat a previously announced digit upon presentation of the subsequent digit, the subsidiary task. Results indicated degradations in performance appeared on the subsidiary task only during unpredictable noise bursts. As expected there was no effect observed on the primary task. A third experiment demonstrated essentially the same effects for uncontrollable noise.

In several subsequent studies Glass and Singer (1972, 1973) were interested in the "costs" or aftereffects of exposure to stressful noise.

Taken together, the results of these experiments demonstrate substantial impairments in frustration tolerance immediately following termination of noise.

In summary, task performance is not affected during noise (stress) except when noise is made especially aversive by presenting it unpredictably or in circumstances where the subject has no control over it. Even in these latter cases, however, noise does not prevent either behavioral or autonomic adaptation. Finally, a great amount of task decrement is observed following a period of exposure to stressful noise. The question now is whether crowding as a stressor has a similar effect. Both models of crowding predict that it does.

Four studies may be used to illustrate the striking similarities between noise as a stressor and crowding as a stressor (Aiello, DeRisi, Epstein & Karlin, 1976; Freedman, Klevansky & Ehrlich, 1971; Sherrod, 1974; Stokols, Rall, Pinner & Schopler, 1973).

In a series of three experiments, Freedman and his associates (Freedman et al., 1971) examined the performance of very simple to complex tasks (e.g., crossing out a specific number from a list of random numbers, forming as many words as possible from a set of letters, rote memorization of a list of words) under varied conditions of density. Spatial density was varied by using different room sizes and social density was varied by placing different numbers of people in each room. Freedman et al. could not find any significant effects of density on performance.

Stokols et al. (1973) also found spatial density to have no effect upon their subjects' task performance (total number of points earned by group members during an experimental game), however, Aiello et al. (1976) found support for their expectation that crowded subjects would be less creative. This latter finding contradicts the earlier observation of Freedman et al. concerning high density and their measure of divergent thinking.

Sherrod (1974) correctly noted the correspondence between Glass and Singer's (1972, 1973) findings using noise as a social stressor and Freedman and his associates research dealing with crowding and task performance. Sherrod, therefore, hypothesized that conditions of crowding had no effect on simple task performance but that it would have deleterious effects on complex task performance and negative aftereffects of crowding might be observed on postcrowding behaviors. Simple tasks consisted of number comparison, addition, picture number learning, finding A's, chain association and subtraction and multiplication. Sherrod used a paper and pencil version of the Stroop Color-Word Test (cf. Jensen & Rohwer, 1966) as a measure of complex task performance. Results indicated that conditions of crowding had no effect on either simple or complex task performance, i.e., a replication of the work completed at Freedman's laboratory. In the post-crowding situation, however, significant negative behavioral aftereffects were observed for the crowded groups on a frustration tolerance measure. Perceived control was also found to reduce these aftereffects.

Freedman's and Sherrod's results concerning complex task performance using crowding as a stressor are somewhat inconsistent with the finding of Glass and Singer that extremely adverse noise had deleterious effects on complex task performance. The inconsistency might be explained by the fact that neither the Stroop Color-Word Test used by Sherrod nor the verbal concentration tasks used by Freedman actually comprise a complex task in the sense in which Glass and Singer's measure comprised a complex task. As explained before, in the noise experiment subjects were required to engage in a primary task simultaneously with a secondary task, both of which required considerable concentration. The complexity of Glass and Singer's task, then is different than the complex tasks used by either Freedman et al. or Sherrod.

Statement of the Problem

Issue 1. This issue deals with the density manipulation. Problem 1: Before subsequent issues may be dealt with it is necessary to answer the question, "Do manipulations for density produce feelings of crowding?"

Issue 2. Issue 2 is concerned with task performance during the after crowding. Problem 2: Will crowding adversely affect performance of a primary task? Problem 3: Will crowding adversely affect performance of a secondary task? Problems 2 and 3 are related since both tasks are performed simultaneously. To parallel noise research, crowding should affect the secondary task and not the primary task. Such a finding would demonstrate the sensitivity of the primary-secondary task paradigm to crowding stress. Previous crowding research has used tasks like the Stroop task. Problem 4: Is the Stroop task sensitive to crowding stress? If it is not, other tasks similar to the Stroop task may not be sensitive to crowding stress.

Issue 3. This issue is concerned with adaptation and adaptation level. Problem 5: Will adaptation to crowding be shown by using a repeated measures design? Adaptation would be displayed by increasing competence in task performance during crowding. Problem 6: Does the individual difference variable, Stimulus Screening, moderate task performance during crowding? Problem 7: Does the individual difference variable, Personal Space, moderate task performance during crowding?

Issue 4. This issue is concerned with the experience of crowding. Problem 8: Do crowded individuals perceive the physical environment differently than not crowded individuals? Problem 9: Do crowded individuals perceive others in their environment differently than not crowded individuals? Problem 10: Are crowded individuals' mood states different from not crowded individuals? Problem 11: Do crowded individuals perceive the tasks performed during and after crowding differently than not crowded individuals.

Statement of the Hypotheses

Hypothesis 1. High social density will produce feelings of crowding.

Hypothesis 2. There will be no difference between crowding conditions on primary task performance.

Hypothesis 3. Crowded subjects will make significantly more errors on a subsidiary task than not crowded subjects.

Hypothesis 4. Crowded subjects will make significantly more errors than not crowded subjects on a post-crowding task.

Hypothesis 5. Due to adaptation to crowding a pattern of steadily increasing competence will be observed during conditions of crowding.

Hypothesis 6. During crowding non-screeners make significantly more errors than screeners.

Hypothesis 7. Crowded far personal space subjects make significantly more errors than crowded close personal space subjects.

Hypothesis 8. Crowding will negatively affect subjects' perception of the physical environment.

Hypothesis 9. Crowding will negatively affect subjects' perception of their social environment.

Hypothesis 10. Crowding will negatively affect subjects' mood states.

Hypothesis 11. Crowding negatively affects the perception of tasks performed during and after crowding.

Method

Pilot Study

As noted above the personal space intrusion model predicts that close personal space persons display better performance on tasks during high density than far personal space persons. Also the stimulus overload model predicts that screeners should do better than nonscreeners. The question therefore arises as to whether measures of Personal Space and Stimulus Screening are related.

To answer the above question, 47 undergraduate and graduate

University of Nebraska at Omaha students were administered Duke and Nowicki's (1973) Comfortable Interpersonal Distance Measure (CID, Appendix A) and Mehrabian's (1976) Stimulus Screening Measure (Appendix B). Of the original 47 subjects, 11 did not complete the CID correctly and were dropped from the data yielding results on 36 subjects.

The CID served as a measure of personal space and was scored by measuring the distance (in mm) from the center of the diagram to the subject's "stop" mark on each approach plane. Means were calculated for each subject on each separate diagram and for the four diagrams combined. The latter mean served as an indication of each subject's characteristic personal space requirements since correlations between the separate means and the combined mean ranged from .78 to .90 ($p < .001$, in all cases). Analysis of the relationship between Subject's characteristic personal space requirements and their scores on the Stimulus Screening Measure showed the two measures to be independent ($r = -.22$, n.s.).

These results indicate that personal space, as measured by CID and stimulus screening, as measured by Mehrabian's Stimulus Screening Measure are not related and may therefore serve as independent variables for the present research.

Design

The parameters of the present study were two levels of social Density (eight-person groups and four-person groups), two levels of Personal Space (close and far) and two levels of Stimulus Screening (screeners and nonscreeners) in a 2 x 2 x 2 factorial design. Since the individual was used as the unit of analysis, four high density groups (4 groups x 8 persons = 32) and eight low density groups (8 groups x 4 persons = 32) were used, (N = 64).

Subjects

One hundred and forty-five male and female subjects from the University of Nebraska at Omaha subject pool were contacted for pretesting on the two subject variables. Persons with other than normal color vision were excluded. Of these, 64 (32 male and 32 female) served as subjects for the experiment. Previous research demonstrated that using groups consisting of both sexes does not affect task performance (Freedman, et al., 1971; Sherrod, 1974). Consequently, the present study did not control for sex composition of the experimental groups.

Instruments

Subjects were pretested in groups on the Comfortable Interpersonal Distance Measure (CID; Duke and Nowicki, 1973; Appendix A) and the Stimulus Screening Measure (Mehrabian, 1976; Appendix B). Duke and Nowicki have reported test-retest reliability coefficients for the CID between .75 and .86 for male and female college students. Correlations between the CID and real life approach distances were found to range from .65 to .71 for white college students and .83 to .84 for black college students. On the basis of this evidence the CID seems to provide a satisfactory measure of personal space requirements.

Mehrabian's Stimulus Screening Measure is still somewhat in the experimental stages of development (test-retest reliability coefficients have not yet been reported). An oblique rotation factor analysis was performed by Mehrabian on the 137 original items yielding factors which could be identified with the various senses (e.g., vision, audition, olfaction, etc.). Significant correlations were reported between all factors ($p < .01$), that is, visual screeners tended to also be olfactory screeners, auditory screeners, etc. Correlations between the original 137 item theoretical "screener" test and the final 40 item "screener" subtest ranged from .92 to .96. Thus, the 40 item subtest is in accord with the original conception of what a screener is, assuming the original 137 items are an adequate definition of what is theoretically a screener.

In a demonstration of convergent validity Mehrabian reported the following correlations ($p < .05$ in all cases) with the Stimulus Screening Measure: (a) trait anxiety, -.49; screeners are generally less arousable, (b) neuroticism, -.54; screeners are less neurotic than non-screeners, (c) achieving, .22; screeners achieve more than non-screeners, (d) emotional empathy, -.65; screeners are less aware of the feelings of others, (e) affiliative tendency, -.23; screeners are more independent than non-screeners, (f) sensitivity to rejection, -.23; screeners are disturbed less than non-screeners by social criticism. These findings provide a nomethetic net appropriate for screening and on the basis of the above evidence the Stimulus Screening Measure seems adequate for present research purposes.

Facilities and Equipment

A small room (Appendix H) approximately 1.94 m (L) x 1.33 m (W) x 2.75 m (H) was used for the first part of the experiment. In a room this size subjects in the low density condition had approximately .65 m^2 per person and high density subjects had approximately .32 m^2 per person. A second, but larger room (Appendix H) was used for the second part of the experiment. Eight wooden chairs were placed in the smaller experimental room.

A tape recorder was used for presenting instructions and lists of paired-associates. A remote speaker attached to this recorder was installed in the smaller experimental room, hanging from the ceiling in the center of the room.

Procedure

Subjects were contacted by the experimenter and a time was arranged for pretesting. During pretesting subjects were assigned a subject number for data identification purposes which was used throughout the entire experiment.

Rotter's (1966) measure of locus of control was administered and indications of subject's age, sex and grade point average (as an estimate of intelligence) were obtained as possible covariates. As shown in Table 1, no significant relationships were found among any of the state or demographic variables. Therefore, subject's locus of control, age, sex, and GPA were not considered to be possible sources of systematic bias with respect to the personal space and screening measures.

After scoring the CID and the Stimulus Screening Measure a median was computed for each measure.[1] These were used as the dividing

Table 1

Correlations of Screening and Personal Space with Sex, Grade Point Average (GPA), Age, and Locus of Control (LOC)**

Variables	Coefficient
Screening with:	
Sex	-.22
GPA	-.15
Age	.14
LOC	-.21
CID with:	
Sex	-.19
GPA	-.12
Age	.04
LOC	-.21

**None of the correlations were significant (all p's < .12), N = 64.

points giving two levels of Personal Space (close and far) and two levels of Screening (screener and non-screener). Based upon pre-testing information subjects were then assigned to one of four categories: (a) close personal space--screener, (b) close personal space--non-screener, (c) far personal space--screener, and (d) far personal space--non-screener. Once subjects were assigned to one of the above four conditions, they were again contacted and randomly assigned to either the high or low density groups. Low density groups consisted of one subject from each of the above four conditions and high density groups had two subjects from each of the above four conditions.[2] Thus, in a low density group there was one subject who was categorized as "close personal space--screener," one as "close personal space--non-screener" one as "far personal space--screener," and one as "far personal space--non-screener." High density groups consisted of two subjects from the category "close personal space--screener," two "close personal space--non-screeners," two "far personal space--screeners," and two "far personal space--non-screeners."

