

CULTURE AND DENSITY EXPOSURE EFFECTS

ON THE PERCEPTION OF CROWDING.

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BY

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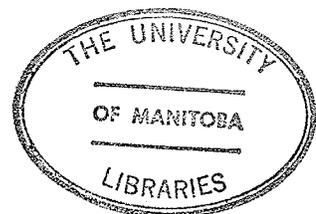
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Abstract

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The absence of obvious social pathologies in crowded human populations has been explained by ethnographers in terms of enculturation effects whereas perceptual researchers cite adaptation as the mechanism which reduces stress in crowded populations. In the present study it was hypothesized that persons who (a) lived in high density residential environments, (b) were of Chinese cultural extraction and (c) experienced public settings would show higher thresholds for the perception of crowding than persons from low density residential environments, North American cultural extraction or who were exposed to private settings. Thirty Chinese and thirty Canadian subjects who lived in either high or low density residential environments were tested for their crowding threshold for a public and a private simulated setting using the Desor method for measuring crowding threshold. A 2 x 2 x 2 ANOVA for repeated measures was performed which crossed two levels of Culture, two levels of Present Residential Density and the two test Settings as the repeated measure. A main effect for Setting supported the hypothesis that thresholds for crowding would be higher for public than for private test settings. No effect was detected for Present Residential Density but a main effect emerged for Culture which supported the hypothesis that Chinese would display higher thresholds for the perception of crowding than Canadians. A subsequent 2 x 2 ANOVA which crossed Culture and Setting while controlling for the Past Residential Density experience of the subjects by means of matching, revealed a significant Culture x Setting interaction but no main effect for Culture. Chinese subjects placed significantly more figures in public settings than did Canadians. This finding was interpreted as evidence that Culture may be confounded with Past Residential Density effects and taken alone is a relatively poor predictor of crowding threshold.

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Culture and Density Exposure Effects

On The Perception of Crowding.

Recent studies of crowding phenomena in human populations stress the distinction between spatial density, defined as persons per unit area, and crowding or social density, which is now conceived as a complex, subjective attribution which often but by no means invariably accompanies exposure to high density settings (See Lit. Review). Both physico-spatial properties of the built environment and/or natural environments and psycho-social variables have been shown to influence the perception of crowding in humans (Baum & Davis, 1976; Baxter & Deanovich, 1970; Bickman, Teger, Gabriele, McLaughlin, Berger & Sunaday, 1973; Burch & Walker, 1978; Desor, 1972; Epstein & Karlin, 1975; Smith & Haythorn, 1972; Stokols, Rall, Pinner & Schopler, 1973; Sundstrom, 1975; Burch, Note 1).

Two issues emerging from this research warrant empirical investigation. First, it has been observed that human responses to high population densities are by no means as stereotypic as those reported for animals (Calhoun, 1962, 1966; Christian, 1956). Indeed, there is marked variation between cultures in the levels of density which are experienced by human populations with a conspicuous absence of those stress related "social pathologies" which were so often predicted for human societies on the basis of laboratory studies of infrahuman species (Anderson, 1972; Draper, 1973; Mitchell, 1971). In fact, both Anderson (1972) and Draper (1973) have reported that in some cultures high density living arrangements are often chosen over readily

available lower density residential settings. Since North American psychologists tend to think of crowding as an aversive and stressful condition under most circumstances, the anomalous fact that many people seek out high density settings for long term occupancy requires explanation. It is of considerable empirical interest whether the perception of crowding is determined partly or totally by a person's cultural milieu. While the ethnological studies cited above supply anecdotal evidence to support the notion that culture has such mediating effects on the perception of crowding, no quantitative empirical studies which compare the perception of crowding in subjects from different cultures have yet been reported.¹

An alternative explanation for the absence of "social pathologies" among many persons living in high density environments has been offered by Wohlwill (1974) in the construct of adaptation. Adaptation is, of course, an ubiquitous psychological phenomenon and Wohlwill argues that it modulates or "filters" the hyperstimulation which characterizes high density settings and which is thought to be a prime determinant of the perception of crowding (Burch & Walker, 1978; Mackintosh, West & Saegert, 1975; Milgram, 1970; Saegert, 1973). According to Wohlwill, adaptation occurs as a result of "a quantitative shift in the distribution of judgmental or affective responses along a stimulus continuum, as a function of continued exposure to a stimulus" (Wohlwill, 1974, pg.134). In other words, persons who have been exposed to high density settings for some time may be expected to display affective and/or judgmental responses (e.g., whether or not a given setting is to be considered

crowded) which differ from those of people who have no such history of exposure. Thus it also becomes tenable to ask to what degree differences in the perception of crowding can be attributed to adaptation processes operating directly on perception as opposed to the determining influences of culturally transmitted and prescribed adaptive strategies.

Thresholds for the perception of crowding can be measured by means of a projective simulation technique devised by Desor (1972). The instrument consists of a scale model room (or several such rooms) and a supply of miniature human figures which subjects are instructed to place in the room(s) until they reach the point where the addition of one more figure would make the room appear crowded. The number of figures so placed in the room(s) is considered to be a quantitative measure of the subject's crowding threshold for the situation assumed to hold for the model room. Desor used this technique to show that such architectural variables as room shape and amount of access, as well as non-architectural factors such as the definition of the situation to be assumed in the room all influence the crowding threshold for a given setting. The same measurement concept was adopted by Baum & Davis (1976) to show that room brightness and complexity of decoration influence the perception of crowding and Burch (Note 1) extended these findings by demonstrating that different room hues also affect the crowding threshold. Cohen, Sladen & Bennett (1975) used a variation of the same procedure to illustrate the impact of acquaintanceship, activity definition and interaction level on per-

ceptions of crowding. In short, the Desor technique is a convenient objective measure of crowding threshold in simulated settings.

The Desor procedure can be used to test hypotheses regarding the adaptation/enculturation issues mentioned above. If an adaptation mechanism operates in the perception of crowding, then differences in residential density conditions to which persons are exposed might be expected to produce differences in their crowding thresholds. Specifically, it was hypothesized that:

(1) Persons currently inhabiting high density residential environments should display higher thresholds for the perception of crowding than persons inhabiting low density residential environments.

(2) If enculturation was an important determinant of crowding threshold, subjects from different cultures should display different crowding thresholds. In the present study, Chinese subjects were expected to display higher thresholds than their Canadian counterparts for reasons reviewed by Anderson (1972).

(3) Finally, it was predicted that higher crowding thresholds would be displayed for public settings (defined as spaces over which the user cannot exert control over who enters the setting) than for private settings (defined as spaces over which the user can exert control over who enters the setting) replicating the setting differences for crowding threshold reported in earlier studies (e.g., Cohen, et al., 1975; Desor, 1972).

Method

Subjects

The few extant studies which have appeared in the literature which report on crowding phenomena in other cultural settings than North America deal with India (Van Groenou, 1977), the !Kung bushmen of Africa (Draper, 1973) and ethnic Chinese of Hong Kong and Singapore (Anderson, 1972; Hassan, 1975; Mitchell, 1971). The most plentiful information thus pertains to the ethnic Chinese who also happened to comprise one of the

the largest minorities from which subjects could be drawn for experimental purposes. Accordingly, Chinese persons were selected for the present investigation to constitute one of the cultural groups to be tested, native born Canadians comprising the contrasting cultural group.

Subjects for this study were recruited from among students taking Introductory Psychology at the University of Manitoba who volunteered for research participation. All subjects received course credit for their cooperation in the study. The investigation was introduced as follows:

"I am recruiting subjects for an experiment on social interaction and urban life. If you would like to participate in this experiment, it is necessary that you complete this brief pre-experimental questionnaire. All responses are strictly confidential. If you do not answer all of the questions on the questionnaire, I'm afraid I cannot consider you as a potential subject for the study. Both males and females are invited to volunteer for the experiment and I am especially interested in recruiting persons from China, Hong Kong, Singapore, Taiwan or other nations with a predominantly Chinese culture.

On the basis of the questionnaire responses, you may be called to participate in a short experimental procedure and complete another questionnaire for which you will receive one hour of experimental credit. If you are not selected for the experiment, your pre-experimental questionnaire will be destroyed.

A pre-experimental questionnaire was then circulated which requested information regarding (a) name, (b) telephone number, (c) sex, (d) age, (e) country of birth, (f) residence history showing all countries the subject had lived in and how long he had resided in each, (g) year level in university, (h) the type of dwelling the subject had lived in longest before coming to university, (i) the subject's current dwelling

type, (j) occupation held longest by father, (k) current occupation of father, (l) annual income expressed in Canadian dollars. (See Appendix B for samples of pre- and post-experimental questionnaires. See Tables 1-8 for descriptive statistics on the subjects selected for the study.)

Insert Tables 1-8 About Here

There were 210 respondents to the questionnaire, 42 of whom were native born Chinese. The remainder were Canadians except for five persons born in the U.S., two from Nigeria, one from Germany and one from Austria. Persons other than native born Canadians were deleted from the study so that only Canadians or Chinese comprised the two cultural groups tested.

Thirty Chinese students were selected half of whom reported their current dwelling type to be a single family detached house, a duplex or a fourplex. These subjects were classified as having a current residential environment of low density. The other half of the Chinese was comprised of subjects who reported that they lived in high rise apartments or student residence buildings (buildings of more than five floors) or low rise apartments or student residences (buildings of less than five floors). These subjects were classified as having a current residential environment of high density. The same thirty subjects were also classified in terms of whether the residential environment they had occupied the longest could be characterized as high density or low density using the same criteria for density as applied to their current residential environments.

Within the dwelling type criterion, Chinese subjects were selected so as to favour those who had lived in Canada or other Western countries the shortest possible time in order to minimize resocialization effects. The Chinese who finally took part in the study consisted of 14 females (Mean Age = 18.6 years) and 16 males (Mean Age = 22.2 years) with a mean length of residence in Canada of 3.1 years. Most subjects (19, 63%) were from Hong Kong while five (16%) were from Malaysia. Two subjects came from Indonesia and one subject each from Mainland China, Thailand, Singapore and Burma.

Ten Canadians were eliminated from the prospective subject pool because their pre-experimental questionnaire responses were incomplete or indecipherable. The remaining 149 subjects were used as a pool from which 30 Canadians were selected and matched to their Chinese counterparts. Matching criteria in order of precedence consisted of (a) current dwelling type, (b) sex, (c) income level, (d) year in university, (e) past occupational status of father, (f) age. Matching on criteria of lower precedence was sacrificed in order to obtain the best possible match on variables of higher precedence. All Chinese subjects were matched perfectly to Canadian controls in terms of current dwelling type and sex. Perfect matching was obtained on income level in 19 cases with seven more cases being matched within one income category of each other, three cases were matched within two categories and one case was four categories discrepant from its control. Year level in university was matched per-

fectly in 26 cases and within one year in three more cases; only one case was discrepant by three years. Perfect correspondence was obtained for past occupation of the subject's father in eight cases while 12 more subjects could be matched within one category of occupational type; ten subjects were discrepant by two categories or more. Finally, perfect matches in terms of age were obtained in seven cases, nine more cases matching within one year, five within two years and the nine cases which remained were three or more years discrepant in age.

Design

The experimental design consisted of a 2 x 2 x 2 factorial ANOVA for mixed effects (Glass & Stanley, 1970). Two levels of Culture (Canadian and Chinese) were crossed with two levels of Present Residential Density (High versus Low) and two different definitions of the Setting to be assumed for the model rooms of the Desor apparatus (Public Setting versus Private Setting) constituted a third, repeated measure factor also having two levels.

Dependent Measures

The dependent measures consisted of the crowding threshold scores for each subject for the two different test settings, crowding threshold being defined as the number of figures a subject was willing to place in the model rooms before they just started to appear crowded. Other dependent measures were taken by means of a post-experimental questionnaire (see Appendix A for a sample of this questionnaire), which requested information regarding (a) number

of persons who shared the subject's past and present dwellings (i.e., measures of In-dwelling Density), (b) the number of rooms in past and present dwellings (i.e., a measure of "Room Density"), (c) availability of private outdoor spaces such as yards or private outdoor spaces for both past and present dwellings, (d) the subject's estimate of whether or not his past dwelling was typical of those in his neighborhood, (e) an open-ended question asking what sort of place the subject imagined the public setting to be and (f) three open-ended questions which measured the subject's awareness of the experimental hypotheses, experimenter expectations and adverse reactions to the experimental procedures.