At the beginning of the experiment subjects were met in the hall-way outside the small experimental room by the experimenter and given a clipboard containing their test booklet (Appendix D). They were also asked to sign a human subjects consent form. When all subjects were present they were escorted into the small experimental room and asked to take a seat. Instructions for the tasks were presented via the tape recorder and subjects were asked by the experimenter to adhere strictly to the instructions. The experimenter then left the room closing the door behind him and immediately started the tape recorder.

Test materials during density. The tasks which subjects completed during the density conditions consisted of four sets of primary and secondary tasks lasting eight minutes per set. Each primary task consisted of finding and marking with a slash all the occurrences of a specific pair of numbers (e.g., all the 7's and 8's) in a set of random numbers. The length of the random numbers lists would take the average person about 10 minutes to scan under normal conditions. The four sets of random numbers used were contained in the task booklet given to the subjects at the beginning of the experiment (Appendix D).

While engaged in the primary task, subjects were also required to work on a secondary task. The secondary task consisted of learning ten paired-associates using the study-test method (Appendix C). At the end of the primary task (i.e., when the "stop work" instruction was given) the stimulus terms were presented and subjects were required to provide the response term in the space provided. After the four sets of tasks were completed, subjects were instructed via tape to complete the during crowding questionnaire (Appendix D). When all subjects had completed the questionnaire the person seated closest to the door was instructed to open the door.

When the door was opened the experimenter informed the subjects that they had completed part 1 of the experiment. Subjects were then taken to the larger experimental room for testing of task performance after density.

Test materials after density. The task which subjects were required to perform after density was a modified 240 item paper and pencil version of the Stroop Color-Word Test (cf. Jensen & Rohwer, 1966; Sherrod, 1974; Appendix G). This task consists of four color names printed in contrasting (and occasionally corresponding) ink color. The task is to identify the color of the ink, code the ink color and record the coded ink color on an IBM sheet. When the ink color contrasts with the cognitive meaning of the word a competing response situation is generated and coding further complicates this task.

The Stroop task was considered to be a measure of moderately complex task performance. The 240 items would take the average person 11 minutes to complete under normal conditions; subjects were allowed 10 minutes for completion.

After being tested on the Stroop material a brief after density questionnaire assessing perceptions of the Stroop task was administered (Appendix H). Subjects were then debriefed and dismissed.

Summary of dependent measures. Hypothesis 1 stated that high density produces feelings of crowding. One questionnaire item (crowded-isolated) assessed subjects' feelings of crowding. Hypotheses 2 and 3 dealt with primary and secondary task performance. Two measures of task performance were obtained during Density conditions: (a) the number scan was designated as the primary task, and (b) learning paired-associates was designated as the secondary task. Both of these tasks were scored for error. Error for the primary task was defined as total number of occurrences in the entire number set minus the number of occurrences found. Error for the secondary task was defined as number of response terms not recalled or recalled incorrectly (i.e., paired with the wrong stimulus word). Hypothesis 4 stated that crowded subjects would make significantly more errors than not crowded subjects on a post-crowding task. One measure of task performance was obtained after Density conditions, the Stroop task. Error on the Stroop task was defined as incorrect recording of the coded ink color plus the number of uncompleted items. Hypothesis 5 dealt with adaptation to crowding. Whether adaptation occurred was assessed by observing task performance on the primary and secondary tasks from Trials 1 to 4. Hypothesis 6 and 7 predicted the personality variables, Stimulus Screening and Personal Space, to moderate task performance during and after crowding. The number scan task, paired-associates task and Stroop task were dependent measures for Hypotheses 6 and 7.

Seven-point scale questionnaire ratings were dependent measures for Hypotheses 8, 9, 10, and 11. Hypothesis 8 dealt with subjects' perception of the physical environment. Subjects rated the physical environment on the dimensions: small-large, warm-cool, cheerful-gloomy, dark-light, annoying-pleasing, friendly-hostile, stuffy-drafty, adequate-inadequate, and private-public. Hypothesis 9 dealt with subjects' perception of others. Subjects rated the social environment on the dimensions: friendly-hostile, passive-aggressive, cooperative-competitive, annoying-pleasing, and good-bad. Hypothesis 10 dealt with subjects' mood states. Mood states were rated on the dimensions: tense-relaxed, comfortable-uncomfortable, restricted-free, cooperative-competitive, happy-sad, and crowded-isolated. Hypothesis 11 was concerned with subjects' perceptions of tasks completed during and after density. Each task completed during the experiment was rated on a seven-point scale as to the perceived difficulty of the task, degree of luck required, the amount of effort required to complete the task, the amount of skill subjects perceived that the task required, how much control the subjects thought they had over the task and how interesting the task was.

Results

Manipulation Check

Hypothesis 1 predicted that high density would produce greater feelings of crowding. This was tested by a univariate analysis of variance of the questionnaire item crowded-isolated (Table 2). Subjects in eight-person groups reported that they felt significantly more crowded (M = 1.75) than subjects in four-person groups (M = 3.29).

Task Performance During Crowding

Hypothesis 2 predicted no significant differences in performance across Density conditions for the primary number search task. A 2 x 2 x 2 x (4 trials) mixed design analysis of variance was computed and the main effect for Density was significant (Table 3). Crowded subjects made significantly more errors (M = 66.23) than not crowded subjects (M = 39.66).

Hypothesis 3 predicted that crowded subjects would make significantly

Table 2

Analysis of Variance Summary for Subjects

Perception of Crowding

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	F
Total	63	143.97		
Density (D)	1	34.51	34.51	21.69*
Screening (S)	1	0.14	0.41	0.09
Personal Space (P)	1	1.26	1.26	0.80
DS	1	2.64	2.64	1.66
DP	1	0.14	0.14	0.09
SP	1	0.00	0.00	0.00
DSP	1	0.14	0.14	0.09
Residual	56	89.12	1.59	

*$p < .001$

Table 3

Analysis of Variance Summary for the Number Scan Task

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F*
Density (D)	1	45209.39	45209.39	9.93*
Screening (S)	1	36.00	36.00	0.01
Personal Space (P)	1	7590.77	7590.77	1.67
DS	1	17030.23	17030.23	3.74
DP	1	11315.63	11315.63	2.49
SP	1	6241.00	6241.00	1.37
DSP	1	855.48	855.48	0.19
N/DSP	56	254913.40	4552.02	
Trials (T)	3	21901.56	7300.52	17.64*
DT	3	1479.23	493.08	1.19
ST	3	559.80	186.60	0.45
PT	3	971.91	323.97	0.78
DST	3	2306.41	768.80	1.86
DPT	3	1487.58	495.86	1.20
SPT	3	1187.56	395.85	0.96
DSPT	3	1060.80	353.60	0.85
Residual	168	69528.75	413.86	

*$p < .001$

more errors on the secondary task (i.e., the paired-associates task). A 2 x 2 x 2 x (4 trials) mixed design analysis of variance was computed and the Density main effect for the paired-associates task was not statistically significant (Table 4).

Post-Crowding Task

Hypothesis 4 predicted that crowded subjects would make significantly more errors than not crowded subjects on the post-crowding task. Univariate analysis of variance was performed on the Stroop task. The Density main effect was not statistically significant (Table 5). There was a significant main effect for Personal Space, and a significant three-way interaction of Density x Screening x Personal Space. The percent of variance these latter two effects accounted for was calculated (Omega squared, Hays, 1963). The main effect for Personal Space accounted for 6 percent of the total variance and the Density x Personal Space x Screening interaction accounted for 7 percent of the variance.

Adaptation

Hypothesis 5 was concerned with adaptation to crowding and predicted steadily increasing competence from Trial 1 to Trial 4. Tables 3 & 4 indicate that the Trials main effects were significant on both the primary and secondary tasks. Individual comparisons of the four number search trials were made using the Tukey (a) procedure. Significantly more errors ($p < .01$) were made on the first and last number scans (M = 63.88 and M = 59.67, respectively) than the second and third (M = 40.83 and M = 47.40, respectively). There were no significant

Table 4

Analysis of Variance Summary for the Paired-Associate Task

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F*
Density (D)	1	54.39	54.39	3.15
Screening (S)	1	34.52	34.52	2.00
Personal Space (P)	1	6.89	6.89	0.40
DS	1	1.00	1.00	0.06
DP	1	4.00	4.00	0.23
SP	1	16.00	16.00	0.93
DSP	1	66.02	66.02	3.82
N/DSP	56	968.12	17.29	
Trials (T)	3	203.84	67.95	19.24*
DT	3	15.20	5.07	1.43
ST	3	10.39	3.46	0.98
PT	3	2.70	0.90	0.26
DST	3	4.97	1.65	0.47
DPT	3	9.66	3.22	0.91
SPT	3	1.72	0.57	0.16
DSPT	3	9.64	3.21	0.91
Residual	168	593.33	3.53	

*$p < .001$

Table 5

Analysis of Variance Summary Table for

the Post-Crowding Stroop Task

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	F
Total	63	168252.13		
Density (D)	1	2462.64	2462.64	1.02
Screening (S)	1	346.89	346.89	.14
Personal Space (P)	1	13196.27	13196.27	5.49**
DS	1	2197.27	2197.27	.91
DP	1	40.64	40.64	.02
SP	1	15.02	15.02	.01
DSP	1	15345.00	15345.00	6.38**
Residual	56	134648.40	2404.44	

**$p < .05$

differences between the first and last or second and third pairs. Individual comparisons were also made of the four paired-associates trials using the Tukey (a) procedure. Performance on the second word list was significantly better ($p < .01$, M = 1.42 errors) than the first (M = 3.31), third (M = 3.19) and fourth (M = 3.77). There were no other significant differences.

Adaptation Level

Hypothesis 6 predicted the Density x Screening interactions to be significant and Hypothesis 7 predicted the Density x Personal Space interactions to be significant. No significant effects were found for either screening or personal space on primary or secondary task performance (Tables 3 & 4), and none of the predicted interaction effects were significant.

Questionnaire Items

Perception of environment. Hypothesis 8 predicted that crowding would negatively affect perception of the physical environment. Multivariate analysis of variance was performed on the questionnaire items assessing perception of the environment (small-large, warm-cool, cheerful-gloomy, dark-light, annoying-pleasing, friendly-hostile, stuffy-drafty, adequate-inadequate, and private-public. The main effect for Density was significant, $F\ (9,48) = 6.45$, $p < .001$.

Univariate analysis of variance was computed on each of the predicted dimensions: small-large, annoying-pleasing, and private-public. Significant Density main effects were found on each of these dimensions: small-large, $F\ (1,56) = 7.82$; annoying-pleasing, $F\ (1,56) =$

22.22 ($p < .05$ in all cases). Crowded subjects perceived the experimental room as being smaller (M = 1.50) than not crowded subjects (M = 2.06), more annoying (M = 2.81 and M = 3.56) and more public (M = 4.50 and M = 2.13). In short the crowded environment was perceived as more negative than the not crowded environment.

Perception of others. Hypothesis 9 predicted that crowding would negatively affect subjects perception of their social environment. Multivariate analysis of variance was computed on questionnaire items assessing subjects perceptions of others (friendly-hostile, passive-aggressive, cooperative-competitive, annoying-pleasing, and good-bad). The Density main effect was not statistically significant, $F (5,52) = 1.12$, n.s.

Mood state. Hypothesis 10 predicted that crowding would negatively affect subjects' mood states (i.e., questionnaire items tense-relaxed, comfortable-uncomfortable, restricted-free, cooperative-competitive, happy-sad, and crowded-isolated). A multivariate analysis of variance was computed on the above dependent measures. There was a significant main effect for Density, $F (6,51) = 7.05$, $p < .001$ and a significant Density by Personal Space interaction, $F (6,51) = 2.44$, $p < .05$.

Univariate analyses of the predicted dimensions, (i.e., comfortable-uncomfortable, and restricted-free) were computed. There was a significant main effect for Density on the comfortable-uncomfortable dimension (Table 6). Crowded subjects reported that they felt more uncomfortable (M = 3.75) than not crowded subjects (M = 3.75).

Table 6

Analysis of Variance for the Dimension

Comfortable--Uncomfortable

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	F
Total	63	230.11		
Density (D)	1	54.39	54.39	20.70*
Screening (S)	1	0.14	0.14	0.05
Personal Space (P)	1	15.02	15.02	5.72**
DS	1	1.27	1.27	0.48
DP	1	0.39	0.39	0.15
SP	1	0.39	0.39	0.15
DSP	1	11.39	11.39	4.34**
Residual	56	147.12	2.63	

*$p < .001$

**$p < .05$

Table 6 indicates a significant main effect for Personal Space and a significant Density x Screening x Personal Space interaction. An Omega squared was calculated for the Personal Space main effect and the Density x Screening x Personal Space interaction. The main effect for Personal Space was found to account for 5 percent of the total variance and the three-way interaction accounted for less than 4 percent.

There was a significant main effect for Density on the *restricted-free* dimension (Table 7). Crowded subjects felt less *free* (M = 1.84) than not crowded subjects (M = 3.00). A significant Density x Personal Space interaction was found for this variable, also. An Omega squared was calculated and the Density x Personal Space interaction accounted for 6.5 percent of the total variance.

Task perceptions. Hypothesis 11 predicted that crowding would affect subjects' perceptions of tasks performed during and after crowding. Questionnaire items were completed by subjects rating the three tasks performed. Tasks were assessed as to the perceived *difficulty*, *luck*, *effort*, *skill*, *control*, and *interest* involved in the tasks. A multivariate analysis of variance on subjects' perceptions of the tasks was computed. No significant differences were found (p's > .10).

Discussion

The test of Hypothesis 1 provided a check on the Density manipulation and was supported. Thus the answer to Problem 1 is that the density manipulation was sufficient to produce the perception of crowding.

Table 7

Analysis of Variance for the Dimension

Restricted--Free

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	F
Total	63	125.76		
Density (D)	1	21.39	21.39	14.03**
Screening (S)	1	0.77	0.77	0.50
Personal Space (P)	1	5.64	5.64	3.70
DS	1	0.16	0.16	0.01
DP	1	9.77	9.77	6.41**
SP	1	0.77	0.77	0.50
DSP	1	1.89	1.89	1.24
Residual	56	85.37	1.52	

**$p < .05$

Task Performance and Crowding Stress

Issue 2 was concerned with whether crowding adversely affects task performance. Hypotheses 2 and 3 were derived to test the assumption that crowding does adversely affect task perfromance. Hypothesis 2 predicted no significant difference in the performance of the primary number search task between crowded and not crowded subjects. A significant difference was found on the primary number search task, crowded subjects made significantly more errors in the number search than not crowded subjects.

Hypothesis 3 predicted that crowded subjects would make significantly more errors on the secondary task (i.e., learning paired-associates). It was found that crowded subjects did not make significantly more errors than not crowded subjects on the paired-associates task.

Overall, crowding caused a decrement in task performance. Although, prior to experimentation, the experimenter designated the number scan task as the primary task, subjects indicated during unstructured debriefing interviews that they had actually considered learning paired-associates to be the most important task while marking numbers was considered less important. In answer to problems 2 and 3, crowded individuals showed more task decrements on the task they perceived as secondary (marking numbers) than their not crowded counterparts. Crowding did not, however, affect performance of the task that subjects perceived as primary (learning paired-associates).

Most subjects indicated during debriefing that they had not suspected the density manipulation during the experiment. Most said they thought the experiment was a rather straight-forward memory study. According to subjects, they perceived the number scan as a distractor for the "true task," the memory of paired associates. So they concentrated harder on the paired-associates even though instructions stated that the most important task was the number scan task. On the other hand, decrements were probably not due to misunderstood instructions. Data was not discarded because of improper completion, and no differences were found for paired-associates which were presented in the same manner as the instructions.

Hypothesis 4 was not supported. Results indicated that crowding did not produce decrements in task performance after crowding on the Stroop task. Previous research has shown detrimental aftereffects of crowding on task performance (Dooley, 1974; Evans, 1975). Also, the Stroop task did not produce task decrements during crowding in Sherrod's (1974) study. To answer problem 4, the present findings suggest that the Stroop test may not be sensitive to crowding stress as a measure of complex task performance. This may be true of similar tasks, also (e.g., Freedman, 1975).

In summary, the primary--secondary task paradigm is appropriate for use in future research in crowding because it is sensitive to the effects of crowding. Previous negative findings not using a primary--secondary paradigm must be regarded with caution, especially in view of the present findings concerning the Stroop task. The present study indicated that the Stroop task is not sensitive to crowding stress. It is now clear that Sherrod's (1974) negative results using the Stroop task were due to the nature of the task. By implication, similar moderately complex tasks probably do not show the detrimental effects of crowding. The conclusion that crowding is not stressful because very little task decrement was observed during crowding is not warranted. For example, Freedman's (1975) conclusion that crowding is not inherently stressful may be somewhat premature, since the tasks he used in attempting to demonstrate the negative effects of crowding were probably not sensitive to crowding stress.

Adaptation and Adaptation Level

Issue 3 was concerned with adaptation during crowding and possible personality moderators of task performance during crowding. Hypothesis 5 predicted that adaptation to crowding would occur and Hypotheses 6 and 7 predicted Personal Space and Screening to moderate task performance during crowding.

Since subjects rather suddenly and without warning found themselves in a crowded situation, one would expect that adaptation to crowding should have been observed across task trials. Hypothesis 5 predicted that adaptation would have been displayed by steadily increasing competence on tasks as time progressed. The significant trials effect on both the primary and secondary tasks, however, probably indicates the effects of learning, fatigue and boredom rather than adaptation to crowding. The observed pattern was different from that predicted for adaptation and the same pattern was observed in both crowded and non-crowded subjects. In answer to problem 5, the present research effort again failed to show adaptation to crowding.

Of primary importance is the fact that the present research failed to replicate the findings of Dooley (1974) concerning personal space (Hypothesis 7). In the present study, close personal space did not appear to ameliorate the detrimental effects of crowding on task performance. The answer to problem 7, however, is equivocal. The present negative results may be due to the use of the CID as a measure of personal space. As Aiello, DeRisi, Epstein and Karlin (1976), Knowles and Johnson (1974) and Aiello, Epstein and Karlin (1976) have found, the CID measure of personal space was not related to actual seating distance measures.

An alternative explanation for the present negative findings might be that the personal space manipulation may not have worked because both close and far subjects were sufficiently invaded to produce equal amounts of stress. That is, during crowding, subjects with close personal space could have been invaded to a similar extent as subjects with far personal space. Regardless of characteristic interaction distance, if close personal space individuals were invaded they would have been subject to the same crowding stress as far personal space subjects. Thus, if both close and far subjects were invaded they would be expected to show equal amounts of decrements on complex tasks during crowding stress. This explanation seems tenable given the extreme amount of closeness in high density conditions.

The answer to problem 6 is equally clouded. The two above arguments may also apply as explanations for the negative findings for the Screening manipulation (Hypothesis 7). The failure to find significant differences in task performance for screeners and non-screeners may be due to the use of the Stimulus Screening Measure, itself. It is too early to tell if this is a poor measure of screening since the present study was the first empirical test of its validity in crowding research. As a first indication, however, it appears the Stimulus Screening Measure may need more refinement for use in crowding research.

On the other hand, the density manipulation may have created such an intense information rate that both screeners and non-screeners were equally overloaded. Screeners may not have been able to habituate to irrelevant stimuli (other people) in the present study any better than non-screeners due to an excessively high information rate. On the other hand, the high density situation may not have created enough stimulus overload, however, this does not seem likely.

In summary, in the present study as in previous research, adaptation to crowding stress was not observed. Further, personal space and screening manipulations of adaptation level produced negative results. The latter findings may be due to either the instruments used or the intensity of the density manipulation. Further research is needed to determine which explanation is more appropriate.

The Experience of Crowding

Issue 4 dealt with the experience of crowding. Hypothesis 8 predicted that crowding would negatively affect perception of the physical environment. This was supported. Hypothesis 9, however, was not supported. It preducted that during crowding the perception of others would be negatively affected. Hypothesis 10 predicted that crowding would negatively affect mood state and was supported. Hypothesis 11, which dealt with the effects of crowding on perceptions of tasks performed, was not supported.

In answer to problems 8, 9, 10, and 11, results of the questionnaire items revealed that, in general, crowding basically affected subjects perception of the environment (problem 8) and mood states (problem 10) while perception of the social environment and tasks (problems 9 and 11, respectively) remained relatively unaffected. The finding that crowding negatively affected general perceptions of the physical environment but not general perceptions of the social environment is somewhat contrary to previous research using a social density manipulation (Loo, 1973). Previous research tends to indicate that manipulations of social density largely result in changes in perception of the social environment rather than in perception of the physical environment as the present study found. Further analysis revealed that both the physical and social environments were perceived as more annoying by crowded subjects. Thus, manipulating social density possibly only produces negative changes in perception of others during conditions where members are added to an already existing group and may be of no concern where groups are simply brought together as in the present study. At any rate, social density manipulations make aspects of both the physical and social environments to be perceived as annoying.

The present research found some support for Altman's privacy maintenance model of crowding. Crowded subjects perceived the experimental room as smaller yet more public than their non-crowded counterparts. In further support of Altman's model, crowding was experienced as an uncomfortable restriction of actions. Characteristic spatial distance may operate as a variable in crowding only so far as it ameliorates somewhat the general depression of moods since this was the only predicted interaction to show statistical stability. In other words, during crowding persons with close and far personal space zones may show similar decrements in performance and perceive the social and physical environments to be just as annoying but individuals with close personal space zones may feel a little better about the situation. Psychological stress (i.e., crowding) need not produce negative affect in some individuals.

Finally, questionnaire items dealing with perceptions of the tasks themselves indicated that crowded subjects did not differ from their noncrowded counterparts. Subjects indicated the tasks to be the same level of difficulty regardless of whether or not they were performing them during crowded conditions. Also, subjects did not differ in the degree to which they attributed luck to be a factor in their task performance. These findings suggest that subjects are capable of separating a cognitive task from the task environment even though the task environment did affect performance of the cognitive task. The finding that subjects did not perceive a loss of control over tasks during crowding has important ramifications. Adaptation to crowding has been postulated as a means of maintaining control during the crowding experience, however, research has consistently failed to show adaptation. Yet, the perception of control is maintained, probably through the use of coping behaviors such as reduced eye contact, etc.

Summary

This research dealt with four issues in crowding. Issue 1 was concerned with the density manipulation. It was found that high density conditions would produce greater feelings of crowding than low density conditions.

Issue 2 dealt with task performance during and after crowding. During crowding a primary--secondary task paradigm was used. It was found that, overall, crowding does produce decrements in performance of cognitive tasks. The Stroop task used in previous research is not sensitive to crowding stress.

Issue 3 was concerned with adaptation to crowding and adaptation level. In the present study adaptation was not observed. Also, individual differences in adaptation level were not found to moderate task performance during crowding. Further research is needed to ascertain whether these negative findings were a function of the operational measures of personal space and screening or whether the density manipulation used was too intense, thus, obliterating positive effects.

Issue 4 was concerned with the experience of crowding. It was found that crowding stress did not distort perceptions of others or tasks performed during or after crowding but critically altered perceptions of the physical environment and mood state.

References

Aiello, J. R., DeRisi, D. T., Epstein, Y. M., & Karlin, R. A. Crowding and the role of interpersonal distance preference. Unpublished manuscript, Department of Psychology, Rutgers University, New Brunswick, N.J., 1976.

Aiello, J. R., Epstein, Y. M., & Karlin, R. A. Effects of crowding on electrodermal activity. Sociological Symposium, 1975, 14, 43-57.

Altman, I. The environment and social behavior: Privacy, personal space, territory, and crowding. Monterey, Calif.: Brooks, Cole, 1975.

Argyle, M., & Dean, J. Eye-contact, distance and affiliation. Sociometry, 1965, 28, 289-304.

Baron, R. M., Mandel, D. R., Adams, C. A., & Griffen, L. M. Effects of social density in university environments. Journal of Personality and Social Psychology, 1976, 34, 434-446.

Baum, A., & Greenberg, C. A. Waiting for a crowd: The behavioral and perceptual effects of anticipated crowding. Journal of Personality and Social Psychology, 1975, 32, 671-679.

Baum, A., & Koman, S. Differential response to anticipated crowding: Psychological effects of social and spatial density. Journal of Personality and Social Psychology, 1976, 34, 526-536.

Baum, A., Riess, M., & O'Hara, J. Architectural variants of reaction to spatial invasion. Environment and Behavior, 1974, 6, 91-101.

Baum, A., & Valins, S. Residential environments, groups size, and crowding. Proceedings, 81st Annual Convention, APA, 1973, 211-212.