Apparatus

A model room apparatus was constructed similar to that described by Desor (1972). Two model rooms were built to a scale of 2.5 cm = 46 cm. The rooms were rectangular in shape measuring 22 cm by 28 cm which represented a full scale room size of 3.9 m by 5.0 m. Floors were made of 1.5 cm thick acoustical tile board providing a surface which would easily accept the pin supports of the model human figures. Walls consisted of matt white poster board 13.5 cm in height supported at the corners by polystyrene angle braces. The interior surfaces of the walls were left in their original matt white without paint or further decoration.²

A supply of miniature figures was constructed to the same scale as the rooms. Bodies were made of 8.25 cm sections of wooden dowel with thumb tacks glued to the "foot" end and wooden beads attached to the other end to represent heads. The beads were painted with facial

markings so that a front and back could be discerned for each figure and sections of pipe cleaner were added to represent arms. No other adornment was applied nor were any markings placed on the figures which might indicate their sex.

The realism of the rooms was enhanced by the addition of a minimal amount of furniture constructed to the appropriate scale. Both rooms contained a coffee table 8.5 cm by 2.5 cm by 2.1 cm in height which was constructed of balsa wood and left in its natural wood tones. Also, a sofa was included 11 cm by 3 cm by 2.1 cm in height at seat top. The total floor area occupied by these furnishings was identical for both model rooms.

To minimize the tendency of subjects to compare the number of figures placed in one room with their previous performance, poster board covers were placed over the rooms. Furthermore, the order of room presentation was randomized by a coin toss for each subject so that possible order effects were randomly distributed across conditions.

Procedure

Upon arriving at the experimental room, subjects were tested individually. The two rooms were placed side by side on a table and the subject stood facing the rooms which were covered and presented in random order. Beside the rooms was a box containing a supply of miniature human figures. The experimenter introduced the procedure as follows:

"Imagine that these (pointing to the rooms) are rooms and that these (indicating the figures) are people and that you are one of these people. Read the instructions on the instruction card in front of each room and follow them carefully during the experiment.

"As you know from your own experience, some rooms with many people in them may seem very, very crowded. These same rooms with very few people in them do not seem crowded at all. I want you to put these figures in these rooms until the rooms just start to feel crowded to you. That is, do not put so many figures in the room that it is very crowded and do not leave the room empty. But put figures in the room until the room just starts to feel crowded to you.

After this explanation was delivered, subjects were questioned to determine whether or not they understood the instructions and asked to paraphrase them. This interaction was considered necessary to insure that both Chinese and Canadian subjects had equivalent understanding of the procedure to be followed.

The experimenter then left the room and observed the subject's figure placements from an adjoining observation area. The instruction card which accompanied the Private setting room read as follows:

"Imagine that this is a living room in your home where people are standing and talking. Put as many people as you can in this living room until it just starts to feel crowded to you."

The instructions for the Public setting read similarly:

"Imagine that this is a public lounge area where people are standing and talking. Put as many people as you can in this public lounge area until it just starts to feel crowded to you."

When subjects had completed their figure placements, the experimenter re-entered the experimental room and led the subject to an adjoining room where he completed the post-experimental questionnaire.

While the subject worked on this questionnaire, the experimenter returned to the experimental room and counted the figures which had been placed in each setting. Upon completion of the post-experimental questionnaire, subjects were debriefed and thanked for their participation.

Results

Analysis of Crowding Threshold Scores

The crowding threshold scores from all 60 subjects for both private and public Settings were analyzed in a 2 x 2 x 2 repeated measures ANOVA for mixed effects. The results of this analysis are summarized in Table 9.

Insert Table 9 About Here

A significant main effect for Culture was detected, $F(1,56) = 6.42$, $p = .014$, with Chinese subjects placing significantly more figures in the model rooms (Mean = 16.53) than Canadian subjects (Mean = 12.18). A main effect also emerged for Setting, $F(1,56) = 46.25$, $p = .0001$, with significantly more figures being placed in the room designated as a "public lounge area" (Mean = 16.85) than for the room described as a "living room" (Mean = 11.86). No effect was detected for Present Residential Density and there were no statistically significant interactions.

It was expected that possibly both Present Residential Density and Past Residential Density may exert an influence on crowd-

ing thresholds. In the present study 45 of the 60 subjects reported a Past Residential Density experience of Low Density and 15 reported a High Past Density experience. To investigate the impact of the Past Density variable, a minor analysis was performed in which Past Residential Density was controlled by using only those subjects who reported an experience of Low Past Residential Density (15 Chinese and 30 Canadians). Since Present Residential Density was shown above to have no impact on crowding threshold scores, the minor analysis crossed two levels of Culture (Chinese and Canadian) and two levels of Setting (Public and Private) in a 2 x 2 repeated measures ANOVA for mixed effects while holding Past Residential Density constant across subjects. The results of this analysis are presented in Table 10.³

Insert Table 10 About Here

A significant main effect for Setting was detected, $F(1,43) = 62.47$, $p = .0001$, with more figures being placed in the setting described as a public lounge area than in the setting described as a living room. The main effect for Culture which emerged in the initial analysis disappeared in the present analysis when Past Residential Density was controlled, $F(1,43) = 1.05$, $p = .310$. The disappearance of this effect is consistent with the notion that Culture may be confounded with a Past Residential Density effect. The Culture x Setting interaction also attained statistical significance, $F(1,43) =$

5.28, $p = .026$, with Chinese subjects placing significantly more figures in the setting termed a public lounge area (Mean = 17.06, S.D. = 6.75) than did Canadian subjects (Mean = 14.03, S.D. = 5.51). Performances for the two cultural groups were identical for the setting described as a "living room", with Canadians placing the same number of figures (Mean = 10.33, S. D. = 4.02) as Chinese (Mean = 10.33, S. D. = 4.35) in this setting. This outcome suggests that even when Past Residential Density is controlled, Culture may have a significant impact on crowding threshold when in interaction with other variables though it does not seem to have this potency by itself. The results of this minor analysis must be qualified by the non-orthogonality of cell frequencies which operate in the above analysis to render liberal all tests of main effects and interactions. While the liberality of the test cannot be expected to reduce the Setting main effect to non-significance, similar confidence cannot be placed in the interaction.

Analysis of Post-hoc Measures

Seven post hoc measures were taken which were deemed of interest insofar as they might further illuminate those factors which are related to performance on measures of crowding threshold. While a number of different analytical approaches could be entertained, a correlational procedure seemed most to commend itself in light of the post-hoc nature of the measurement procedures. The seven variables being examined were (a) present in-dwelling density, (b) past in-dwelling density, (c) present room density, (d) past room density,

(e) present private space (the availability of private outdoor spaces near the dwelling the subject presently occupied), (f) past private space (the availability of private outdoor spaces near the dwelling the subject had occupied the longest), (g) the typicality of the dwelling unit which the subject had occupied the longest with respect to the dwellings which surrounded it. Added to these seven post-hoc measures were (h) the subject's cultural classification, (i) his score on the private setting crowding threshold measure and (j) his score on the public setting crowding threshold measure.

Variables a, b, c, d, i and j were continuous variables whereas e, f, g and h were discrete dichotomous variables. Pearson Product Moment Correlation Coefficients were calculated when two continuous variables were being examined, Point Biserial Coefficients were ascertained for the association of a continuous and a dichotomous variable and Phi Coefficients of Association were obtained for the relation between two dichotomous variables. All non-redundant correlation coefficients together with their associated p values are presented in Table 11. Only coefficients which attained statistical significance will be discussed below.⁴

Insert Table 11 About Here

Present in-dwelling density. Present in-dwelling density (the number of persons sharing the subject's present dwelling unit) was positively related to present room density (the number of rooms in the subject's present dwelling unit) $r = +.588$, $p = .0001$. Subjects

who tended to report living in dwellings with many other people in their dwelling unit also reported having more rooms per unit. This finding may be an artifact of dealing with a student population since students living in residence would probably be occupying a single room with one other person whereas students living off campus, e.g., with families or in private apartments, may occupy a dwelling together with other family members or multiple roommates.

Present in-dwelling density was negatively related to the availability of private outdoor spaces to the subject's present dwelling unit, $r_{pbi} = -.489$, $p \approx .0001$. Subjects who reported high in-dwelling densities also tended to report having access to private outdoor spaces exclusively for their own use. Once more, persons living off campus in family dwellings might reasonably be expected to have yards or gardens whereas persons in student residence would not.

Present room density. Present room density (the number of rooms in the subjects' present dwelling unit) showed significant relationships to past room density ($r = +.561$, $p = .0001$), availability of private outdoor space to the subject's present dwelling unit ($r_{pbi} = -.691$, $p \approx .0001$), availability of private outdoor space to the dwelling unit occupied longest ($r_{pbi} = -.335$, $p \approx .009$), cultural classification of the subject ($r_{pbi} = -.333$, $p \approx .009$) and the subject's crowding threshold score ($r = -.302$, $p = .019$). The positive relation between measures of room density in both past and

present dwelling units suggests a continuity in the type of dwelling subjects select for occupancy. Those having lived longest in dwellings with many rooms tended to continue to do so as was also true of persons who lived in dwellings having fewer rooms.

The negative correlation between present room density and the availability of private outdoor spaces to the present dwelling unit reflects the tendency of dwellings having many rooms also to have access to private outdoor spaces. A similar negative relationship between present room density and the availability of private outdoor spaces to the dwelling unit occupied the longest again points to a certain similarity in residential environments over time. The absence of change in this regard is to be expected since the acquisition of private outdoor spaces requires economic resources beyond those commonly found in student populations.

Inverse relationships also emerged between present room density and the subject's cultural classification. Chinese subjects tended to report having fewer rooms in their present dwelling unit than their Canadian controls. Also, subjects who reported lower present room densities tended to place significantly more figures in public settings than subjects who reported having more rooms in their present dwelling units, although it has been suggested above that this apparent culture effect is probably confounded with adaptation effects attributable to past residential density.

Past room density. Past room density (the number of rooms in the dwelling unit the subject occupied longest) was inversely related

to the availability of private outdoor spaces to the subject's present dwelling unit ($r = -.264$, $p = .041$), the availability of private outdoor spaces to the dwelling unit the subject had occupied the longest ($r_{pbi} = -.589$, $p \approx .0001$), the subject's cultural classification ($r_{pbi} = -.662$, $p \approx .0001$), the subject's private setting score ($r_{pbi} = -.275$, $p \approx .033$) and his public setting score ($r_{pbi} = -.407$, $p \approx .0001$).

Subjects who reported having a relatively large number of rooms in the dwelling they occupied longest tended also to report the availability of private outdoor space to their past dwelling as well as their present dwelling. These subjects were most likely to be of Canadian cultural extraction and their crowding threshold scores for both public and private settings were lower than for other subjects. This pattern of findings is fully consistent with the effects of past residential density already observed on crowding thresholds.

Present private space. The availability of a private outdoor space to a subject's present dwelling unit was significantly related to the availability of a private outdoor space to the dwelling a subject had occupied the longest ($\phi = .360$, $p < .01$). Once more, this correlation probably reflects a similarity between past and present residential environments.

Past private space. The availability of a private outdoor space to the dwelling a subject had lived in longest was significantly related to both cultural classification ($\phi = .734$, $p < .001$) and the scores for the public setting crowding threshold ($r_{pbi} = .287$, $p \approx .026$). Canadians were more likely than Chinese to report the availability

of a private outdoor space to the dwelling unit they had occupied longest and the availability of such a space in the past was related to lower scores on the crowding threshold measure for the public setting.

Typicality. The subject's self-rating of how typical the dwelling unit he occupied longest was of those in the immediate neighborhood was directly related to both the crowding threshold scores for the public setting ($r_{\text{pbi}} = +.374$, $p \approx .003$) and for the private setting ($r_{\text{pbi}} = +.303$, $p \approx .019$). Dwellings rated by their occupants as typical of those in the immediate neighborhood tended to be associated with lower crowding threshold scores. The conceptual link between these two variables, however, is not intuitively obvious.

Culture. The cultural classification of the subject was significantly related to crowding threshold scores for public settings ($r_{\text{pbi}} = +.385$, $p \approx .002$), a finding already attributed above to an interaction of Culture and Setting factors the former of which is probably confounded with the effects of past residential density. Already discussed above are the significant relationships between culture, past room density and present room density.

Private setting scores. Scores on the crowding threshold measure for the private setting were directly related to scores for the public setting ($r = +.714$, $p = .0001$) suggesting that persons having a relatively high threshold in one setting would manifest a similarly high threshold in other settings.

Responses to open-ended items. Responses to the open-ended items of the post-experimental questionnaire are summarized in Appendix B. Answers to question four ("When you were putting figures into the 'public lounge area', what sort of place did you imagine the 'public lounge area' to be?"), were highly variable and showed no recognizable pattern. Replies ranged from statements which were as vague as "a lounge", "a place full of people doing various things" to images which must have carried a high degree of sharpness for the subject, e.g., "City Hall of Hong Kong", "West lounge of Tache Hall during a party". There was no clear cut tendency one way or the other to visualize a specific, vivid and real setting versus maintaining a vague "set" for some nondescript "public place".