Bickman, L., Teger, A., Gabriele, T., McLaughlin, C., Berger, M., & Sunday, E. Dormitory density and helping behavior. Environment and Behavior, 1974, 5, 465-490.

Calhoun, J. Population density and social pathology. Scientific American, 1962, 206, 139-148.

Canter, D., & Canter, S. Close together in Tokyo. Design and Environment, 1971, 2, 60-63.

Cosby, P. Effects of density, activity and personality on environmental preferences. Journal of Research in Personality, 1973, 7, 45-60.

Davis, D. E. Physiological effects of continued crowding. In A. H. Esser (Ed.), Behavior and environment, New York, Plenum, 1971, 133-147.

Desor, J. A. Toward a psychological theory of crowding. Journal of Personality and Social Psychology, 1972, 21, 79-83.

Dooley, B. Crowding stress: The effects of social density on men with "close" or "far" personal space. Unpublished doctoral dissertation, University of California at Los Angeles, 1974.

Duke, M. P., & Nowicki, S., Jr. A new measure and social learning model for interpersonal distance. Journal of Experimental Research in Personality, 1972, 6, 1-16.

Edney, J. J. Human territoriality. Psychological Bulletin, 1974, 81, 959-975.

Ehrlich, P. The population bomb. New York: Ballantine, 1968.

Esser, A. H. Behavior and environment. New York: Plenum, 1971.

Evans, G. W. Behavioral and physiological consequences of crowding in humans. Unpublished doctoral dissertation, Department of Psychology, University of Massachusetts, Amherst, 1975.

Felipe, N., & Sommer, R. Invasions of personal space. Social Problems, 1966, 14, 206-214.

Freedman, J. L. Crowding and behavior. San Francisco: W. H. Freedman, 1975.

Freedman, J. L., Klevansky, S., & Ehrlich, P. R. The effect of crowding on human task performance. Journal of Applied Social Psychology, 1971, 1, 7-25.

Galle, O. R., Gove, W. R., & McPherson, J. M. Population density and pathology: What are the relationships for man? Science, 1972, 176, 23-30.

Glass, D. C., & Singer, J. E. Urban stress. New York: Academic Press, 1972.

Glass, D. C., & Singer, J. E. Experimental studies of controllable and uncontrollable noise. Representative Research in Social Psychology, 1973, 4, 165-183.

Greenberg, C. Density and the expectation of social interaction: A study of waiting room behavior. Unpublished master's thesis, Wayne State University, 1974.

Greenberg, C., & Baum, A. Compensatory response to anticipated densities. Journal of Applied Social Psychology, in press.

Greenberg, C. I., & Firestone, J. Compensatory responses to crowding: Effects of personal space intrusion and privacy reduction. Journal of Personality and Social Psychology, 1977, 35, 637-644.

Hall, E. T. The hidden dimension. New York: Doubleday, 1966.

Hays, W. L. Statistics. New York: Holt, Rinehart, & Winston, 1963.

Jensen, A. R., & Rohwer, W. D., Jr. The Stroop color word test: Areview. Acta Psychologica, 1966, 25, 36-93.

Kaplan, K. J., & Greenberg, C. I. Regulation of interaction through architecture, travel, and telecommunication: A distance-equilibrium approach to environmental planning. Environmental Psychology and Nonverbal Behavior, 1976, 1, 17-29.

Knowles, E. S. The application of social physics to the effects of others: The gravity of crowding. In A. Baum & Y. Epstein (Eds.), Human response to crowding. Hillsdale, N.J.: Lawrence Earlbaum Assoc., 1976.

Knowles, E. S., & Johnson, P. K. Interpersonal consistency in interpersonal distance. Journal Supplement Abstract Service, 1974, 4, 124.

Krutch, J. W. A naturalist looks at overpopulation. In F. Osborn (Ed.), Our crowded planet. New York: Doubleday, 1962.

Lazarus, R. S. Psychological stress and the coping process. New York: McGraw-Hill, 1966.

McGrew, P. L. Social and spatial density effects on spacing behavior in preschool children. Journal of Child Psychology and Psychiatry, 1970, 11, 197-205.

Mehrabian, A. Manual for the questionnaire measure of stimulus screening and arousability, 1976, A. Mehrabian, University of Southern California.

Mehrabian, A., & Diamond, S. G. Effects of furniture arrangement, props, and personality on social interaction. Journal of Personality and Social Psychology, 1971, 20, 18-30.

Milgram, S. The experience of living in cities. Science, 1970, 167, 1461-1468.

Patterson, M. L. Stability of nonverbal immediacy behaviors. Journal of Experimental Social Psychology, 1973, 9, 97-109.

Patterson, M. L. An arousal model of interpersonal intimacy. Psychological Review, 1976, 83, 235-245.

Patterson, M. L., & Sechrest, L. B. Interpersonal distance and impression formation. Journal of Personality, 1970, 38, 161-166.

Ross, M., Layton, B., Erickson, B., & Schopler, J. Affect, facial regard, and reactions to crowding. Journal of Personality and Social Psychology, 1973, 28, 69-76.

Rotter, J. B. Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs, 1966, 80 (1, Whole No. 609).

Sherrod, D. R. Crowding, perceived control, and behavioral aftereffects. Journal of Applied Social Psychology, 1974, 4, 171-186.

Simmel, G. The metropolis and mental life. First published in 1903. Adapted in Coser, L. A., Masters of sociological thought. New York: Harcourt Brace, 1971.

Smith, S., & Haythorn, W. W. The effects of compatibility crowding, group size, and leadership seniority on stress, anxiety, hostility, and annoyance in isolated groups. Journal of Personality and Social Psychology, 1972, 22, 67-69.

Sokolov, E. N. Perception and the conditioned reflex. New York: Pergamon Press, 1963.

Sommer, R. Personal space: The behavioral basis of design. Englewood Cliffs, N.J.: Prentice-Hall, 1969.

Stokols, D. On the distinction between density and crowding: Some implications for future research. Psychological Review, 1972, 79, 275-278.

Stokols, D. The experience of crowding in primary and secondary environments. Environment and Behavior, 1976, 8, 49.

Stokols, D., Rall, M., Pinner, B., & Schopler, J. Physical social and personal determinants of the perception of crowding. Environment and Behavior, 1973, 5, 87-117.

Sundstrom, E. Crowding as a sequential process: Review of research on the effects of population density on humans. In A. Baum, & Y. Epstein (Eds.), Human response to crowding. Hillsdale, N.J.: Lawrence Earlbaum Assoc., 1978.

Valins, S., & Baum, A. Residential group size, social interaction, and crowding. Environment and Behavior, 1973, 5, 421-439.

Wirth, L. Urbanism as a way of life. The American Journal of Sociology, 1939, 44, 1-24.

Wohlwill, J., & Kohn, I. The environment as experienced by the migrant: An adaptation-level view. Representative Research in Social Psychology, 1973, 4, 135-164.

Worchel, S., & Teddlie, C. The experience of crowding: A two factor theory. Journal of Personality and Social Psychology, 1976, 34, 30-40.

Footnotes

[1]The reliability of the Stimulus Screening Measure was .92 using Cronback's alpha for the subjects that participated in the present research.

[2]In cases where a subject did not show up for the experiment, the experimenter sat in for the subject by saying that he had not had a chance to try the tasks yet. This happened three times in the four person groups and three times in the eight person groups. One extra four person group and one extra eight person group was then run to create equal cell sizes.

Appendix A

<u>Comfortable Interpersonal Distance Measure</u> (CID) (Duke and Nowicki, 1973).

The following pages each contain a diagram of a room. For each diagram you are to imagine yourself at the center point (facing the number 4) with one of the persons listed below walking toward you on each line. Place a mark at the point on the line where you would prefer that person to stop approaching you, that is, where you think you might begin to feel uncomfortable about that person's closeness. Do this for each line in the numbered order so that the line numbered 1 will be first, the line numbered 2 will be second and so on.

1. For the first diagram, imagine a stranger of the same age and sex as yourself.

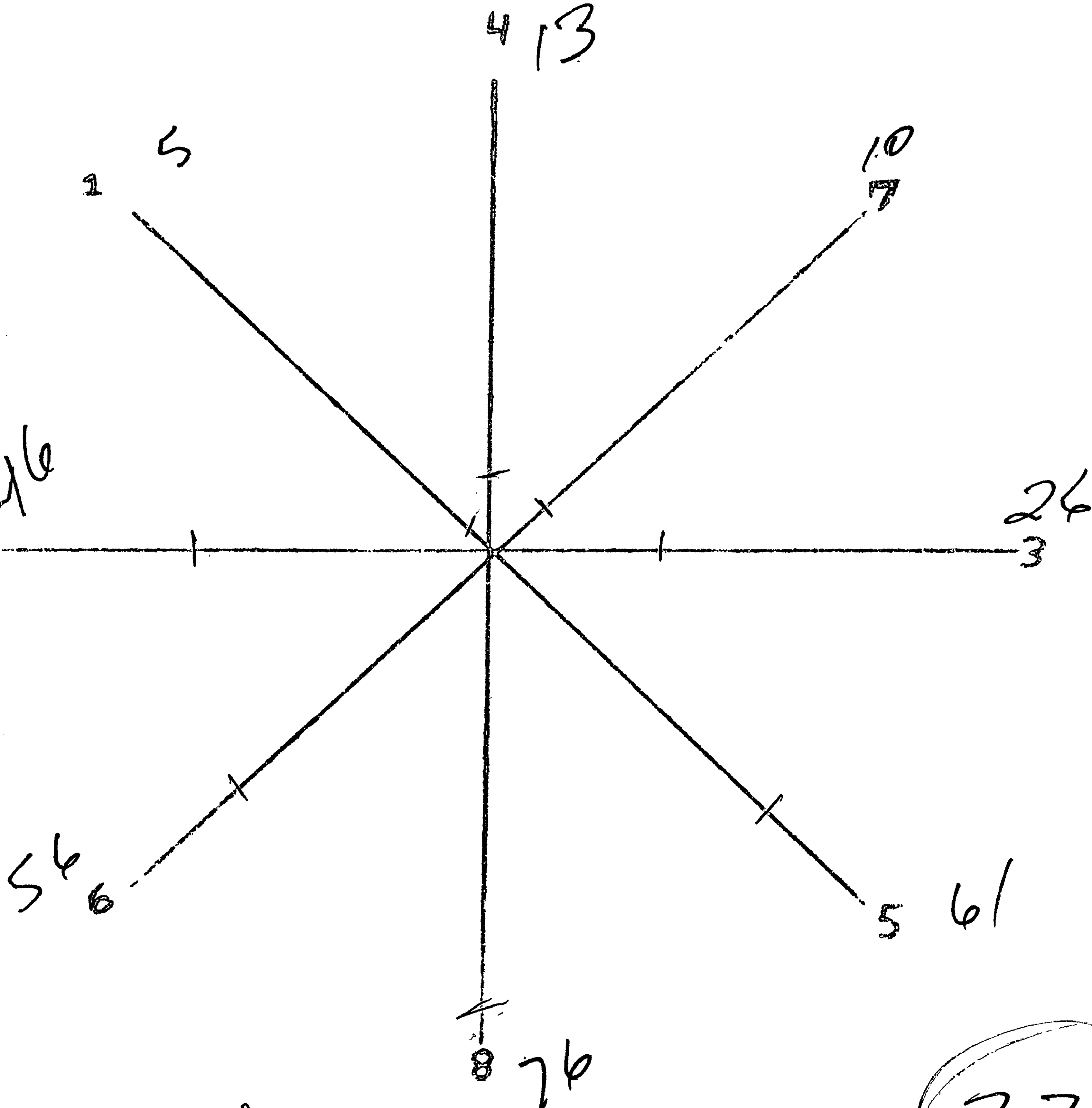
2. For the second diagram, imagine a stranger of the same age as yourself but of the opposite sex.

3. For the third diagram, imagine a friend of the same age and sex as yourself.

4. For the fourth diagram, imagine a friend of the same age as yourself but of the opposite sex.

Finally, place the appropriate number from the list above in the upper right hand corner of each page to label each diagram.