Question five attempted to probe the awareness of the subject regarding what might be the general experimental hypotheses under test ("What do you think was the goal of this research?"). Naturally, replies to such questions show varying degrees of creativity. Five subjects made statements which revealed a significant understanding of one or more of the research objectives and the influence of subject expectancy effects upon their performances cannot be ruled out. The remaining 55 subjects gave responses which revealed no substantial understanding of the hypotheses beyond what would be accessible to them in the information which had already been supplied by the experimenter during the recruitment process and in the experimental instructions themselves.

Question six ("How do you think the experimenter expected you to behave in this experiment?") probed the subjects' perceptions of the experimenter's expectations for their behavior. A common response was the belief on the part of the subjects that the experimenter expected them to be "honest", "natural", or "to express my true feelings". Other subjects used this item to elaborate on their guesses concerning the experimental hypotheses, i.e., what the experimenter was trying to discover phrased in terms of an expectation. No consistent pattern of perceived expectations emerged from the comments which might have skewed the experimental results. Two Chinese subjects said they thought the experimenter expected them to place more figures in the public lounge than in the private setting, but two other Chinese subjects reported perceiving the reverse expectation. Seven Canadians thought more figures should be placed in the lounge whereas one Canadian thought more figures belonged in the private setting. It is doubtful, however, that these perceptions exerted much influence on the results because of the small numbers involved and the inconsistent pattern of perceived expectations.

Question seven ("Was there anything in the experimental procedures which made you feel embarrassed, upset or anxious?") was included as a safeguard to detect any subject who, by some remote chance, experienced aversive or negative feelings during the experiment. This was considered ethically necessary to intercept these subjects for immediate debriefing. Fifty-one of the sixty subjects used in the study reported

no discomfort at all which was to be expected from such an innocuous procedure. The remaining nine subjects reported mild uneasiness which they attributed to the novelty of participation in an experiment or (in three cases) to their awareness of being observed through an observation window.

An overall impression which can be gleaned from the open-ended responses is the interesting fact that with only one exception, when subjects referred to the figures or the model rooms in their written responses, they are invariably referred to as "people" and "rooms". This tendency hints at the possibility that the simulation technique was realistic enough to elicit sufficient empathy and imaginative participation to mask the perception of the figures as "little wooden sticks" and render them instead as "people" in references used in unguarded conversation.

Discussion

. Hypothesis 1: The effect of present residential density on crowding threshold.

The first hypothesis which was tested in this study was the assertion that persons experiencing relatively high levels of residential density would display higher thresholds for the perception of crowding than persons experiencing relatively low levels of density in their present residential environments. The results of the major analysis which crossed Culture with Present Residential Density and Setting did not

provide support for this assertion. The absence of a significant main effect for Present Residential Density ($F(1,56) = 1.43, p = .237$) points to the conclusion that this factor plays a relatively little part in determining crowding thresholds.

Hypothesis 2: The effect of enculturation on crowding threshold.

The second hypothesis consisted of the expectation that if enculturation played a major role in determining crowding thresholds, differences would be expected in the measured crowding thresholds for subjects with the same exposure experience to residential density but who came from different cultural backgrounds. The results of the major analysis which crossed Culture with Present Residential Density and Setting seemed to provide support for this hypothesis with the appearance of a main effect for Culture ($F(1,56) = 6.42, p = .014$). This apparent effect of Culture is, however, ephemeral. When Past Residential Density was controlled by means of matching subjects on this variable in the minor analysis which crossed Culture with Setting, the main effect for Culture disappeared ($F(1,43) = 1.05, p = .310$). In this subsequent analysis, Culture is a significant determinant of crowding threshold scores only when it interacts with another variable, in this case Setting.

This pattern of results suggests that enculturation per se is a variable of questionable significance when its effects upon crowding threshold are considered in isolation from other influences. Indeed, since the effect of controlling Past Residential Density

was the disappearance of the main effect for Culture, it is tempting to conclude that Culture and Past Residential Density are confounded. Variables which are confounded should also be highly correlated and the Point-Biserial Correlation between Culture and Past Residential Density was determined to be $r_{bpi} = +.577$, $p \approx .0001$. In light of these findings, differences which have been attributed to cultural factors by ethnographers must now be reconsidered as possible instances wherein cultural differences have been confounded with differences due to adaptation effects. In fact, the field studies of Anderson (1972) and Mitchell (1972) which examined Chinese populations were conducted in urban settings which, not unexpectedly, confound culture with environmental adaptation effects. When these factors are measured separately and their respective influences are independently assessed, Culture appears to be largely irrelevant as an explanatory construct for crowding threshold differences.

Unfortunately, any conclusions which might be drawn regarding the effects of Past Residential Density on crowding thresholds can only be speculative. When this factor is controlled by means of matching, the main effect for Culture drops out. This provides indirect support for the notion that Past Residential Density may be a significant determinate of crowding thresholds. Additional indirect evidence of the importance of historical influences in shaping crowding threshold level can be found in the fact that three instances of significant correlation between historical factors and

crowding threshold scores were observed in the post-hoc analysis whereas only one significant correlation emerged between crowding threshold scores and variables which characterized the contemporary residential environment of the subjects. While these results do not provide conclusive evidence of a Past Residential Density effect on crowding threshold, they are fully consistent with what would be expected if an adaptation mechanism were operative in the perception of crowding as is the case in many other domains of perceptual and social behavior.

Hypothesis 3: The effect of setting differences on crowding threshold.

Finally, it was hypothesized that situational differences in crowding thresholds would be observed across cultures and adaptation histories. This hypothesis found substantial support in the results of a significant main effect for Setting. Both Chinese and Canadian subjects, regardless of their past or present residential environments, discriminate public versus private settings as being crowded with different absolute numbers of people present. Both Chinese and Canadian subjects tended to place more figures in the public setting than in the private one.

The potent effect of situational differences in determining crowding thresholds has been demonstrated in the past by other researchers in a manner consistent with the present findings (Desor, 1972; Cohen et al., 1975). Cohen et al. determined that 69% of the variance in figure placements could be attributed to the

joint influence of acquaintanceship, activity definition and level of interaction to be assumed for the settings being tested, i.e., to various factors which define the setting in question. Thus, the effect attributable to differences in Setting found in the present study are in accord with existing findings.

Conclusions from the post-hoc analysis.

The analysis of the post-hoc measures can probably be most constructively summarized in terms of an adaptation interpretation of crowding perception. Statistically significant correlations emerged which show (a) that as past room density increases, the crowding threshold for both public and private settings tends to decrease; (b) that for subjects who reported having access to private outdoor spaces in the past, crowding thresholds were lower (as well as a near significant correlation in the same direction for private setting threshold, $r_{pbi} = +.223$, $p \approx .087$); (c) for subjects who reported that their dwellings were typical of those in the immediate neighborhood, thresholds were lower for both public and private settings and (d) another near significant correlation ($r = +.227$, $p = .081$) suggesting that low past in-dwelling density was directly related to a low threshold for private settings. Taken together these correlations depict a population which has a history of relatively many rooms per dwelling, access to private outdoor spaces, whose dwellings tended to be located in homogenous neighborhoods of dwellings of which the dwelling of the subject was a typical

instance, and who lived with relatively few other persons per dwelling unit. Subjects drawn from this population displayed a relatively lower threshold for crowding in both public and private settings than their counterparts who reported a converse history. The historicity of these findings is logically concordant with an adaptation theory of the formation of crowding threshold since the duration of exposure to a stimulus is always a critical dimension in adaptation effects. It is therefore reasonable to suppose that those stimulus conditions to which a person had been exposed longest should have the greatest influence in shaping perceptual responses. The pattern of results obtained in this study are largely in accord with such a view.

This interpretation of the results is further strengthened by the observation that only one variable which characterized the subjects' present residential environments was significantly related to crowding threshold scores, namely, present room density. The lower the present room density (i.e., the fewer the number of rooms in the subject's present dwelling unit) the higher his crowding threshold for public settings ($r = -.302$, $p = .019$) and also, the higher his threshold for private settings, although this relationship did not attain statistical significance ($r = -.227$, $p = .081$). While this bit of evidence is inconsistent with the assertion that past environmental conditions are prepotent over present conditions, it is nevertheless fully consistent with a model of crowding perception wherein adaptation to environmental conditions (past as well as present) is a significant determinant of crowding

threshold.

General conclusions.

Clearly, there is much potential for future research in the directions already demarcated by the present investigation. The findings reported above are not as conclusive as one might wish, especially in the absence of Canadian subjects with past histories of high residential density. In view of this fact, a replication of the present research is indicated, possibly using different populations (e.g., Oriental and European) which would insure ample subjects to fill all cells.

Even though the results are suggestive rather than conclusive, some of the implications are interesting. Culture is frequently referred to, without proof, as a major formative influence in many classes of behavior. Yet, at least one instance seems to have been found where culture may be confounded with another factor, namely, adaptation, which accounts for more variance. The question may now be put, in how many other instances is behavior attributed to cultural determinants when in fact it is shaped by wholly other forces?

If adaptation eventually proves to be as significant an influence as the present investigation suggests, other research problems require attention. For example, what is the time course of the formation of this adaptation response? Is there a critical period, say in childhood, when adaptation to crowding is most likely to form? Or is adaptation to density like any other adaptation

process, forming at about the same rate throughout life? What factors potentiate adaptation to density? Can persons be found who sensitize rather than adapt to density and what will be the consequences to such persons in the heavily urbanized civilization of the future?

Alternatively, it may be that adaptation to density is simply irrelevant to its behavioral consequences as is suggested by the work of Glass & Singer (1972). Perhaps high population density is just one more stressful environmental factor to which measurable adaptation of perception and response can be demonstrated but which produces its affective and behavioral aftereffects regardless of the adaptation which has occurred.

Finally, if the perception of crowding can be shown to exhibit true adaptation effects, can similar parallels to other perceptual processes also be demonstrated? For instance, is there a power function between social or spatial density measures and perceived crowding? Can contrast effects be shown wherein ratings of the crowdedness of various settings can be related to immediately prior conditions and/or perceptions of the surrounding environment? What relationships exist between these perceptual phenomena as observed at the room level for simulated settings and full scale, real settings and "macro" urban environments?

While all of these questions are fascinating and will undoubtedly receive research attention at some time, the findings of the present study must be kept in context. In spite of the difficulties which attend cross cultural research, the findings do suggest that

situational (Setting) factors and adaptation effects influence the Desor measure of crowding threshold. Qualified by the validity of the Desor procedure, these results are suggestive only of issues which require further attention. Nevertheless, they do point to the problems which must be addressed.

A Review of Research on the Perception of CrowdingHistorical Background and Definitions

It has been a perennial observation among those who comment on human affairs that special things happen to people when they aggregate in large numbers. Plato provides the first record of philosophical speculation regarding the effects of crowding on human affairs, though it can hardly be maintained that he was the first person ever to consider the matter. In any case, for Plato, the crowd and the mob were synonymous ideas. He distrusted large congregations of people believing that in their collective enthusiasms individual rationality and moral integrity were sacrificed to the blind, amoral irrationality of the herd. It is not difficult, then, to sympathize with Plato's distrust of democracy which he viewed as only a minute improvement on anarchy.

In the centuries which followed the Greek philosophers, speculation concerning crowd psychology was usually handled as a parenthetical aside to systems of political philosophy, Plato's distrust of the mob being frequently re-echoed but little elaborated by subsequent authors.

Le Bon (1895) was the first person to attempt to construct an explanatory model of crowd behavior. Accepting without question the hoary assumption that crowding releases essentially destructive tendencies in human behavior, Le Bon tried to explain this in terms of an hysterical splitting of personality which rendered individuals

especially susceptible to suggestion. Having relinquished reason to the collective will, Le Bon argued that crowds were inherently incapable of critical thought being inclined instead toward unreflective action motivated especially by vivid, image-like ideas. Thus, crowding had the effect of dissociating the individual personality and rendering it vulnerable to suggestion by the demagogue.

Positions similar to Le Bon's were developed by his contemporaries (e.g., Sighele, 1895; Sidis, 1898) as well as subsequent authors who adopted his biases (e.g., Ross, 1908; Martin, 1920). The later writers, however, had absorbed a somewhat more analytic perspective on crowd phenomena. The source of the violent and antisocial impulses which were viewed as the dominant motivating factors in crowd behavior could be readily identified with the repressed contents of a bestial unconscious. The dissociation fostered by the crowd, while then rendering a person more suggestible, tended also to facilitate his identification with the demagogue and provide a social context wherein people could safely "go crazy together". But it was Freud (1921) who most stressed the dual role of suggestion and identification to account for the non-rational behavior of crowds.

This short and admittedly sketchy introduction to the history of "crowd psychology" has been undertaken to elucidate the context in which much modern research on crowding has appeared. There is a traditional bias in Western intellectual tradition which views crowding as an essentially dangerous, negative and aversive condition for humans to experience. Whether this bias has grown up from a lengthy

history of observing the cruel realities of political life or whether it is merely a hold-over from the elitist snobbery of intellectuals for the "masses" still remains open to question. It may be that such a bias has developed primarily from individual philosophical speculations rather than empirical observation. Nevertheless, it has come to be one of the fundamental operating assumptions which guides both the selection of research problems and interpretation of results even among contemporary investigators. Freedman (1975) has rightly observed that the assertion that crowding always and invariably has negative effects on people is a bias, not a fact, and as such is a matter open to empirical inquiry. Yet, while several authors had acknowledged the validity of Freedman's argument, most major theories of the psychology and perception of crowding formulate these phenomena in terms of stress and other constructs of pathogenesis. While the effects of crowding on humans may indeed be negative and the intellectual tradition may be reflecting something about human behavior which is true rather than simply traditional, it is still useful to be sensitive to the intellectual climate which has given rise to modern crowding research.

The decade of the 1950s witnessed three developments which were to be of major significance to research on crowding in the decades which followed. First, Hans Selye (1956) formulated his theory of the relation between stress and physiological pathology. This theory was soon adopted and generalized to social and psychological pathologies by writers in the social sciences as well.

Second, there was an increase in all sorts of scientific activity during and after World War II, some of this in field ecology. Whole populations of wild animals were being studied in their natural settings and statistical methods were being applied to the analysis of population dynamics in naturally occurring animal groups. Christian (1956) was the first to review a long standing but sparse literature on the phenomenon of "population crashes" wherein large range populations of a given species would increase steadily over time followed by a sudden and catastrophic "die-off". When this pattern of population growth and decline could not be explained by factors of nutrition, predation or epidemic, Christian suggested that it could be explained in terms of stress reactions. His subsequent laboratory studies provided convincing support for this hypothesis since freely growing laboratory colonies of mice showed all the physiological indications of death from stress-related syndromes when the population crash phenomenon was studied under controlled conditions. These findings also agreed with histological studies of specimens collected from field populations of animals which were in the catastrophic die-off phase of their demographic cycles.

Finally, also in the decade of 1950s, the world became aware of two factors which were increasing the densities of human settlements dramatically. Improved medical care had reduced infant mortality to the point where high rates of absolute population growth were being recorded. More important, however, was the great in-

flux of rural populations to urban areas in the industrialized countries (a migration which is presently also occurring in lesser developed nations). The combination of these two factors promised large urban populations living in high densities for the near future and it became common to believe that the results of Christian's work would have implications for human populations as well.

These fears gave rise to a number of studies which attempted to relate all sorts of social and psychological pathologies to high levels of population density (Baldassare, 1975; Booth & Cowell, 1976; Booth & Edwards, 1976; Booth & Johnson, 1975; Calhoun, 1962; Cappon, 1971; Cassel, 1972; Galle, Grove & McPherson, 1972; Harburg, Erfurt, Hauenstein, Chape, Schull & Schork, 1973; Harburg, Schull, Erfurt & Schork, 1970; Marsella, Escudero & Gordon, 1970; McCarthy, Galle, Omer & Zimmern, 1975; Mitchell, 1971; Moore, 1976; Webb & Collette, 1975; and numerous others). Some of this research was rather poorly controlled and much was inconclusive. The etiologies of almost all social ills tend to be multidimensional and the attribution of pathology to single factors such as crowding is a dubious endeavor. In addition, studies of social pathologies and density are necessarily post hoc correlational efforts which leave the reader little wiser regarding relationships of causation and consequences.

A major positive outcome from the above research had been an enhanced appreciation for the complexity of high density phenomena for human populations. The failure of correlational studies to show

any conclusive relationship between high population densities and pathology for human communities led to the recognition that high density and crowding were not invariably synonymous. When research on crowding shifted from the study of animal populations to human groups, theoretical formulations and research endeavors of the late 1960s and early 1970s began to articulate a distinction between density, measured as the number of people (organisms) per unit area, and crowding, which especially for humans, was an entirely different phenomenon. Furthermore, the psychological research on social facilitation (Zajonc, 1965) clearly indicated that density itself had to be distinguished operationally from group size. The often quoted early studies of Christian (1956) and Calhoun (1962, 1966) can be seen in retrospect to yield uninterpretable results since both studies completely confound density with group size. This particular distinction was a recurrent methodological flaw in early studies of the effects of crowding on humans (Loo, 1973) and continues to appear from time to time in field studies of crowding.

Stokols, Rall, Pinner & Schopler (1973) attributed the conflicting views of researchers regarding the effects of crowding to imprecise definition. The authors argued that density is an essentially objective measure of the number of organisms in a bounded area whereas crowding is a subjective syndrome of stress resulting from a disparity between one's supply of space and one's demand for space. Stokols et al. further argued that both environmental

and personal attributes determine one's need for space. The Stokols et al. paper served to sharpen the distinction between density as a physical state and crowding as a psychological event. It can also be seen that crowding is viewed in situational rather than absolute terms. Depending upon one's "demand for space", one and the same population density may be perceived as crowded or not.

In another paper, Stokols (1973) also distinguished between crowding at the "micro" level involving individuals and/or small groups in highly limited territories interacting for brief periods and "macro" level crowding wherein large numbers of people are exposed to experiences of crowding over long periods. Most research, Stokols notes, concerns micro level crowding phenomena although the principles discovered at this level may not apply directly to macro level phenomena. Unfortunately, this distinction has received relatively little attention in subsequent literature, perhaps because Stokols himself is rather vague on exactly what methods can be used to measure the impact of long term crowding on large populations. This criticism is especially pointed when it is recalled how singularly difficult the demographic studies of urban pathologies turned out to be and how equivocal their results.

Rapoport (1975) advanced the theoretical articulation of crowding studies by asserting that density defined as population per unit area was of no psychological interest at all. He distinguished density per se from what he termed "affective density" or the experience of feeling crowded. Changes in affective density were attributed

to perceptual processes rather than some automatic or stereotypic response to the mere presence of others. For Rapoport, density alone could not be a good predictor of human behavior because the perception of crowding was mediated by such factors as (a) differences in response due to situational variables, (b) previous adaptation and (c) social organization factors such as the clarity and stability of social dominance hierarchies which might dictate the use of space. Affective density (the experience of crowding) rested upon the affective appraisal of a perceived population density as unfavourable, aversive or uncontrollable. The perception of affective density was thus viewed as a judgement based upon the assessment of certain environmental cues. The critical dimension of perceptual function along which isolation, density and crowding could be distinguished was the rate of information processing, a notion already suggested some years before by Milgram (1970). Thus, high affective density was likely to be perceived in environments which were complex, novel, heterogenous and high in demand qualities (e.g., setting demanding social interaction) when this was perceived together with the evaluation that the setting was unwanted, uncontrollable, threatening or inescapable.

Rapoport's work served to frame the psychology of crowding as essentially a problem in perception and attribution. The task for psychology was then considered to consist of the elucidation of exactly which factors were most salient as "cues" to the perception

of crowding and factors such as "thresholds", adaptation and contrast effects which might account for individual differences in perceptions of crowding and responses to it. It is also useful to note that Rapoport proposes a kind of double component theory of crowding which involves first a perceptual-cognitive judgment that one is experiencing a high rate of information processing followed by a negative affective response to this judgment. It is, then, theoretically possible for a person to perceive high population densities without thereby experiencing a subjective state of crowding. This particular model has received more elaboration in the work of Choi, Mirjafari & Weaver (1976) though their contributions do not involve significant substantive departures from Rapoport's position.

A number of empirical studies to be discussed below have indirectly refuted the details of Rapoport's model by showing that humans respond to two distinct species of perceived density and that these responses are often behaviorally distinct. Baum & Koman (1976) provide a lucid explanation of the distinction between perceived spatial density and perceived social density, the combination of which often determine the perception of crowding. Spatial density is often perceived as spatial inadequacy, crampedness, behavioral restraint and/or encroachment upon one's personal space by undesired others. Perceptions of spatial density can be modulated by characteristics of the physical setting which alter perceptions of available space (e.g., room colour, room brightness, openness). Responses to increased spatial densities include increased arousal,

stress and adoption of behaviors suited to goal attainment in small spaces. In males, increased spatial density has been associated with heightened feelings of aggression while for females, the usual affective response is toward more positive evaluations of others and the physical surroundings together with increased affiliative behavior.

Social density is characterized by frequent social interaction with large numbers of other people. While the sexes perceive both spatial and social density similarly, their affective and behavioral responses to them vary. The usual way of manipulating social density is to alter group size or vary the rate of interaction whereas spatial density can be changed by manipulating room (space) size.

The distinction between social and spatial density is central to most recent research on the perception of crowding. The issue has been developed here in some detail because it bears directly on assessment of the meaningfulness of research findings. It is not uncommon for an investigator to confound social and spatial density either at the level of experimental manipulation, measurement or interpretation. It is also common to encounter studies which use one species of density as an independent variable while addressing the other as a dependent variable. When spatial density is manipulated and then a measure is taken which actually taps dimensions of social density the interpretation of results becomes less obvious than one might assume.

An additional consideration involves the fact that while more recent research is careful to manipulate spatial and social density separately, the two factors are almost always completely confounded

in natural settings. It is a rare room which can grow as additional people enter (although there do exist movable partitions which do not make this idea wholly fantastic) thus holding spatial density constant while increasing group size. It is also often the case that even with groups of constant size (theoretically constant social density) increases in spatial density may affect some measures of social interaction, thus indicating a kind of "spill-over" effect from spatial density manipulations to social interaction behaviors. In this sense, spatial and social density manipulations are only partially separable.

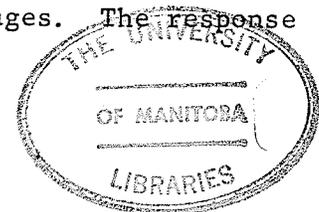
Despite these impediments to ecological validity, the contributions discussed above have increased the precision with which studies of human crowding phenomena are now executed. They have also sharpened the development of research hypotheses by increasing awareness of the complexity of human perceptions of crowding. Together with these theoretical and methodological formulations, the increased interest in crowding effects on humans has initiated a considerable growth in research activity on the perception of crowding per se and it now receives treatment as a "legitimate" subject of psychological inquiry apart from the earlier studies of animals and the sociological studies of epidemiology.

The Perception of Spatial Density and Spatial Extent

One approach to the study of the perception of crowding has started from the common sense observation that crowding is often felt in situations where too many people occupy too little space.

Some studies have concentrated on determining which variables mediate the perception of spatial extent, i.e., the perceived capacity of space to accommodate people whereas other studies have concentrated on the physico-spatial variables which mediate social interaction itself.

The main theoretical conception which underpins many of the studies of spatial extent was proposed by Milgram (1970) in the construct of information overload. Milgram was seeking a theoretical notion which would account for the psychological and experiential difference between the ambience of cities and the ambience of rural areas and small towns. Furthermore, rather startling behavioral differences had been observed between urban dwellers and rural residents the most dramatic example of which was by-stander apathy. Milgram speculated that many of the worst features of urban life, its anonymity, impersonality, the dominance of institutional and bureaucratic forms of encounter, by-stander apathy, the ubiquity of scheduled and highly structured styles of interaction, could all be accounted for in terms of adaptational responses to a surfeit of information inputs. According to this view, as more people come to occupy a smaller physical space the probability of both positive and negative interaction increases dramatically. Both in terms of positive goal attainment and avoidance of punishing and/or negative encounters, more "messages" from the physico-social environment must be processed per unit time. But in urban settings the influx of information is so great that it threatens to overload the system in a chaos of contradictory and inconsistent messages. The response



to this dysfunctional state of affairs is the adoption of a variety of social and behavioral strategies which serve to moderate the number and type of messages which require attention. Among these strategies Milgram suggested (a) the allocation of less time to each input which has the effect of accelerating and "superficializing" interaction, (b) disregard of low priority items which takes the form of decreased concern with the lives of other people, (c) re-drawing of the boundaries in social exchanges so as to shift burdens of responsibility as when strangers and newcomers to a city are no longer welcomed by the community but must bear the responsibility themselves for injecting themselves into it, (d) reception of messages may be blocked entirely as when people, unwilling to "get involved", ignore the derelict and impoverished members of their own community, (e) reduction of the intensity of inputs by the use of filtering mechanisms such as unlisted telephone numbers and appointment schedules which disperse inputs over time, (f) creation of specialized institutions to deal with certain kinds of inputs as when social welfare agencies are established to deal with the needy, the derelict and the deviant. These adaptational mechanisms, according to Milgram, protect the individual from excessive information input and provide a logical explanation for many of the behaviors which can be commonly observed among urban dwellers.

Information overload theory was soon adopted by persons interested in the perception of crowding. Perhaps it was such a mechanism that could account simultaneously for the arousing and stressful

characteristics of high density settings. Two sources of messages were initially thought to contribute to the overload condition, (a) messages having their source in the social environment, e.g., other people and (b) messages coming from the physico-spatial environment, e.g., complexity, novelty and heterogeneity of the cityscape. Later, this view was reformulated such that features of the physico-spatial environment came to be viewed as a set of factors which served to regulate rates of interaction and probabilities of interpersonal contact.