Diagram 1



293

33

Diagram 2

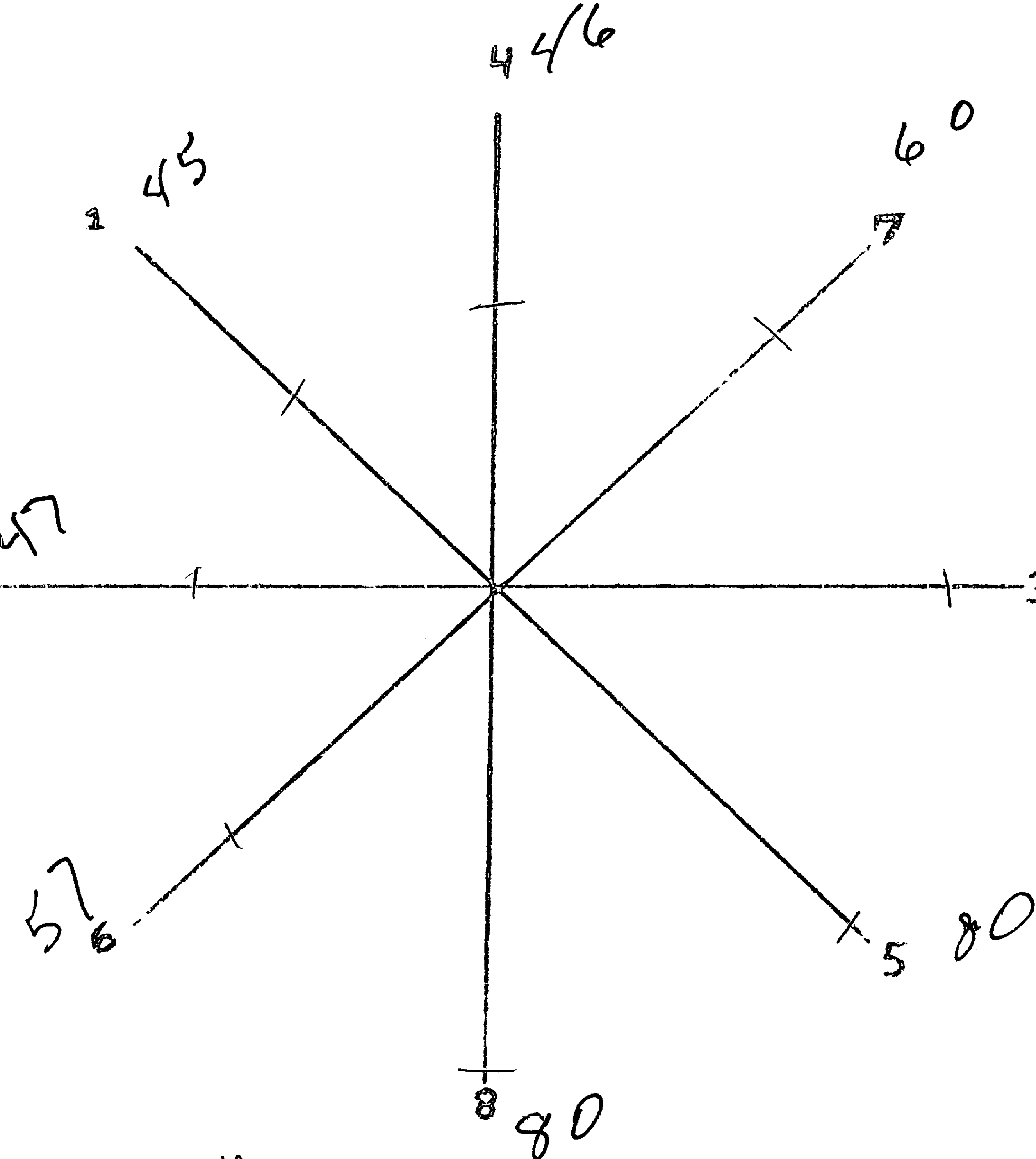


Diagram 3

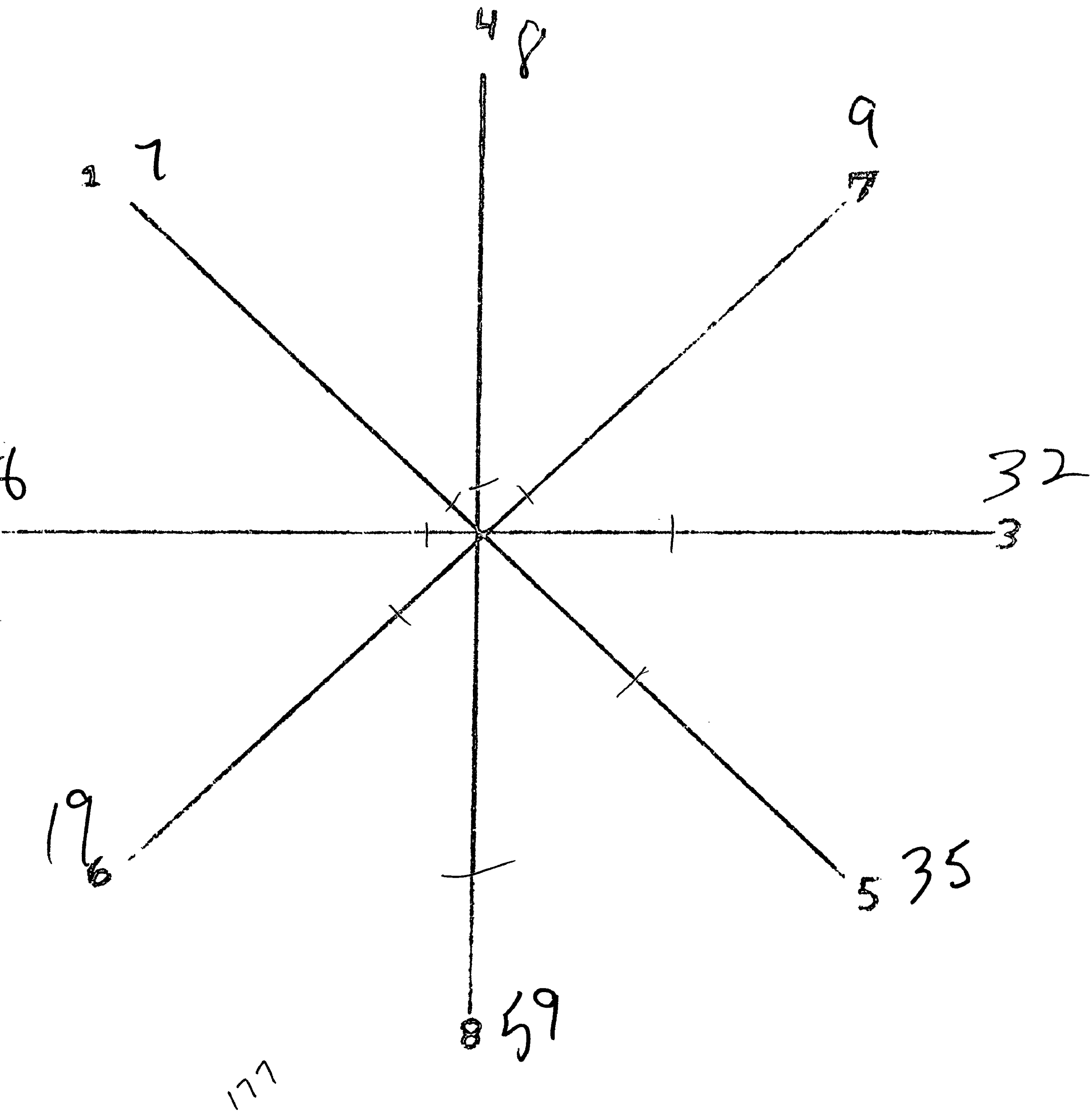
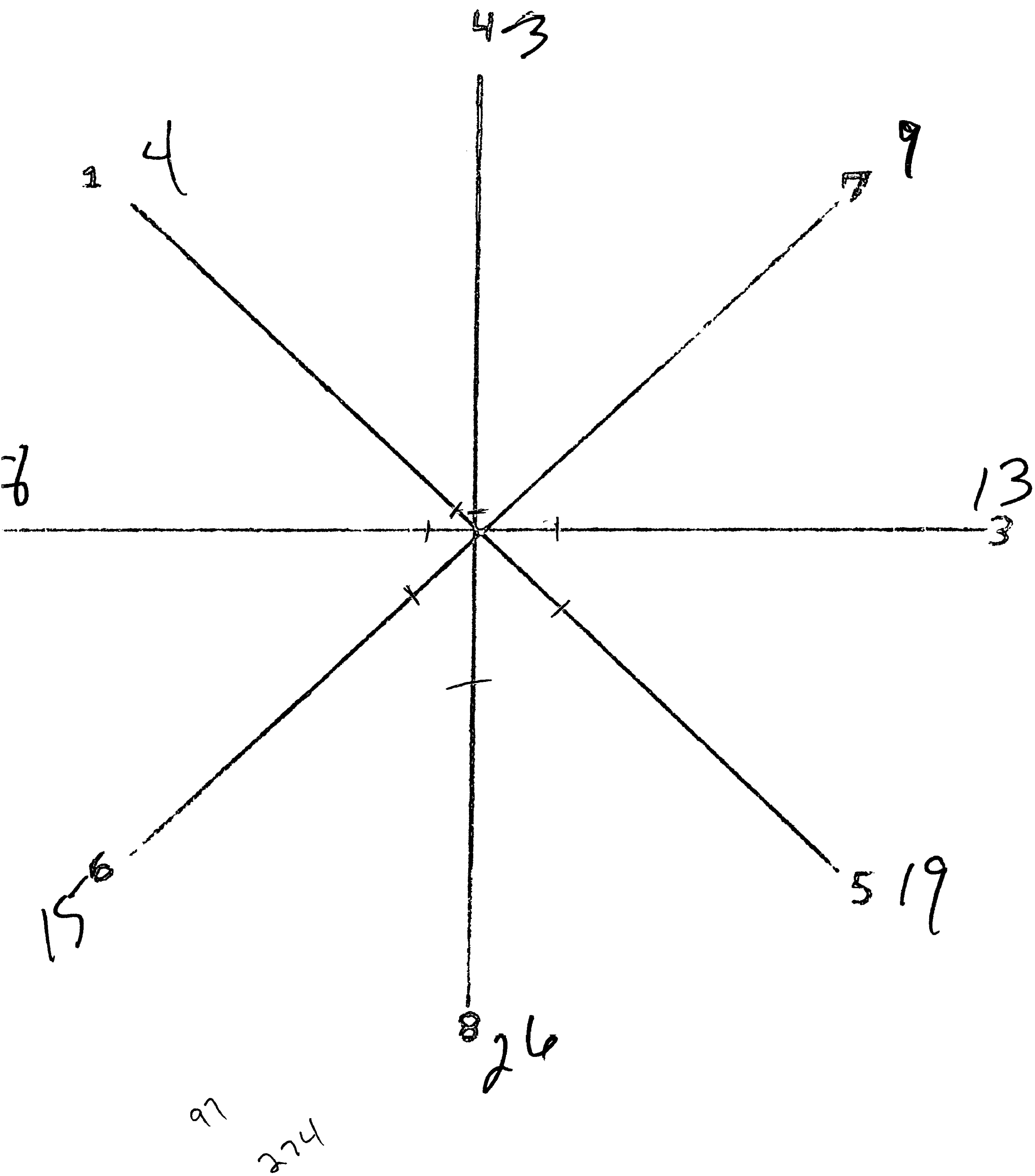


Diagram 4



Appendix B

<u>Stimulus Screening Measure</u> (Mehrabian, 1976).

Please use the following scale to indicate the degree of your agreement or disagreement with each of the statements on the following two pages. You may agree or disagree in different degrees with each statement. Highest agreement is +4; highest disagreement is -4, and when you cannot agree or disagree with a statement, simply answer with 0. Use the other numbers on the scale to show more moderate feelings in each direction. Record your answers in the spaces provided below.

+4 = very strong agreement
+3 = strong agreement
+2 = moderate agreement
+1 = slight agreement
0 = neither agreement nor disagreement
-1 = slight disagreement
-2 = moderate disagreement
-3 = strong disagreement
-4 = very strong disagreement

1. -1	11. +2	21. +2	31. +4
2. +1	12. +2	22. -4	32. +3
3. +4	13. +2	23. +1	33. +4
4. +4	14. -2	24. +1	34. +3
5. +4	15. +3	25. -4	35. +1
6. +4	16. +2	26. +1	36. +3
7. 0	17. +2	27. +4	37. +4
8. -2	18. +2	28. -2	38. -1
9. +1	19. 0	29. +3	39. +4
10. +1	20. +2	30. +3	40. +3

Remember to include the + or - also.