Desor (1972) postulated that it was the overall level of social stimulation which controlled human judgments of crowding. She hypothesized that features of the architectural environment which could be shown to mediate the level of social stimulation would in turn influence perceptions of crowding in a given setting. To test this hypothesis, Desor constructed scale model rooms and human stick figures which she instructed subjects to place in the rooms under specified conditions of social interaction and interpersonal relationship. Subjects were told to imagine two predominantly interactive and two predominantly co-active activities for the miniature rooms, one of each of these activities customarily occurring while standing and the other while sitting. Using both male and female subjects, Desor then manipulated architectural features of her model rooms and measured the number of figures subjects were willing to place in these rooms as a function of changing conditions. The number of figures placed in each room was considered to be the subject's "crowding threshold" for that situation.

In her first experiment, Desor hypothesized that the number and type of partitions in a room would influence crowding threshold since walls serve to limit social stimulation by effectively blocking visual perception of others and interaction with them. This hypothesis was substantially supported. More figures were placed in partitioned spaces of the same overall area than in unpartitioned spaces. Furthermore, more figures were placed in settings where standing and interactive activities were assumed than in settings where either coactive or sitting activities were specified. There were no significant sex differences in these results.

In a second experiment, Desor argued that the observation that partitioning allows greater numbers of figures to be accommodated with no increase in the level of crowding is the same as to maintain that figures can be placed at greater densities in small rooms without increasing the perceived level of crowding. Thus, if judgments of crowding were controlled by the amount of space per figure, then figures should be placed at equal densities in all rooms. However, if the overall level of social stimulation was the significant controlling variable, figures should be placed at greater densities in small rooms. By exposing her subjects to model rooms of different sizes, Desor found substantial support for the latter hypothesis when the amount of access to all rooms being tested was the same. More figures were placed in smaller rooms than in medium or large rooms before the criterion "maximum uncrowded" was reached.

Finally, Desor hypothesized that room shape (greater disparity of linear dimensions) and amount of access (number of doors per room)

would both influence perceptions of the probability of social interaction and hence the perception of crowding in the setting. To test these hypotheses, Desor exposed her subjects to rooms of equal area which varied in shape (square to progressively more rectangular) and number of doors (two versus six) and then measured the number of figures placed in these rooms. Both of these hypotheses found support in Desor's results. More figures were placed in rectangular rooms than in square rooms of the same area and more figures were accommodated by rooms with two doors than rooms with six doors.

While the ecological validity of Desor's simulation technique may be questioned and no studies have yet been reported which establish validity and reliability parameters for the technique, its face and construct validity seem to be sound. Furthermore, her technique of measuring crowding threshold illustrated clearly the effects of architectural parameters which could logically be expected to influence perceptions of crowding. The technique has also been used in a series of subsequent studies all of which will be reviewed below and which have further elaborated Desor's original findings.

Solar (1973) adopted a modified version of the Desor procedure to test the effects of definition of the situation (already shown by Desor to be a significant variable), familiarity, "external density" and "immediacy" of furniture arrangements on crowding threshold. Three scale model rooms were constructed wherein subjects were told to imagine three different ongoing situations, (a) a party,

(b) a waiting room and (c) a study room. They were also to assume either that the other people in the room were friends or strangers (familiar versus unfamiliar). In the high "external density" condition all three model rooms were situated in model "environments" representing a large city whereas in the low external density condition the surrounding model environment depicted a low density suburb. Finally, the chairs used to furnish the model rooms were either arranged in a circle so as to maximize potential social interaction (immediate furniture arrangement) or side by side so as to minimize interaction (non-immediate arrangement).

Solar's results indicated that more figures were placed in rooms defined as party settings (i.e., interactive activity) than in settings where people were assumed to be waiting or studying. More figures were also placed in rooms when they were assumed to be friends than strangers and more were placed in rooms surrounded by a suburban setting than when surrounded by an urban setting. This last observation is a most interesting one since it suggests that perceptions of crowding may not be determined entirely by stimuli present in the immediate setting but that such perceptions are instead partly a function of a total "gestalt" which includes the cityscape as well. Below, a field study by Schmidt & Goldman (1976) will be discussed which lends partial support to this view.

Baum & Davis (1976) also employed the Desor technique to test additional hypotheses formulated on the basis of information overload theory as well as some intuitive hypotheses regarding spatial

extent. These investigators observed that it is a common experience to perceive rooms which are light in colour to be larger than rooms which are darker in colour. Accordingly, they hypothesized that light coloured rooms would be perceived as larger and therefore able to accomodate more figures than darker rooms of the same area.

In addition, Baum & Davis agreed with the social overstimulation model of the perception of crowding. They argued that room decoration schemes which provide alternative, socially acceptable fixation points for attention would be perceived as less crowded, i.e., they would accomodate more figures than rooms less elaborately decorated. In other words, when a subject began to feel overloaded with social stimulation, one way he might be able to manage this overload would be to look at paintings on the wall or sculptures on tables if such were available and hence reduce his level of interaction with others in a socially acceptable fashion.

To test these hypotheses, Baum & Davis constructed model rooms along the lines of those fabricated by Desor, some rooms painted light green and others painted dark green. Complexity of room decoration was manipulated by hanging small paintings on the walls of some rooms while leaving others unadorned. Finally, 80 male and 80 female subjects were asked to imagine either situations involving social interaction or non-interaction for the setting they viewed.

The room colour hypothesis was strongly supported. More figures were placed in the light green rooms than in dark green rooms of the same area. Thus, the perceived spatial extent of the setting

was a significant determinate of crowding perception. The visual complexity of room decoration, however, produced no effect on the thresholds of crowding although dark room colour interacted with complex room decoration to reduce the perception of crowding for situations requiring social interaction only. Apparently, complex decoration does very little to provide the alternate fixation points necessary to ameliorate social overstimulation. In retrospect, this is not surprising since social interaction almost invariably is the "figure" which appears on the "ground" of the physical setting. Having a much higher demand quality than features of the physical environment, it is not difficult to understand why such effects might be swamped by the influence of more potent factors such as the definition of the situation. Persons in Western societies who do not allocate their attentional resources in this fashion are early on diagnosed as autistic and exposed to additional socialization pressure to allocate attention to social contacts.

Burch (Note 1) criticized the Baum & Davis study on the grounds that the room "colour" manipulation actually confounded the notion of colour with that of brightness, i.e., one component of colour. Since the hue, saturation and brightness components of any colour can be specified and manipulated separately, Burch performed a study in which subjects were exposed to nine model rooms, each room representing a controlled combination of three levels of hue (yellow, green and blue) and three levels of brightness (light, medium and

dark) with saturation held constant across the nine model rooms. Consistent with the Baum & Davis study, it was hypothesized that brighter rooms would accommodate more figures than darker rooms because they would be perceived as more spacious. In addition, the differential arousal properties of yellow versus green and blue hues were hypothesized to produce differences in the overall level of arousal and thence via a stimulation equilibrating mechanism to produce a difference in crowding threshold. If perceptions of crowding were due to overstimulation, then fewer figures should be placed in yellow rooms (some studies having shown yellow to be the most arousing hue) than in green or blue rooms (some studies having shown these hues to be least arousing).

Burch's results supported the first hypothesis. More figures were placed in brighter rooms than in darker rooms. Furthermore, hue differences were also observed but the reverse of those expected. Significantly more figures were placed in yellow rooms than in blue or green rooms. While this finding suggested that both hue and brightness of interior decoration are significant mediators of perceptions of spatial extent and crowding, this effect is clearly not operating through a physiological mechanism. Subjects in the Burch study placed more figures in yellow rooms in a manner consistent with the association value of that hue, i.e., being a happy, exciting, vibrant hue, rather than its stimulation value. In other words, more figures were placed in yellow rooms because a room of such a hue may have been perceived as "appropriately crowded" because such hues are associated with the presence of many other people.

Investigations similar to those already mentioned have been attempted in field settings as well as the laboratory. Stokols, Smith & Prostor (1975) studied the effects of different levels of partitioning on perceptions of crowding, self-manipulation (taken as an index of behavioral tension) and ratings of the setting itself. These investigators observed the offices of the California Department of Motor Vehicles (DMV) on three separate occasions. Seventeen females and 45 males were observed when (a) the office was in its normal, unpartitioned condition, (b) after a "medium" level of partitioning was created by setting up standards and rope barriers forming aisles and (c) after a "high" level of partitioning was created by installing solid, temporary partitions in the same locations as the rope barriers had been in the previous condition. After subjects had moved through one of these three conditions and completed their business with DMV, they were intercepted before leaving the office by the experimenters who gave them questionnaires designed to tap their perceptions of crowding and of the DMV office environment. Furthermore, while standing in line, the subjects' behavior was video taped to record self-manipulations of clothing or body as an index of behavioral tension. Stokols et al. hypothesized that, consistent with the social overstimulation model of the perception of crowding, the unpartitioned room would be perceived as most crowded whereas the fully partitioned office would be perceived as least crowded. It was also predicted that subjects in partitioned settings would manifest less behavioral tension than subjects in unpartitioned settings.

The results of this study showed significant differences on a number of measures but none of them consistent with hypotheses. There were no significant differences between perceptions of crowding in partitioned versus non-partitioned settings. Stokols et al. hasten to interpret this non-finding as a refutation of Desor's results with the effects of partitioning on crowding threshold to which it bears some resemblance. However, findings which do not attain statistical significance hardly provide positive refutation of significant findings unless they appear in such quantity as to clearly indicate the probability that Desor's results were the consequence of Type I error. To dispose of Desor's findings, Stokols et al. must use a highly similar procedure together with measures of the perception of crowding which allow valid comparisons between the results of the two studies. Desor was measuring the number of figures placed in each room until that room reached the point where the subject would judge it to be crowded if one more figure was added. The subjects in the Stokols et al. study were not, however, reporting their crowding thresholds, only their ratings of the setting as more or less crowded. It is difficult to understand how ratings measured on an ordinal scale which lead to non-significant findings constitute disproof of highly significant findings measured with a ratio scale.

The Stokols et al. results also showed a main effect for behavioral tension with more self-manipulation occurring in partitioned spaces and more manipulation being observed in males than among female subjects. There were also significant correlations between the

the perception of crowding ratings, self-ratings of tension and ratings of the office environment as stuffy, hot, noisy and small. It seems clear, however, that the self-manipulation variable as a measure of "behavioral tension" is a dubious one. Since the partitions were placed in such a fashion as virtually to create queues in the office, it is not impossible that increases in self-manipulation were the result of increased privacy rather than behavioral tension. With a solid partition on both sides of the subject and those ahead of him in line with their backs turned, self-manipulative behaviors could hardly be considered a startling finding. It certainly cannot be viewed as evidence of behavioral tension and the tendency of males to self-manipulate more than females (the findings of Kinsey aside) is utterly devoid of theoretical significance. Finally, the correlations between perceptions of crowding and ratings of the office environment as hot, stuffy, et cetera, casts some doubt on what sort of "crowding" Stokols et al. actually measured. The original hypothesis concerned an information overload approach to crowding perception which is pre-eminently a social over stimulation model of crowding. How the correlation of ratings of crowdedness and such environmental parameters as heat and air quality are supposed to illuminate the relation between social over stimulation and the perception of social density is hard to see. Cues such as heat and odour relate to spatial density rather than social density.

Schiffenbauer, Brown, Perry, Shulack & Zanzola (1977) performed another field study wherein they hypothesized that dormitory rooms with equal actual floor area would be perceived as more or less crowded depending upon how much of this area was actually usable. They also predicted that rooms with a more extensive visual vista (e.g., rooms located higher in the dormitory building with a better view) and rooms which received more natural light and were therefore brighter would be perceived as less crowded than rooms of an opposite description. These hypotheses were superficially derivative from those of Baum & Davis (1976) and Burch (Note 1).

Seventy-five dormitory residents responded to a questionnaire designed to tap ratings of crowdedness and perceptions of the spaciousness of rooms. Results from the 75 returns indicated that usable floor space was significantly correlated with both perceived room size and elevation in the building. Interestingly, brighter rooms were perceived as less crowded but they were not rated as larger in apparent size. This finding is consistent with those reported by Burch (Note 1) and Baum & Davis (1976). Also interesting was the finding that rooms with more usable floor space were rated as larger but not less crowded than rooms with less usable space. It has been such apparently paradoxical findings which have led to the observation that perceived room sizes and perception of spatial and social densities are essentially unrelated. These findings are consistent with Desor's results that the amount of space per person is a less significant determinant of the perception of crowding than is the number of people present in the setting.

A field study by Schmidt & Goldman (1976) provides some corroboration in a naturalistic setting for the laboratory findings of Solar (1973) that the total environment in which a setting is embedded helps to determine perceptions of crowding for that setting. Schmidt & Goldman distributed questionnaires to 697 subjects of white, Black or Chicano populations in Riverside, San Bernardino, California. The questionnaires attempted to tap perceptions of crowding at the level of the subjects' homes, neighborhoods and city. The report of the study does not make clear what type of crowding (spatial versus social density) the authors were interested in and the fact that their questionnaire contained 83 items which by factor analysis yielded 16 different "scales" strongly suggests that more than one meaning of "crowding" was tapped. It is nevertheless of interest to note that differences emerged between these ethnic groups in their perceptions of crowding.

All respondents tended to perceive crowding at the residential level as a function of "preferential factors" such as the ability to obtain privacy when desired. This finding suggests that across ethnic groups crowding in a residential setting carries largely social density connotations, i.e., the presence of unwanted, inescapable or aversive social stimulation rather than reduced space per person. However, for Blacks and Chicanos, the evaluation of residential settings as crowded was influenced by the total urban gestalt since they tended to include factors from the neighborhood and city levels of evaluation in ratings of their residences. The white subjects cognized crowding largely in terms of psychological

(social density) factors rather than physical (spatial density) factors whereas this relationship was reversed for Blacks and Chicanos.

This study implies both that persons from differing sub-cultures may select their cues for the perception of crowding from different universes of stimuli (spatial versus social density cues) and also that for many people, the overall urban scene plays a significant role in their perceptions even of their home environments. Such findings are congruent in their logic both with the observations of Solar (1973) and Milgram (1970).

Two other studies warrant mention in connection with perception of spatial densities. Both the research of Baum & Greenberg (1975) and Baum & Koman (1976) clearly illustrate that people do not actually have to experience high spatial and social densities for their perceptions of a setting and their responses in it to be altered. Indeed, the mere anticipation that crowding is imminent is sufficient to elicit changes in perception and behavior.

Baum & Greenberg (1975) convinced small groups of subjects that they were about to be joined by either few or many others. The effect of this treatment tended to alter perceptions of the experimental room making it seem smaller, hotter, stuffier, et cetera, altered the behavior of subjects in that they tended to select more peripheral seat positions to avoid close social contact and also affected their ratings of the other subjects (and confederates) in the room.

Using an identical procedure, Baum & Koman (1976) compared subjects in large and small rooms who were anticipating the arrival of either a large or small number of other subjects and who also anticipated either a highly structured or totally unstructured task session to follow. Many interesting results emerged from this study which will be discussed in detail in the next section. Important here, however, was the finding that anticipated group size interacted with room size such that room size influenced the perception of crowding only for subjects expecting small groups. When small groups were expected, this increased perceived crowding only for subjects waiting in small rooms, i. e., the situation which would maximize inescapable social interaction. No sex differences were observed in the perception of crowding with the exception of one three way interaction indicating that when small groups were expected in small rooms, men tended to perceive these as more crowded than women.

These two studies are significant for several reasons. First, they illustrate that perceptions of spatial density, spatial extent, properties of a physical setting and even behavior in that setting can be markedly influenced by a set of conditions which do not in fact prevail in the setting, namely, the anticipation of crowding rather than the fact of high density.

Second, both studies illustrate a methodological development which allows spatial density and social density to be manipulated independently and simultaneously in the same study. It is important

to note, however, that only in studies where crowding is anticipated can this manipulation actually be attempted. Had the anticipated groups actually appeared, group size (social density) and spatial density would once again have been confounded. This fact leaves open the question regarding how the subjects' responses to anticipated density might differ from what their responses would have been to actual variations of spatial and social density.

Finally, it is of some interest to note that responses to increasing spatial density differ from those to increasing social density with sex differences appearing for the former but not the latter. This will be a significant point to keep in mind as studies of the factors which determine the perception of social density are reviewed in the next section.

Summarizing the research on the perception of spatial density and spatial extent, it appears that room size and the perceived capacities of spaces to accommodate people as measured by the Desor method of crowding threshold assessment are influenced by (a) the shape of the space being perceived (Desor, 1972), (b) the amount of access available in the space (Desor, 1972), (c) the partitioning of the space (Desor, 1972), (d) the ongoing interaction to be assumed for the setting (Baum & Davis, 1976; Desor, 1972; Solar, 1973), (e) the arrangement and type of furnishings to be found in the setting (Baum & Davis, 1976; Solar, 1973), (f) room brightness (Baum & Davis, 1976; Burch, Note 1; Schiffenbauer et al., 1977),

(g) room hue (Burch, Note 1), (h) the environment in which the setting is perceived to be embedded (Schmidt & Goldman, 1976; Solar, 1973). Related to these findings are additional reports from field studies and experiments which do not use simulation methods such as those of Desor (1972). In this connection it has been learned that perception of spatial density is influenced by (a) amount of natural light being received by a room (Schiffenbauer et al., 1977), (b) the number of other people who are anticipated to arrive in the setting (Baum & Greenberg, 1975; Baum & Koman, 1976).

The Perception of Social Density

The perception of social density is pre-eminently a process of forming a judgment or making an attribution that there are too many people present in a given setting. Clearly, such judgments are only tenuously related to the actual number of people in the setting and even more tenuously related to the space available per person (spatial density). It is also intuitively clear that such judgments are formed on the basis of highly relativistic criteria which presumably change in response to a number of situational and relationship variables which govern interpersonal interaction. A considerable number of studies have attempted to isolate one or more of the factors which contribute to the formation of such judgments.

There has been an attempt to apply information overload theory to social density concerns as well as the perception of spatial density. Again, it was speculated that excessively high levels of information input from the social environment may provide the

chief cue for perception of social density. Saegert (1973) proposed a dual component model of the perception of crowding which attempted to relate the spatial and social aspects of density. Spatial density, she argued, induces stress and arousal by reducing the available space and individual freedom of movement within that space. Thus, for Saegert, spatial density is synonymous with behavioral restraint. Social density, on the other hand, increases as a function of group size which effectively increases the "cognitive load" of the situation by multiplying the number of relationships and the amount of stimulation present.

Using a similar theoretical approach, Mackintosh, West & Saegert (1975) performed two field studies of the perception of crowding. They reasoned that if high social densities exposed people to information overload this would precipitate a stress reaction which would in turn affect measures of cognitive task performance and emotionality.

In one experiment, volunteer subjects from a university psychology class were instructed to obtain prices for a list of different styles of shoes being sold in a Manhattan department store. This task was performed by one group of subjects when the store was crowded and by another group when the store was relatively empty. After completing the task, subjects were tested for memory of the store layout and decoration by drawing a map of the area where they had just shopped. Measures were also taken of affective variables. It was hypothesized that subjects who experienced a crowded store would experience more cognitive overload and this

would manifest itself in poorer memory performance on the map drawing task and also induce more negative affect than for subjects shopping under less crowded conditions. These two hypotheses were supported by the results. Subjects shopping in a crowded store drew less accurate and less detailed maps than those shopping in an uncrowded setting. Furthermore, subjects reported more negative affect, frustration, aggressive feelings and feelings of task inadequacy when the store was crowded than when it was empty.

In their second study, Mackintosh et al. used a similar procedure but the setting was the Penn Central Railway Station wherein subjects were given a series of tasks to perform (e.g., purchasing a newspaper, checking a train schedule, et cetera) when the station was either crowded or empty. Measures of "overload" consisted of the time required to complete each task and the total number of tasks successfully completed. It was hypothesized that subjects in a crowded railway station would experience more disruptive cognitive overload than those in an empty station and that this would manifest itself in impaired task performance. As in the previous study, these hypotheses were supported by statistically significant results.

Numerous methodological and conceptual problems exist in these two studies. First, spatial and social density were completely confounded on both occasions. Thus, if overload did occur and if negative affect was indeed generated by the situation, it is

impossible to ascertain what caused it.

Second, the tasks themselves confound the concept of overload with other factors in the spatio-social environment. There is no need to attribute the decrement in task performance in crowded settings to a construct as bizarre as overload when it is clear that the mere presence of other people constitute physical obstructions which both visually obscure a to-be-remembered environment and also slow one's movement through it. Feelings of frustration, task inadequacy and aggression are not surprising when one has a task to perform in a setting which inhibits physical movement in and visual scanning of the environment.

Third, no attempt was made to match subjects before the experiment on the basis of their map drawing ability and memory facility. It may also be that crowded settings serve to divert attention from the physical surroundings to the social activity in them. Decrements in memory for the physical layout of the store may thus be due not to overload but to distractions of attention from the physical setting.

Sufficient questions could be raised concerning the Mackintosh et al. study that Burch & Walker (1978) devised a different test of the overload hypothesis. Volunteer subjects were assigned to either large or small groups and given cognitive-perceptual signal detection-type listening tasks to perform. One group of subjects (the Low Complexity group) were instructed to detect the frequency of a single word which occurred in a passage of literature being

read by a tape recorded voice. Another group of subjects performed a similar but much more complex task. Two prose passages of equal length were read simultaneously, one from each channel of a stereo tape recorder. In this (High Complexity) task subjects were asked to record the frequencies of three different words irrespective of which channel they heard them coming from. It was assumed that subjects performing the complex task would experience cognitive overload while those performing the simple task would not. It was hypothesized that this state of overload would differentially influence feelings of crowdedness in the experimental room which were measured by questionnaire.

Burch & Walker found that perceptions of crowding were significantly related to group size (social density) as were feelings of anxiety measured by the State Anxiety Inventory. However, task complexity had no effect on the perception of crowding. Both performance scores and behavioral observations of subjects in the high complexity condition clearly indicated that a condition of overload had been created, yet this did not influence perceptions of crowding. It was concluded that if information overload plays a significant role in the perception of crowding, the information source is of central importance because messages from non-social sources, e.g., a tape recording, had no impact on perceptions of crowding.

Proshansky, Ittelson & Rivlin (1975) proposed a different conceptualization of the perception of crowding. They posit a

model of human psychology which asserts that people are inherently cognizing and goal directed organisms. In the process of attempting to fulfill their needs, people become involved in interactions with the environment and that in any situation, people will organize their environments so that they maximize freedom of choice. This heavily cognitive conception of human behavior maintains that it is the construct of maximization of freedom of choice which serves to meaningfully relate the notions of privacy, crowding and territoriality. Presumably, territorial behaviors are those actions which secure maximum freedom of movement and exploitation with respect to a geographically bounded area whereas privacy relates to behaviors which control access by others to information about oneself or to one's time, attention and physical presence. Crowding is presumably experienced when the presence of others somehow diminishes one's freedom of choice in a bounded geographical locale (territorial invasion) or with regard to the voluntary dissemination of information about oneself or access to one's physical or psychological presence (invasion of privacy).

There has been partial empirical support provided for such a view of the perception of social density. Sherrod (1974) performed an experiment in which groups of eight female subjects were exposed to three spatial density manipulations by adjusting the size of the experimental room. One group was exposed to low spatial density, another to high density and a third to high density with the added instruction that they were free to leave the setting at any time.

Subjects performed simple and complex tasks for one hour while being exposed to these three density treatments, then all groups worked in a non-crowded setting on tasks designed to assess frustration tolerance and proof-reading performance. It was hypothesized that those subjects who had reduced freedom of choice to leave the high density setting would experience more stress than either those who had freedom of choice or who were tested in low density settings. This increased stress was expected to manifest itself as a reduced tolerance for frustration among the high density, no-choice subjects.

Sherrod reported that no differences emerged on simple or complex task performance during the density treatment, nor were there measurable decrements in proof-reading performance after the treatment (contradicting the findings of Mackintosh, et al.). However, significant differences were found between groups on tests of frustration tolerance. Crowded subjects who had no perceived control over their situation (those subjects who were not told that they were free to leave the experimental room) were least persistent in trying to solve a frustrating and insoluble task while crowded subjects with perceived control were next most tolerant and the non-crowded subjects were most tolerant of frustration after the treatment.

While this study does not directly show that reduced freedom of choice leads to perceptions of crowding, it does indicate that reduced perceived control increases the stressfulness of sit-

uations characterized by high spatial densities. In its own way, it is curiously reminiscent of the Glass & Singer (1971) findings that a similar reduction in frustration tolerance was observable when uncontrollable versus controllable noise was used as a stressor.

Eoyang (1974) obtained similar results in a field study of crowding in residential house trailers on a university campus. Fifty-eight university students were surveyed by questionnaire and asked to rate their satisfaction with their current living space. All trailers were of the same total floor area so all variations in density would have been due to changes in group size. Once more, however, group size was unavoidably confounded with spatial density since the number of occupants per trailer could not increase without simultaneously reducing the floor area per person (increasing spatial density) as well as increasing group size (social density). Nevertheless, Eoyang reported that increased numbers of occupants accounted for more of the variance in the life space satisfaction ratings than did measures of privacy. Privacy was measured in this study in terms of whether or not a respondent had a private or a shared bedroom.