+36

1. I am usually not much affected by the feeling of leather or upholstery on my bare skin.

2. I dont't startle easily.

3. My strong emotions in a situation carry over for one or two hours after I leave it.

4. I am not influenced as much as most people by the weather.

5. I am strongly moved when many things are happening at once.

6. Sudden changes are not emotionally moving for me.

7. Having heard a sound, I often lay awake at night for some time.

8. Compared to others, I don't get as "moved" by intense stimulation.

9. The mood of a physical setting affects me a lot.

10. When I get stirred up my heart beats fast and keeps on beating for a while.

11. I am generally less emotional, both in a positive and negative way, than others.

12. A sudden pungent odor can have a great influence on me.

13. When I walk into a crowded room, it immediately has a big effect on me.

14. Things usually don't get me stirred up.

15. A long spell of bad weather affects me greatly.

16. A very emotional incident early in the day can change my mood for the whole day.

17. I am not affected much by sudden or intense events.

18. I am not affected much by the hardness or softness of the furniture I use.

19. Strong foul odors can make me tense.

20. Drastic changes in weather can affect my mood.

21. I am calm almost all the time.

22. I am not one to feel the changes in the mood of a situation.

23. I am tremendously affected by sudden loud noises.

24. I get excited easily.

25. I am not bothered by the sight of an accident for a long time.

26. I sometimes tremble from excitement.

27. Strong emotions don't have a lasting effect on me.

28. I am not one to be strongly moved by an unusual odor.

29. I quickly overcome being startled.

30. I am excited or moved long after a good movie.

31. Sometimes if I have many things to do at once, I get rattled.

32. I am not affected much by the feel or textures of the clothes I wear.

33. I am excitable in a crowded situation.

34. It is easy to feel aroused when a lot is happening.

35. Highly arousing stimulation affects me for a short time.

36. I don't react much to sudden loud sounds.

37. Sometimes I get emotionally moved over even simple things.

38. My moods are not quickly affected when I enter new places.

39. Sudden changes have an immediate and large effect on me.

40. Extremes in temperature don't affect me a great deal.

Appendix C

Paired-Associate Task Stimuli

Set A

1. king-rock
2. car-house
3. girl-door
4. tree-lake
5. clock-flag
6. book-church
7. coin-pencil
8. ink-kiss
9. factory-diamond
10. paper-dirt

Set B

1. cabin-hall
2. snake-wine
3. hammer-nail
4. bird-candy
5. rod-wife
6. arrow-body
7. noose-storm
8. army-truck
9. hospital-blood
10. mountain-cat

Sample Set

1. dog-store
2. cake-ice
3. race-wax
4. apple-book

Set C

1. fork-arm
2. apple-chair
3. boy-star
4. city-bar
5. cane-pupil
6. shoes-tower
7. table-stone
8. garden-breast
9. water-man
10. pipe-oats

Set D

1. river-woman
2. street-vest
3. potato-shotgun
4. harp-animal
5. nun-poster
6. ankle-soil
7. file-whale
8. photograph-bowl
9. tomb-woods
10. baby-meat-

Number Pairs

Set A (7, 3)
Set B (0, 2)
Set C (7, 9)
Set D (5, 1)
Sample (3, 1)

Appendix D

Subjects' Task Booklet

INSTRUCTIONS

During this part of the study you will be required to work on two tasks at the same time. One task consists of circling numbers and the other task consists of learning words. Of these two tasks the marking numbers task is more important.

For the marking numbers task the pages of this test booklet contain several sets of numbers. To perform the marking numbers task you must scan as quickly as possible an entire number set and mark all the occurrences of a specific number. I will tell you which number to mark at the beginning of each number set. For each number set I will tell you a different number to look for and mark so if you finish a number set before I tell you to stop working do not go on to the next number set. To finish a number set before I tell you to stop working will require that you work as quickly as possible on each number set since each set is strictly timed.

While you are working on the marking numbers task you will also need to learn a set of words that go together. For the learning words task I will repeat ten pairs of words several times while you are working on the marking numbers task. While you are marking numbers you must also listen to the words that go together and learn as many of the pairs as possible. When I tell you to stop working on marking numbers I will ask you to turn to a page that has ten blank spaces on it. Do this immediately. I will then test you on how many of the word pairs you were able to learn for the learning words task by saying one of the words from each pair. You will be required to write in the blank spaces the word that goes with each word that I say. For example, if the word pair is box and well and during the test I say the word well you must write the word box in the blank space. If you can not remember the word that goes with the word that I say during the test, write the word None in that blank space. There should be no blank spaces at the end of the test. You will have ten seconds to remember each word pair so you must write the words in as quickly as possible.

To give you an idea of how both tasks are done, I will now give you a short sample test. The number set for the sample test is found on the next page. While you are working on the number set sample I will repeat the sample word pairs.

Work as quickly as possible on NUMBER SET SAMPLE to find all the .....

NUMBER SET SAMPLE

995701927419655741706927818252106984903449471145885590905112
995701927419655741706927818252106984903449471145885590905112
7156202857446163990449190191517752195096166615227641610768473
918915961563148977580126344394106344250805585185991610337038
3261329975285517560105944927473515625629999049690918296361082
9070199505586291637954613428801295232307569416495278188903220
94953957258280982539044969618104802236824130421673757077921
99562690189579834752891863553094291036507119510850236801011
150114657348360930933997506907729059197714324368576957840961
934961129977361276521382540925391697628912455849232363270001
916168919864809163769178253498310162092219103595537993669445

You will find the blank spaces for the sample learning words task below. When I say one of the words from a word pair, you are to write the other word in that blank space. If you do not remember the other word, write <u>None</u> in the blank space for that pair.

1. ________________

2. ________________

3 ________________

4. ________________

DO NOT GO TO THE NEXT PAGE UNTIL INSTRUCTED TO DO SO

NUMBER SET A

104802236824130421673757077921995629630189579854752891863553

094291036507119510850236801011521620705648663541643263929334

024888152529676007420536691921150114657348360930933997506907

729059197714342368576957840961939696112997336127652138254092

539169762891245584923236327001330627229520591573920421326418

015362559522527062438183711008564200546363661533428823148235

526368752971048518215240433362463693378785828224210559787637

288340483968086390642566964117020118539397265616801665642751

699940707210281539883327603427927378568908178512596026894904

585860999814346741032420087308073519642326432664322642294305

816473099576393078560612127756988721887617453530607099749636

889744823777233774528936831273232164269809172470701336358731

197312487846901847634440726766916468919864809163769178253498

310162092218103595337993669445334885226713916163081988504146

145130669130168253063800500256942408265120849400274404825940

691792798215179394406046818602711949459557740388675686518663

363206768947564607565532218594831497698890229764689434245834

609526656689768328323793739972141945340224830535378130570659

187385686984378623000585972695176179339481056921444481929852

987361360204734263842872815398612801477881536613626390422209

625909396549340713414968490655440316901425331081589010652180

300150151197735494420118871585234955185159193581513580646557

500017679786645989474576671500005820072569011259760976391567

179554650392157145779842734914700605397676072907256436408962

950121566416408186297311557491304051663196773389353162478919

047116988465795579488347342595563491858489634627650752363976

282775491429515522106741200358683791049381899819533510116703

839463500620206642027638419474879176279795876298887357727958

909991884594824356053336288720394750699040980839743333931662

935262049204153055204749823167237928590042559143491740323632

773415617055293886041290830134491274961878171812636427082765

179554650392157145779842734914700605397676072907356436409862

625909396549340713414968490655440316901425331081589010652180

Words Learned During Number Set A

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________
10. ______________________

NUMBER SET B

047116988465795579488347342595563491358489634627650752363976
282775491429515522106741200358683791049381899819533510116703
839463500620206642027638419474879176279795876293887357727958
909991884594824356053336288720394750699040980839743333931662
935262049204153055204749823167237928590042559143491740323632
773415617055293336041290830134491274961878171812636427082765
179554650392157145779842734914700605397676072907356436409862
625909396549340713414968490655440316901425331081589010652180
104802236824130421673757077921995629630189579854752891863553
094291036507119510850236801011521620705648663541643263929334
024888152529676007420536691921150114657348360930933997506907
729059197714342368576957840961939696112997336127652138254092
539169762891245584923236327001330627229520591573920421326418
015362559522527062438183711008564200546363661533428823148235
526368752971048518215240433362463693378785828224210559787637
288340483968086390642566964117020118539397265616801665642751
699940707210281539883327603427927378568908178512596026894904
585860999314346741032420087308073519642326432664322642294305
816473099576393078560612127756988721887617453530607099749636
889744823777233774528936831273232164269809172470701336358731
197312487846901847634440726766916468919864809163769178253498
310162092218103595337993669445334885226713916163081988504146
145130669130168253063800500256942408265120849400274404825940
691792798215179394406046818602711949459557740388675686518663
363206768947564607565532218594831497698890229764689434245834
609526656689768328323793739972141945340224830535378130570659
187385686984378623000585972695176179339481056921444481929852
987361360204734263842872815398612801477881536613626390422209
625909396549340713414968490655440316901425331081589010652180
300150151197735494420118871585234955185159193581513580646557
500017679786645989474576671500005820073569011259760976391567
179554650392157145779842734914700605397676072907256436408962
950121566416408186297311557491304051663196773389353162478919

Words Learned During Number Set B

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________

NUMBER SET C

609526656689768328323793739972141945340224830535378130570659
187385686984378623000585972695176179339481056921444481929852
987361360204734263842872815398612801477881536613626390422209
625909396549340713414968490655440316901425331081589010652180
300150151197735494420118871585234955185159193581513580646557
500017679786645989474576671500005820073569011259760976391567
179554650392157145779842734914700605397676072907256436408962
950121566416408186297311557491304051663196773389353162478919
047116988465795579488347342595563491358489634627650752363976
282775491429515522106741200358683791049381899819533510116703
839463500620206642027638419474879176279795876293887357727958
909991884594824356053336288720394750699040980839743333931662
935262049204153055204749823167237928590042559143491740323632
773415617055293836041290830134491274961878171812636427082765
179554650392157145779842734914700605397676072907356436409862
625909396549340713414968490655440316901425331081589010652180
104802236824130421673757077921995629630189579854752891863553
094291036507119510850236801011521620705648663541643263929334
024888152529676007420536691921150114657348360930933997506907
729059197714342368576957840961939696112997336127652138254092
539169762891245584923236327001330627229520591573920421326418
015362559522527062438133711008564200546363661533428823148235
526368752971048518215240433362463693378785828224210559787637
288340483968086390642566964117020118539397265616801665642751
699940707210281539883327603427927378568908178512596026894904
585860999814346741032420087308073519642326432664322642294305
816473099576393078560612127756988721887617453530607099749636
889744823777233774528936831273232164269809172470701336358731
197312487846901847634440726766916468919864809163769178253498
310162092218103595337993669445334885226713916163081988504146
145130669130168253063800500256942408265120849400274404825940
691792798215179394406046818602711949459557740388675686518663
363206768947564607565532218594831497698890229764689434245834

Words Learned During Number Set C

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________

<u>NUMBER SET D</u>

889744823777233774523936831273232164269809172470701336358731
197312487846901847634440726766916468919864809163769178253498
310162092218103595337993669445334885226713916163081988504146
145130669130168253063800500256942408265120849400274404825940
691792798215179394406046818602711949459557740388675686518663
363206762947564607565532218594831497698890229764689434245834
609526656689768328323793739972141945340224830535378130570659
137385686984378623000585972695176179339481056921444481929852
987361360204734263842872815398612801477881536613626390422209
625909396549340713414968490655440316901425331081589010652180
300150151197735494420118871585234955185159193581513580646557
500017679786645989474576671500005820073569011259760976391567
179554650392157145779842734914700605397676072907256436408962
950121566416408136297311557491304051663196773389353162478919
047116988465795579488347342595563491358489634627650752363976
282775491429515522106741200358683791049381899819533510116703
839463500620206642027638419474879176279795876298887357727958
909991884594824356053336288720394750699040980839743333931662
935262049204153055204749823167237928590042559143491740323632
773415617055293336041290830134491274961878171812636427082765
179554650392157145779842734914700605397676072907356436409862
625909396549340713414968490655440316901425331081589010652180
104802236824130421673757077921995629630189579854752891863553
094291036507119510850236801011521620705648663541643263929334
024888152529676007420536691921150114657348360930933997506907
729059197714342368576957840961939696112997336127652138254092
539169763891245584923236327001330627229520591573920421326418
015362559522527062438183711008564200546363661533428823148235
526368752971048518215240433362463693378785828224210559787637
288340483968086390642566964117020118539397265616801665642751
699940707210281539883327603427927378568908178512596026894904
535860999814346741032420087308073519642326432664322642294305
816473099576393078560612127756988721887617453530607099749636