At first, it might be surprising that privacy ratings did not outweigh group size measures as predictors of life space satisfaction. However, it must be recalled that privacy relates to the power to control unwanted intrusion, surveillance, et cetera. In group living arrangements where shared sleeping quarters are used, it is likely that respondents would exercise discretion in their

selection of persons as roommates whose presence would not be felt as a great compromise of privacy. That is, in such living arrangements, it is likely that non-roommates would represent the most salient intruders upon one's freedom of choice in maintaining privacy and territorial sovereignty. This argument is consistent with Eoyang's findings in that it was the total number of people per trailer rather than the number of people with whom one shared a bedroom that accounted for most of the variance in the perception of crowding and satisfaction. Eoyang also corroborated the common finding of no significant sex differences in the perception of crowding.

Another series of studies have attempted to link the perception of social density not to information overload or reduced freedom of choice but to the stresses and defenses of intrusion upon one's personal space or one's "psychological space" as by visual intrusion, surveillance or inappropriate intimacy.

Kutner (1973) was the first investigator to adopt this approach to density phenomena. In his view, social density was not due to spatial or distance factors but rather to feelings of being over-exposed to the detailed visual inspection of others which occurs in an uncontrollable or intrusive fashion.

Kutner seated groups of either two or four male subjects either facing toward each other or away. He also manipulated distance of seating positions. All subjects were given several measures of anxiety and their behavior was recorded on video tape during the experimental session. Kutner found no differences in

A-state scores between subjects in any of the conditions nor were there any significant correlations between any of the personality scales and the behavioral variables measured. However, results of the film analysis showed significantly more self-protective and contact avoidance gestures in subjects seated face to face than in groups seated facing away from each other. The protective behaviors were more frequent in four person than in two person groups and the effects potentiated over time. While Kutner did not specifically ask his subjects how crowded they perceived the setting to be, his results imply that increased, uncontrollable exposure to visual inspection may indeed be stressful and may provide a cue for the perception of crowding.

Sundstrom (1975) formulated similar hypotheses to the effect that the perception of crowding would be determined by intrusion and goal blocking in interpersonal relationships. Groups of six male college students which included three confederates in each group were placed in large or small rooms and given various tasks to perform. Confederates introduced intrusion by leaning close to the subjects, touching them occasionally and attempting 80% eye contact. Goal blocking was manipulated by refusing to attend to the subject or interrupting him when he spoke. Subject behavior was recorded on video tape and self report measures of perceptions of crowding, stress and self-disclosure were also taken. Sundstrom predicted that high spatial density would intensify responses to intrusion and goal blocking.

Sundstrom's findings indicated that subjects experiencing intrusion and goal blocking reported feelings of being more crowded and uncomfortable than unstressed controls. Contrary to expectations, the stress responses to intrusion and goal blocking were not intensified by spatial density (i.e., room size). Goal blocking produced self-reported irritation which increased with time, lower levels of facial regard, less gesturing and less positive head nodding. Intrusion resulted in initial discomfort which decreased with time. These findings imply that intrusion is easier to cope with than is goal blocking and may indicate that relatively high spatial densities (expressed in terms of a high probability of intrusion) are less likely to lead to judgments of crowding than are conditions which block one's goal attainment. This is an intuitively appealing formulation for which some additional support can be mustered in the next section.

Worchel & Teddlie (1976) have applied an attribution process model to the perception of crowding which bears some relation to the intrusion and goal blocking factors discussed above. For Worchel & Teddlie, the perception of crowding is a judgment arising from a two step process. First, a person is thought to become aroused by violations of his personal space and this is followed by the attribution of the presence of other people as the cause of this state of arousal.

On this basis, Worchel & Teddlie argued that it is invasion of personal space rather than simple spatial density which causes

arousal and the subsequent attribution of crowding. However, they are not as clear as Sundstrom or Kutner on specifying exactly what it is about the proximity of others which precipitates arousal.

Nevertheless, Worchel & Teddlie hypothesized that the perception of crowding could be altered by distracting an individual from making the attribution that his state of arousal is due to the presence of other people.

These hypotheses were tested by instructing 315 previously unacquainted male subjects to perform tasks in either large or small rooms, under conditions of close or far interaction distance and in rooms which were either bare or decorated with pictures. The wall decorations were intended to provide alternate sources of attribution for subjects' states of arousal. All subjects were given questionnaires to measure their perceptions of crowding immediately following completion of their tasks.

Main effects indicated that subjects perceived themselves to be most crowded in small rooms rather than large, at close rather than far interaction distances and in bare rather than decorated rooms. It is interesting to note the similarity between this study and the one performed by Baum & Davis (1976) discussed in the previous section. In present study, room decoration ameliorated the experience of crowding whereas in the Baum & Davis simulation study, it had only an interactive effect with room brightness and definition of the situation.

These main effects were qualified by several interactions. The authors found a significant Density X Distance interaction in which close interaction distance increased perceived crowding regardless of spatial density (i. e., room size) whereas variations in density affected perceptions of crowding only for far interaction distances. There was also a Pictures X Distance interaction wherein pictures reduced perceptions of crowding only under conditions of close interaction distance. This last finding was consistent with hypothesized relationships since close interaction distances would presumably generate the highest levels of arousal and the greatest need to attribute this arousal to some cause, namely, the pictures.

These investigators also took other measures of stress in their subjects such as estimated time to complete all tasks, emergence of group leaders and ability to remember group members' names. All of these indices of stress were greater for close interaction distance conditions. Close interaction distance also significantly inhibited group task performance, made subjects more punitive and inclined them to rate other group members as more aggressive. Importantly, none of these measures was significantly related to spatial density. Interaction distance and personal space violations appear to be far more potent determinates of the perception of crowding than spatial density.

A study by McClelland (1976) partially supports and partially contradicts the results reported by Worchel & Teddlie. McClelland

was interested in the mediating effects which sex and previous acquaintanceship would have on stress levels created by high density conditions. In a rather complex experimental design, two levels of sex, two levels of acquaintanceship, two levels of room size (spatial density) and two levels of task definition (one task requiring interaction and the other requiring only coaction) were simultaneously manipulated. Dependent measures consisted of post-experimental measures of frustration tolerance, verbal self-report scales measuring perceived crowding and several affective dimensions and some open-ended questions designed to elicit comments on the subjects' general perceptions of the experiment.

Groups of six subjects were given bibliography look-up tasks to perform in a simulated library card catalogue room which required them either to work independently with only two boxes of file cards (low interaction condition) or else to work with all twelve available boxes (high interaction condition). McClelland hypothesized that density would affect stress levels only when it forced interaction and behavioral coordination, i.e., only in high interaction conditions. He also predicted that the mediating influence of previous acquaintanceship would interact jointly with density and interaction level to affect stress levels rather than with density alone. The first of these hypotheses can be seen to bear some relation to the work of Sundstrom and Kutner since density represents an intrusion

factor and "behavioral co-ordination" or the lack of it may be regarded as a manipulation of the probability of goal blocking. The second hypothesis which aims at a three way interaction is interpretively rather ambiguous.

The results of McClelland's study indicated that both the spatial density and task interaction manipulations significantly affected perceptions of crowding. Subjects in smaller rooms (high spatial density) perceived them as more crowded than subjects in larger rooms. This finding contradicts that of Worchel & Teddlie wherein spatial density was seen to be unrelated to perceived crowding. However, McClelland's finding that higher levels of interaction increased perceptions of crowding substantially supports the results of Worchel & Teddlie that factors which mediated rates of interaction (e.g., close interaction distances, pictures) also influenced perceptions of crowding.

Other findings from the McClelland study consist of numerous complex interactions which are of dubious clarity and even less theoretical significance. Apparently, neither of the hypothesized relationships being explored were supported by the results.

Wener (1977) attempted a test of the visual intrusion versus the social interaction model of the perception of crowding. His results were largely at odds with those of Kutner and Sundstrom. Wener seated 384 subjects in same sex groups of six persons each. They were seated either facing each other or facing away and half the subjects were given a logic problem to solve while the other

half had no problem. Seating positions were also varied in an unspecified manner. Wener then took questionnaire measures of the perception of crowding and ten other affective response variables. He found that neither task structure nor seating position had any effect on any of the dependent variables measured, a finding considerably at odds with the studies discussed above. Furthermore, he had hypothesized that if visual intrusion was the chief determinant of the perception of crowding then subjects seated facing one another should experience greater levels of perceived crowdedness than subjects facing away. Conversely, if the amount of social stimulation was the critical determinant, then subjects seated facing away should feel the most crowded. His results supported the latter hypothesis. Subjects who were seated facing away felt more crowded than subjects facing each other. In addition, females reported more intense feelings of crowding than did males which Wener attributed to females greater willingness to disclose feelings of stress and discomfort.

Both Wener's hypotheses and his results are somewhat confusing. While the change in seating position is an effective manipulation of visual intrusion it is not as convincing a manipulation of social stimulation as one might hope for. Levels of social stimulation (as measured by the number of persons present and interacting) would have been identical in the seat-facing as well as a seat-facing-away conditions. There is even some question

whether the notions of intrusion and social stimulation can be orthogonally varied in quite this manner since all social stimulation is, in a sense, a form of "intrusion", visual or otherwise. More effective variations in social stimulation can be obtained by altering group size and/or task definitions, neither of which were attempted here.

The sex difference which Wener reported in perceptions of crowding is a highly atypical finding. It is usually the case that the sexes perceive density in identical ways but that their affective responses to it vary considerably. It has also been shown that males show affective responses to variations in spatial density while females respond with greater intensity to changes in social density (See Baum & Koman, 1976). The report of Wener's experimental results leave open the question of exactly what it was he was measuring, i. e., perceptions of crowding or affective responses to a situation already perceived as crowded. Questionnaire items biased in a direction which favour reports of feeling states might well reveal sex differences whereas items which stress perceptual cues would not.

Greenberg (1977) performed an experimental study similar to those reported by Kutner and Sundstrom with similar results. Greenberg hypothesized that spatial intrusion, surveillance (privacy reduction) and restriction of withdrawal behaviors would independently and in combination produce increased perceptions of

crowding and increased efforts at withdrawal coping behaviors.

Eight experimental conditions were created to which 128 male undergraduate subjects were assigned. All subjects were interviewed regarding personal aspects of their lives such as their relationships to parents, personal achievements and failures, and relationships with the opposite sex. Half of the subjects were interviewed by an intrusive interviewer who sat close to the subject, facing him with knees touching and attempting large amounts of eye contact. The remaining subjects were interviewed by a nonintrusive interviewer who sat over a meter away and who avoided bodily and eye contact. Also, half of the subjects were interviewed with two confederates present (surveillance condition) or no confederates present (no surveillance condition) or with their chair located in the corner of the room (high behavioral restraint) or in the center of the room (low behavioral restraint). The behavioral and verbal responses of subjects were recorded on video tape and quantitative measures were taken of facial regard, self-manipulation, posture changes and nervous laughter as indices of stress coping. Level of self-disclosure was expressed as the duration of the interview and all subjects were given post-experimental questionnaires assessing their perception of crowding, of the interviewer, the setting and their mood state.

Greenberg's results showed clear main effects for intrusion and surveillance. Subjects perceived themselves to be more crowded

in the presence of an intrusive interviewer and under conditions of surveillance than persons who experienced neither condition. Furthermore, the subjects who perceived themselves to be most crowded were those who experienced intrusion and surveillance together. Greenberg reported that between these two factors, intrusion accounted for a larger share of the variance than did surveillance which results largely corroborate those of Kutner as well as Sundstrom.

Also consistent with previous research, Greenberg reported that subjects in the intrusion conditions exhibited significantly less facial regard and lower levels of self-disclosure, findings which were also true for subjects who experienced the surveillance treatment. However, neither perceptions of crowding nor measures of facial regard and self-disclosure were affected by seat position manipulations.

Greenberg concluded that his findings indicated the existence of a motivational component in human behavior which seeks to maintain some optimum level of intimacy, privacy and social stimulation. When events in the socio-spatial environment violated these equilibria, compensatory withdrawal behaviors come into operation to cope with the resulting stress.

A field study by Gochman (1977) has provided further support for some of the laboratory findings discussed so far. Deriving her hypotheses from an arousal-attribution model of the perception

of crowding identical to that proposed by Worchel & Teddlie (1976), she hypothesized that unattained goals and/or disconfirmation of expectations would cause arousal. A state of arousal serves to intensify perception of the aversive aspects of high density environments and the density itself provides a ready explanation for the individual's state of arousal. Thus, this formulation argues that density per se may or may not be the source of goal blocking and disconfirmed expectations. Whatever the factors may be which actually block one's goal attainments, density may provide a handy explanation for why one has not in fact attained one's goals. This throws some light on the possible reason for the lack of significant correlations between density and social pathologies mentioned in the first section. It may be that behavioral scientists are inclined to attribute the cause of such pathologies to density since it presents itself as a convenient, plausible explanation for phenomena which, in truth, are disconcertingly complex and obtuse in their etiologies.