Words Learned During Number Set D

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________
10. ______________________

Below is a list of adjective pairs that can be used to describe various environments. I would like you to check ( ) the appropriate box that best describes your feelings of the room that you are in. For example, if you were rating the room on the dimension of clean--dirty, and you felt the room was very clean you would check off the box lying closest to the word clean. If you felt the room was very dirty you would check off the box lying closest to the word dirty. If you felt the room was moderately dirty you would check off either the second or third closest box to the word dirty. Similarly, if you felt the room was moderately clean you would check off the second or third closest box to the word clean. Finally, if you felt the room was neither clean or dirty you would check off the middle box. In each case please check only one (1) box for each dimension.

small	___:___:___:___:___:___:___	large
warm	___:___:___:___:___:___:___	cool
cheerful	___:___:___:___:___:___:___	gloomy
dark	___:___:___:___:___:___:___	light
annoying	___:___:___:___:___:___:___	pleasing
friendly	___:___:___:___:___:___:___	hostile
stuffy	___:___:___:___:___:___:___	drafty
adequate	___:___:___:___:___:___:___	inadequate
private	___:___:___:___:___:___:___	public

--GO TO THE NEXT PAGE--

Use the following list in exactly the same way as the first, only describe the <u>other people</u> taking the test with you.

friendly	___:___:___:___:___:___:___	hostile
passive	___:___:___:___:___:___:___	aggressive
cooperative	___:___:___:___:___:___:___	competitive
annoying	___:___:___:___:___:___:___	pleasing
good	___:___:___:___:___:___:___	bad

Use the following list in exactly the same way as the first two, only describe the way <u>you feel</u> right now.

tense	___:___:___:___:___:___:___	relaxed
comfortable	___:___:___:___:___:___:___	uncomfortable
restricted	___:___:___:___:___:___:___	free
cooperative	___:___:___:___:___:___:___	competitive
happy	___:___:___:___:___:___:___	sad
crowded	___:___:___:___:___:___:___	isolated

--GO TO THE NEXT PAGE--

Now use the boxes in exactly the same way as before to answer the following questions.

(1) To what extent did you feel [redacted]ing numbers was difficult?

not at all ___:___:___:___:___:___:___ very much
moderately

(2) To what extent was your performance in [redacted]ing numbers due to <u>luck</u>?

not at all ___:___:___:___:___:___:___ very much
moderately

(3) How much effort did [redacted]ing numbers require?

very much ___:___:___:___:___:___:___ none at all
moderate

(4) To what extent was your performance on [redacted]ing numbers due to skill?

not at all ___:___:___:___:___:___:___ very much
moderately

(5) To what extent was your performance in [redacted]ing numbers due to circumstances beyond your control?

very much ___:___:___:___:___:___:___ not at all
moderately

(6) To what extent did you find [redacted]ing numbers interesting?

very much ___:___:___:___:___:___:___ not at all
moderately

--GO TO THE NEXT PAGE--

(7) To what extent did you feel learning words was difficult?

not at all ___:___:___:___:___:___:___ very much
moderately

(8) To what extent was your performance in learning words due to luck?

not at all ___:___:___:___:___:___:___ Very much
moderately

(9) How much effort did learning words require?

none at all ___:___:___:___:___:___:___ very much
moderate

(10) To what extent was your performance on learning words due to skill?

very much ___:___:___:___:___:___:___ not at all

(11) To what extent was your performance in learning words due to circumstances beyond your control?

very much ___:___:___:___:___:___:___ not at all
moderately

(12) To what extent did you find learning words interesting?

very much ___:___:___:___:___:___:___ not at all
moderately

When you have all finished, have the person seated closest to the door open the door.

Use the boxes below in exactly the same way as you have before to answer the following questions.

(1) To what extent did you feel coding ink color was difficult?

not at all ___:___:___:___:___:___:___ very much

(2) To what extent was your performance in coding ink color due to luck?

not at all ___:___:___:___:___:___:___ very much
moderately

(3) How much effort did coding ink color require?

very much ___:___:___:___:___:___:___ none at all
moderate

(4) To what extent was your performance on coding ink color due to skill?

not at all ___:___:___:___:___:___:___ very much
moderately

(5) To what extent was your performance in coding ink color due to circumstances beyond your control?

very much ___:___:___:___:___:___:___ not at all
moderately

(6) To what extent did you find coding ink color interesting?

very much ___:___:___:___:___:___:___ not at all
moderately

Appendix E

Stroop Color-Word Task Stimuli

Stroop Instructions

For this part of the study you will work on a task called "coding ink color." Each of you should have received two plastic sheets with 240 words of colors typed in different colors of ink. You shoudl also have received an IBM test response sheet. Please copy, in the upper left hand corner (at the top) of both sides of the IBM sheet the code written on the chalk board:

A = Blue
B = Green
C = Red
D = Black

In the upper right hand corner put your name and the subject identification number that I will give you in the spaces provided on the form.

(list of names and subject numbers)

To perform the coding ink color task you are to code the color of the ink that each of the 240 items in the test is typed in on your response sheet. For example, if the word BLACK is typed in green ink you would darken the B response for that item (green ink). If the word RED was written in blue ink you would darken the A response (blue ink). Do not talk or whisper while you are coding ink color as this may distract others. Also, if you make a mistake do not correct it, just continue to the next item. Finally, do not start until I tell you to do so. You will have 10 minutes to complete this task.

Ready,

Begin coding ink color.

1. GREEN
2. [illegible]
3. RED
4. BLUE
5. BLACK
6. GREEN
7. BLUE
8. BLACK
9. RED
10. GREEN
11. BLUE
12. GREEN
13. BLUE
14. RED
15. BLACK
16. RED
17. BLUE
18. GREEN
19. BLACK
20. BLUE
21. BLUE
22. RED
23. BLUE
24. BLACK
25. BLUE
26. BLUE
27. GREEN
28. RED
29. RED
30. BLACK
31. RED
32. BLUE
33. BLACK
34. GREEN
35. GREEN
36. BLACK
37. RED
38. GREEN
39. RED
40. GREEN
41. GREEN
42. BLUE
43. BLUE
44. RED
45. RED
46. BLACK
47. GREEN
48. BLUE
49. GREEN
50. BLACK
51. RED
52. BLUE
53. GREEN
54. GREEN
55. RED
56. BLACK
57. RED
58. GREEN
59. BLACK
60. RED
61. BLACK
62. GREEN
63. GREEN
64. BLUE
65. RED
66. RED
67. BLUE
68. RED
69. RED
70. BLUE
71. RED
72. RED
73. RED
74. BLUE
75. GREEN
76. RED
77. BLACK
78. RED
79. BLACK
80. GREEN
81. BLUE
82. GREEN
83. RED
84. RED
85. RED
86. RED
87. BLACK
88. BLUE
89. GREEN
90. BLACK
91. RED
92. RED
93. BLUE
94. BLUE
95. BLUE
96. GREEN
97. BLACK
98. GREEN
99. BLACK
100. RED
101. BLACK
102. BLUE
103. RED
104. RED
105. BLUE
106. RED
107. BLACK
108. GREEN
109. RED
110. BLUE
111. RED
112. BLACK
113. RED
114. RED
115. GREEN
116. BLACK
117. BLACK
118. BLUE
119. BLACK
120. GREEN
121. RED
122. BLACK
123. RED
124. BLUE
125. BLACK
126. BLUE
127. RED
128. BLACK
129. BLUE
130. GREEN
131. GREEN
132. GREEN
133. BLUE
134. BLACK
135. RED
136. GREEN
137. BLUE
138. BLACK
139. BLUE
140. GREEN

141. BLACK
142. GREEN
143. BLUE
144. GREEN
145. BLUE
146. BLACK
147. BLUE
148. BLACK
149. BLUE
150. GREEN
151. GREEN
152. GREEN
153. RED
154. RED
155. BLUE
156. BLUE
157. RED
158. RED
159. BLACK
160. RED
161. RED
162. BLUE
163. BLUE
164. RED
165. BLACK
166. BLUE
167. GREEN
168. BLUE
169. RED
170. BLACK
171. RED
172. GREEN
173. RED
174. RED
175. GREEN
176. RED
177. BLACK
178. RED
179. GREEN
180. GREEN
181. BLUE
182. BLACK
183. RED
184. RED
185. BLACK
186. RED
187. RED
188. BLUE
189. GREEN
190. GREEN
191. BLUE
192. RED
193. RED
194. BLACK
195. RED
196. BLACK
197. RED
198. BLACK
199. GREEN
200. RED
201. BLUE
202. GREEN
203. GREEN
204. BLUE
205. RED
206. GREEN
207. BLACK
208. BLUE
209. GREEN
210. BLUE
211. BLACK
212. BLUE
213. BLUE
214. RED
215. BLUE
216. BLACK
217. RED
218. BLACK
219. GREEN
220. GREEN
221. GREEN
222. BLUE
223. BLUE
224. BLACK
225. GREEN
226. RED
227. GREEN
228. GREEN
229. RED
230. BLACK
231. BLACK
232. RED
233. BLACK
234. RED
235. GREEN
236. BLACK
237. BLACK
238. BLACK
239. BLACK
240. RED

Appendix F

Analysis of Variance Summary Tables

Multivariate Analysis of Variance for Perception of the Paired-Associates Task

Source of Variance	Degrees of Freedom	Approximate F - Statistic
Density (D)	6, 51	1.27
Screening (S)	6, 51	0.80
Personal Space (P)	6, 51	1.38
DS	6, 51	0.61
DP	6, 51	0.77
SP	6, 51	0.50
DSP	6, 51	1.49

Note: $p > .05$ in all cases

Multivariate Analysis of Variance Summary Table for Subjects' Perception of the Number Scan Task

Source of Variance	Degrees of Freedom	Approximate *F* - Statistic
Density (D)	6, 51	1.17
Screening (S)	6, 51	1.27
Personal Space (P)	6, 51	0.85
DS	6, 51	0.65
DP	6, 51	0.34
SP	6, 51	0.75
DSP	6, 51	0.72

Note: $p > .05$ in all cases

Multivariate Analysis of Variance Summary Table for

Perception of the Physical Environment

Source of Variance	Degrees of Freedom	Approximate *F* - Statistic
Density (D)	9, 48	6.45*
Screening (S)	9, 48	1.30
Personal Space (P)	9, 48	0.73
DS	9, 48	1.03
DP	9, 48	0.91
SP	9, 48	0.76
SDP	9, 48	1.12

*$p < .001$

Multivariate Analysis of Variance Summary Table for

Perception of the Social Environment

Source of Variance	Degrees of Freedom	Approximate *F* - Statistic
Density (D)	5, 52	1.12
Screening (S)	5, 52	1.36
Personal Space (P)	5, 52	0.46
DS	5, 52	1.19
DP	5, 52	1.00
SP	5, 52	0.05
DSP	5, 52	0.66

Note: $p < .05$ in all cases

Multivariate Analysis of Variance Summary

Table for Mood State

Source of Variance	Degrees of Freedom	Approximate *F* - Statistic
Density (D)	6, 51	7.05*
Screening (S)	6, 51	0.54
Personal Space (P)	6, 51	1.99
DS	6, 51	0.55
DP	6, 51	2.44**
SP	6, 51	0.37
DSP	6, 51	1.42

* $p < .001$

** $p < .05$

Multivariate Analysis of Variance Summary Table for Subjects'

Perception of the Stroop Task

Source of Variance	Degrees of Freedom	Approximate *F* - Statistic
Density (D)	6, 51	0.63
Screening (S)	6, 51	0.40
Personal Space (P)	6, 51	0.88
DS	6, 51	0.47
DP	6, 51	1.78
SP	6, 51	0.26
DSP	6, 51	1.22

Note: $p > .05$ in all cases

Analysis of Variance Summary Table for

the Dimension Small-Large

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	F
Total	63	192.90	192.90	7.82**
Density (D)	1	5.06	5.06	1.54
Screening (S)	1	1.00	1,00	3.48
Personal Space (P)	1	2.25	2.25	1.54
DS	1	1,00	1.00	0.39
DP	1	0.25	0.25	2.41
SP	1	1.56	1.56	2.41
DSP	1	1.56	1.56	
Residual	56	36.25	0.65	

** $p < .05$

Analysis of Variance Summary Table for the Physical Environment Dimension Annoying-Pleasing

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F*
Total	63	76.88		
Density (D)	1	9.00	9.00	8.44*
Screening (S)	1	0.63	0.63	0.06
Personal Space (P)	1	0.00	0.00	0.00
DS	1	0.63	0.63	0.06
DP	1	2.25	2.25	2.11
SP	1	3.06	3.06	2.87
DSP	1	1.56	1.56	1.46
Residual	56	59.75	1.07	

*$p < .001$

Analysis of Variance Summary Table for

the Dimension Private-Public

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F*
Total	63	334.31		
Density (D)	1	90.25	90.25	22.22*
Screening (S)	1	3.06	3.06	0.75
Personal Space (P)	1	0.56	0.56	0.14
DS	1	0.63	0.63	0.02
DP	1	5.06	5.06	1.25
SP	1	1.00	1.00	0.25
DSP	1	6.25	6.25	1.54
Residual	56	227.50	4.06	

*$p < .001$

Analysis of Variance Summary Table for the Social Environment Dimension Annoying-Pleasing

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F*
Total	63	102.87		
Density (D)	1	6.25	6.25	4.22**
Screening (S)	1	5.06	5.06	3.42
Personal Space (P)	1	0.56	0.56	0.38
DS	1	4.00	4.00	2.70
DP	1	4.00	4.00	2.70
SP	1	0.00	0.00	0.04
DSP	1	0.00	0.00	0.00
Residual	56	83.00	1.48	

** $p < .05$

Appendix G

Summary Table of Means for Dependent Measures

	HIGH DENSITY				LOW DENSITY			
	Screeners		Non-Screeners		Screeners		Non-Screeners	
	Far	Close	Far	Close	Far	Close	Far	Close
Words 1 M	3.38	4.75	2.88	3.00	4.63	1.75	2.63	3.50
Words 2 M	2.13	1.38	1.75	1.50	1.88	0.75	0.63	1.38
Words 3 M	3.88	4.63	4.00	3.38	4.00	1.75	1.25	2.63
Words 4 M	5.00	5.38	4.38	2.75	4.75	2.63	2.25	3.00
Number 1 M	59.38	76.13	85.63	96.63	63.50	52.50	34.13	43.13
Number 2 M	39.50	55.88	44.88	68.00	42.25	29.00	16.88	30.25
Number 3 M	37.38	50.38	49.25	94.88	55.38	36.50	27.50	28.00
Number 4 M	58.63	84.38	58.50	100.38	60.50	39.88	26.75	48.38
Stroop M	30.63	92.88	69.63	68.00	62.50	59.63	16.13	73.25
				Physical Environment				
small-large	1.25	1.75	1.25	1.75	1.88	2.75	2.00	1.63
warm-cool	1.88	1.88	2.00	1.88	3.25	3.88	3.50	3.00
cheerful-gloomy	4.38	4.38	4.38	4.75	4.88	3.88	5.00	4.25
dark-light	6.13	6.25	5.50	4.75	5.13	5.00	5.25	5.38
annoying-pleasing	2.63	3.00	3.38	2.25	3.38	3.88	3.38	3.63
friendly-hostile	3.00	3.63	3.38	3.75	4.00	3.25	4.00	3.88
stuffy-drafty	1.63	2.00	1.38	1.25	2.63	3.13	2.63	2.50
adequate-inadequate	4.38	4.50	5.13	4.50	5.13	3.25	3.63	2.88
private-public	4.25	4.38	5.50	3.88	1.88	1.88	2.00	2.75
				Social Environment				
friendly-hostile	2.25	2.63	3.13	2.50	2.13	1.63	2.63	2.75
passive-aggressive	2.88	3.13	3.88	3.88	2.75	3.50	2.75	3.50
cooperative-competitive	2.88	2.50	3.38	3.50	2.13	2.75	3.00	2.75
annoying-pleasing	4.63	4.38	4.63	4.25	5.25	6.00	4.25	4.88
good-bad	2.75	2.63	3.25	2.88	2.63	2.38	2.88	2.88
				Mood State				
tense-relaxed	3.38	3.63	3.13	3.00	2.88	5.00	3.38	3.88
comfortable-uncomfortable	5.75	5.63	6.25	4.75	4.63	2.50	4.00	3.88

	HIGH DENSITY				LOW DENSITY			
	Screeners		Non-Screeners		Screeners		Non-Screeners	
	Far	Close	Far	Close	Far	Close	Far	Close
restricted-free	1.75	2.13	2.13	1.38	2.50	3.75	2.13	3.63
cooperative-competitive	3.50	2.63	4.13	3.13	3.38	2.63	2.75	4.00
happy-sad	2.88	3.63	3.50	4.13	3.50	2.63	3.25	3.38
crowded-isolated	1.38	1.63	1.75	2.25	3.25	3.50	3.00	3.13
				Number Scan				
difficulty	2.63	3.50	3.75	3.50	4.13	2.75	4.25	4.13
luck	2.13	2.25	2.38	1.88	2.75	2.25	2.13	2.00
effort	3.88	3.88	3.50	3.00	3.38	3.13	2.75	2.38
skill	4.75	5.00	4.13	4.00	3.13	4.38	4.63	4.00
control	5.63	4.63	4.63	4.00	5.25	5.00	4.63	4.50
interesting	4.50	5.75	6.25	5.63	5.50	5.75	6.13	5.38
				Paired Associates				
difficulty	5.13	4.38	5.25	3.25	5.13	4.50	4.00	4.38
luck	3.00	2.75	3.50	2.25	3.50	2.88	2.50	2.13
effort	5.38	4.88	5.63	4.50	5.38	5.50	5.00	4.38
skill	3.50	2.63	3.75	2.50	3.63	2.75	3.13	4.13
control	4.75	4.00	4.63	5.13	4.63	5.25	5.63	4.75
interesting	3.88	4.00	5.50	4.00	4.00	3.00	3.63	3.75
				Stroop Task				
difficulty	2.50	3.00	3.88	2.00	2.38	2.75	2.63	4.13
luck	1.75	1.50	2.00	1.50	2.63	2.13	2.25	2.13
effort	3.75	3.75	3.75	4.00	3.50	4.25	3.75	3.38
skill	4.00	4.63	4.00	4.88	4.13	5.00	4.25	4.00
control	6.38	5.38	6.00	4.88	5.63	5.50	5.25	5.75
interesting	3.88	4.13	3.50	3.63	3.88	3.75	3.63	3.75

Appendix H

Scaled diagrams of experimental rooms

Diagram of Large Experimental Room

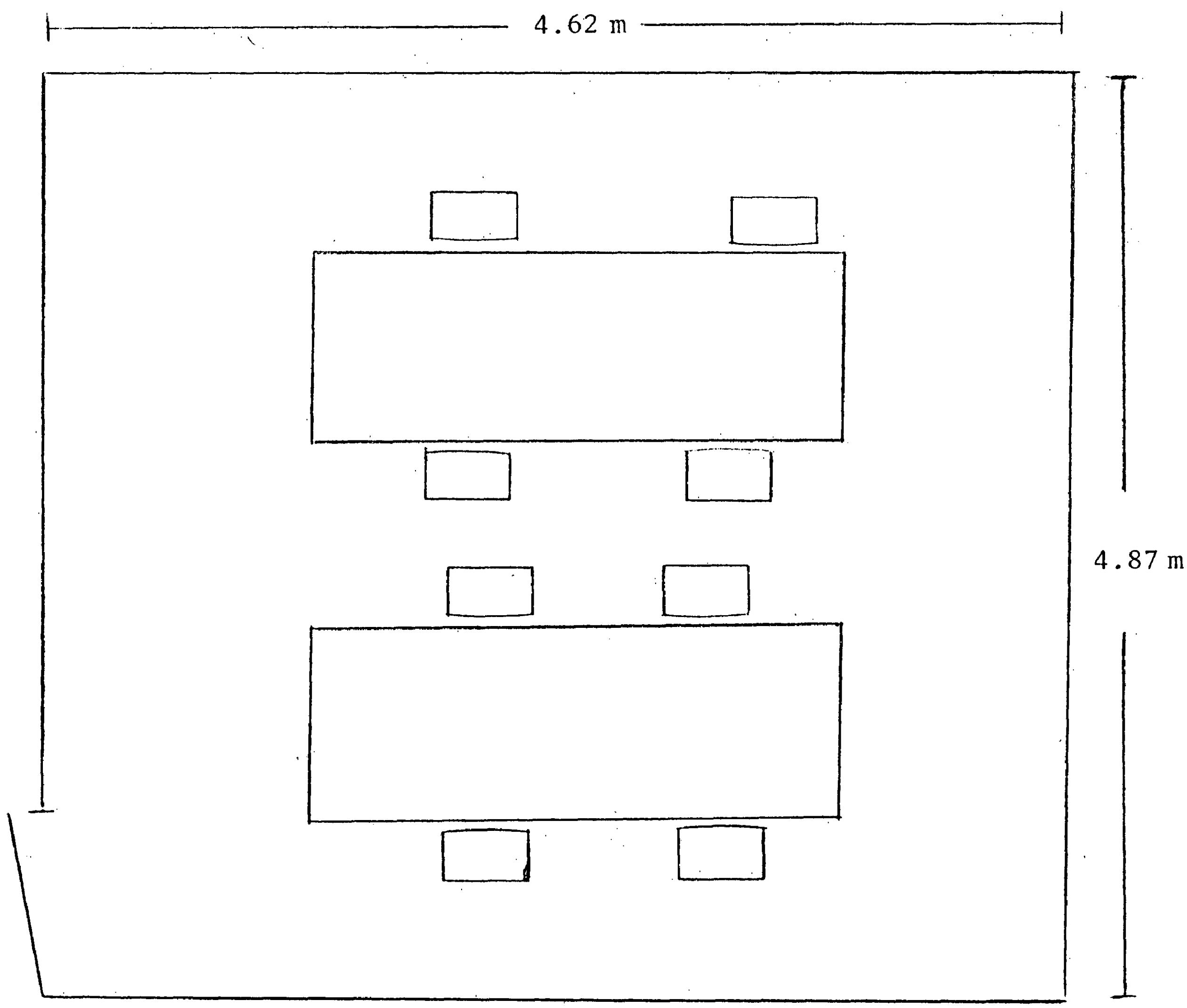


Diagram of Low Density Experimental Room

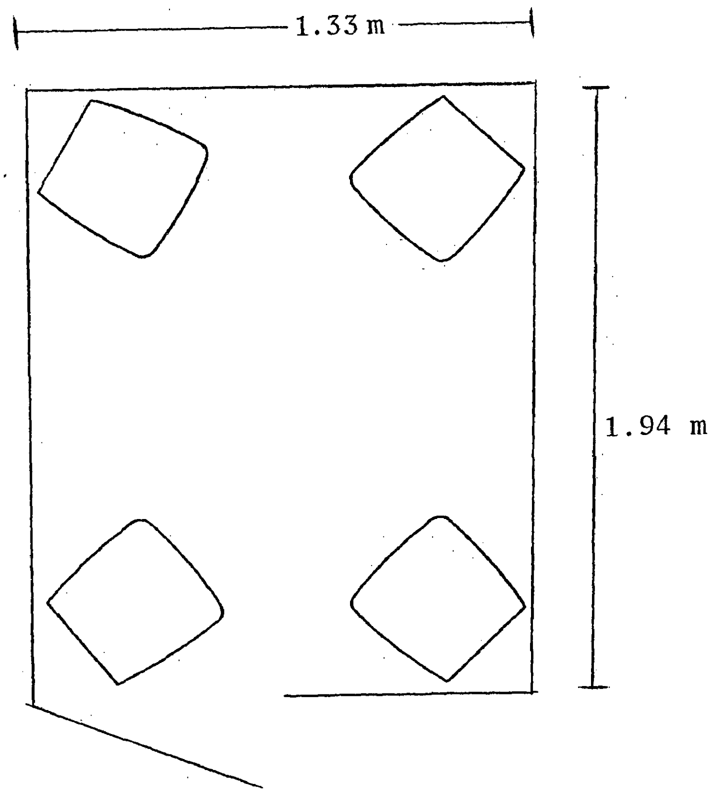


Diagram of High Density Experimental Room