Gochman performed studies in classroom settings and during course registration week at a major university. When university subjects were given various tests of their knowledge of a subject and also asked to rate their perceptions of crowding in the classroom environment, it was found that poor performers in high density classrooms rated those rooms as more crowded than their counterparts in low density rooms. However, students who attained their goals in satisfactory test performance rated both high and low

density classrooms alike in perceived crowdedness.

In a laboratory experiment, students performed an anagram task in a high spatial density setting. Performance on the task was manipulated to either confirm or disconfirm expectations as to the outcome of the task. As Gochman predicted, subjects who experienced disconfirmation of their expectations perceived the setting to be more crowded than subjects whose expectations were confirmed.

Similar studies were performed during course registration where perceptions of crowding in the environment were related to confirmation or disconfirmation of expectations regarding how long the registration process would take and attainment or non-attainment of goals expressed as one's success or failure in registering for desired courses. As in the laboratory studies disconfirmed expectations and failure of goal attainment significantly increased the perceived level of crowding and the subjects' tendency to attribute density as the cause of their disconfirmed expectations and unattained goals. These findings are consistent with those mentioned previously reported by Mackintosh et al. (1975), Sundstrom (1975) and Worchel & Teddlie (1976).

It will be recalled that Rapoport (1975), in differentiating spatial density and social density (affective density), suggested that stimulus heterogeneity and the absence of mechanisms which structure cognitive activity and social interaction provide

significant cues for the perception of crowding. A series of studies which will be reviewed below might be characterized as sharing in common examinations of factors which serve to structure the stimulus world and relationships between people and the effects these factors have on the perception of social density.

The first of these investigations was performed by Smith & Haythorn (1972) in which 56 naval personnel were subjected to laboratory conditions of confinement and social isolation in four sets of four dyads and two triads each. In addition to the variation in group size, subjects were assigned to pairs on the basis of attitudinal and n-achievement compatibility or incompatibility, groups in which either the senior ranked or junior ranked man was the "mission leader", or in conditions of high versus low spatial density (manipulated by changing room size). Subjects were confined in specially designed quarters for 21 days during which they had scheduled work tasks to perform as well as free time for recreation or personal pursuits. Both during and after the period of confinement, measures of self-reported stress, state and trait anxiety, hostility toward isolation partners and annoyance with the physical setting were recorded.

Smith and Haythorn reported that measures of stress, anxiety, annoyance and hostility were all higher during the confinement period than baseline levels recorded before the mission began or immediately after its completion. Subjects reported greater

hostility when a junior ranked man was the mission leader than when a senior ranked man was the leader, and also in attitudinally incompatible groups than in compatible groups. Perceptions of crowding, subjective stress and state anxiety were all higher in the triads than in the dyads. Annoyance with the physical setting was greater in attitudinally compatible than in incompatible groups and among dyads than in triads. This suggests that the environment becomes a perceived cause of annoyance when these feelings cannot otherwise be attributed to interpersonal conflicts arising from attitude differences. Many of these effects, especially the effects of density on anxiety measures increased with time, a longitudinal dimension usually ignored in brief, one-shot laboratory exposures to density.

This study is significant because attitudinal compatibility and appropriate rather inappropriate social relationships (as when the mission leader was the senior ranked man) served to reduce negative affect in the confinement situation and presumably also reduced stress. On this basis, it might be hypothesized that structuring of social relationships and attitudinal compatibility may significantly influence the perception of crowding.

Fisher (1974) performed an experiment which lends additional credence to this assertion. Fisher hypothesized that attributions of crowding are made to settings as part of a general affective response to the setting triggered by other factors in the situation, e.g., the degree of attitudinal agreement which a person experiences

in the presence of others in the setting. He designed an experiment in which 62 females and 61 males interacted with a confederate who displayed either attitudinal agreement or disagreement with the subject. Interactions occurred at four different interpersonal distances of 2.0, 4.0, 5.5 and 13.0 feet with a face to face orientation being maintained in all conditions. After interacting with the confederate, subjects were given questionnaires designed to measure their ratings of the aesthetic qualities of the environment, their perception of crowding and their affective evaluation of the confederate.

Fisher found that there were no differences between the sexes in their responses to the experimental manipulations, so all data were collapsed on this dimension. As predicted, however, subjects who interacted with confederates who expressed attitudinal agreement with the subject also rated the setting more positively, perceived themselves to be less crowded and evaluated confederates more positively than did subjects who experienced attitudinal disagreement with the confederate. Furthermore, these relationships were maintained over the full range of interaction distances. Thus, it appears as though the perception of crowding may also be affected by a kind of "halo affect" from the mood tone created by the social interaction which occurs in a given setting.

Attitudinal agreement serves to structure part of the "social space" into relationships which are known to be dependably positive and relationships which are essentially unknown. Another index of structure in the social environment is the presence of cohesive

groups as opposed to aggregations of unrelated individuals. Baum, Harpin & Valins (1975) argued that groups constitute special social structures which mitigate the stressful effects of high population densities by structuring the social environment so as to reduce uncertainty, by providing clear boundaries which limit or reduce social contacts, by creating group norms which regulate social interaction and reduce experiential heterogeneity and by reducing intragroup conflict by identifying procedures and rules which guide group activities (cf Milgram, 1970).

Baum et al. compared two groups of university sophomores from dormitories of two different designs. One dorm featured clusters of four suites which accommodated six persons each while the other dorm was a 33-man double-loaded corridor design of 2-man rooms. The total living area (i.e., spatial density) per person was identical under both living arrangements.

These two groups were compared under laboratory conditions on measures of how effectively they could organize group activities and form a consensus on a problem to be solved as a group. Questionnaire measures of the perception of crowding in the living environment, the subjects' tendency to avoid interactions with others and their self-ratings of their ability to deal effectively with others were taken. Subjects from suite-type dorms showed more highly developed group structures and reached consensus more rapidly than did the corridor residents. Corridor residents reported that they perceived their dorms to be more crowded, they

felt more like avoiding interactions with others and they felt less adequate in such interactions than did the suite residents. Group affiliation of all kinds (e.g., campus organizations) among corridor residents was lower than for suite residents who reported that they did not perceive their dorm to be crowded at all. The investigators concluded from these results that social environments characterized by the presence of cohesive groups tend to ameliorate perceptions of those environments as crowded, heterogenous and overloaded with social stimulation. Not the least significant observation which can be drawn from this study is the fact that the suite residents were actually exposed to a higher level of social density, i.e., a larger group with whom interaction was required, than were corridor residents and yet it was the latter group, not the former, who perceived themselves to be most crowded. This finding highlights the notion that structure in the social space may be as important a factor in perceptions of social density as the number of other people per se.

Two additional studies bear directly on the issue of social structure effects on perceptions of density. Baum & Koman (1976) performed an experiment which was discussed briefly in the previous section but which has pertinence here as well. It will be recalled that Baum & Koman devised an experimental procedure wherein subjects were convinced that the experience of crowding was imminent. By creating conditions in which subjects anticipated the

arrival of either large or small groups, anticipated social density could be manipulated independently of room size (spatial density). In addition, however, Baum & Koman also manipulated the anticipated amount of social structuring for the situation by telling subjects either that group leaders would be appointed to enforce rules of interaction or else telling the subjects nothing about the coming session.

Results indicated that manipulations of anticipated social structure produced significant interactions between structure and group size. Subjects anticipating the arrival of large groups in unstructured sessions reported that they perceived the setting to be more crowded than persons who expected large groups in structured sessions. These results were paralleled by reports of discomfort and the tendency to select peripheral rather than central seat positions among those who were anticipating large group, unstructured interactions.

Finally, a study by Cohen, Sladen & Bennett (1975) must be discussed in this connection which has been unaccountably ignored in the literature, a fate which it hardly deserves. These researchers employed the Desor technique to measure crowding thresholds for 40 male and 40 female subjects. Eight situational definitions were supplied for the model rooms in which subjects were to assume that the simulated people were either acquainted or strangers, that they were either engaged in an interactive or independent (co-active) activity, and that the situation was either a recreational or work activity.

Cohen et al. found that subjects were willing to place more figures in the model rooms when the people present were assumed to be acquainted than when unacquainted, when they were interacting than when they were coacting and when the situation was assumed to involve recreational rather than work activities. Together, these factors were reported to account for 69% of the variance in figure placements. However, these main effects were qualified by some significant interactions. Subjects placed fewer figures in work situations requiring interaction than in recreational situations requiring interaction, fewer figures in coactive work situations than in coactive recreational situations, but more figures in interactive situations with acquaintances than in interactive situations with strangers. In all of these results, sex differences were negligible. Taken together, they seem to indicate that structured social situations with known others and which feature essentially positive (e.g., recreational) activities lead to higher tolerances for crowding, i.e. reduced perceived crowding as measured by the Desor technique than do the contrasting sets of conditions.

This study also once again implies that the structuring of social stimulation or the lack of it may be as potent a cue to the perception of crowding as is the presence or absence of the social stimulation itself. It will be recalled that suite residents in the Baum et al. study perceived their dorms as less crowded than did corridor residents, and this in spite of the

fact that suite residents were probably receiving higher levels of social stimulation than their counterparts in corridor dorms. Correspondingly, subjects in the Cohen et al. study placed more figures, not less, in situations defined as calling for social interaction suggesting that they might perceive such situations as having a higher capacity to accommodate additional people than settings wherein coercive behavior was called for. These findings lead to the almost inescapable conclusion that if there is a motivational component in human behavior which leads people to maintain some optimum level of desired social stimulation, the definition of that optimum level is at least partly determined by how structured is the social situation. No measure as crude as simple group size (i.e., unmodified social density) could be expected to predict such an optimum level with satisfactory accuracy.

It would be misleading to attempt a simple summary of the studies mentioned in this section, especially of those which report several interactions among their factors. Nevertheless, a few of the clearer findings can be recalled. Perceptions of social density appear to be influenced by (a) invasions of privacy (Proshansky et al., 1975), (b) perceived freedom of choice in crowded settings (Sherrod, 1974), (c) number of others with whom a setting must be shared (Eoyang, 1974), (d) intrusion, visual exposure and surveillance (Kutner, 1973; Greenberg, 1977; Sundstrom, 1975), (e) goal blocking (Gochman, 1977; Sundstrom, 1975), (f) attribution processes (Gochman, 1977; Worchel & Teddlie, 1976), (g) perceived

compatibility of persons in the setting (Fisher, 1974; Smith & Haythorn, 1972), (h) amount of structure which is perceived in or anticipated for the social space (Baum et al., 1975; Baum & Koman, 1976; Cohen et al., 1975).

Cross-cultural Reports of Crowding Phenomena

Ever since Hall (1970) sensitized social scientists to the role of personal space in interpersonal relations, psychologists have adopted Hall's basically anthropological analysis of the differences between cultures in spatial behavior. In most cases the assumption that cultural differences must account for some sizable fraction of the variance in responses to density has been uncritically adopted and presently holds that curious status accorded to untested opinions which the scholarly community nevertheless hold to be matters of fact. This status is impervious to the comments of students in the field who point out that there is utterly no reliable empirical support for the notion that culture is a significant determinate of the perception of crowding, no matter how plausible this assertion may sound when framed as a research hypothesis.

The studies to be discussed below do not involve direct tests of the effects of cultural differences on the perception of crowding and for this reason, they will not be discussed in the same detail as the foregoing research. However, several of them deserve mention because they hint that culture may influence the perception

of crowding or it may provide adaptive mechanisms for ameliorating the impact of density on human life. Since none of the available reports deal with experimental studies, attributions of causation are impossible. All published sources to date (of which a sampling is presented below, not an exhaustive survey) are either descriptive ethnographic studies or correlational demographic comparisons of rates of social pathology.

When Calhoun (1962, 1966) published his studies of the effects of high population densities on animals, these findings were hastily transferred to dire predictions for the fate of humans in similar high density environments. To test hypotheses arising from these findings, researchers naturally turned to Asia where the highest human population densities in the world could be found. For instance, Anderson (1972) reported that population densities in some districts of Hong Kong reached 20,000 persons per acre or 265,000 persons per square mile. This value is approximately 100 times higher than the average population density of New York City. Van Groenou (1977) reported densities of 300,000 persons per square mile for Ahmedabad in Gujarat state of northern India and 492,000 persons per square mile for Bombay, the latter value being almost 200 times higher than the average density of New York. Attempts to relate these high density conditions to the etiology of social and individual pathologies have largely failed when appropriate controls are applied to correlation procedures to account for education, class, income and so forth. In his review of the epidemiological literature,

Lawrence (1974) concluded that there was very little to conclude from such studies aside from the fact that the sources of social pathology could no longer be attributed to any factor as gross and monolithic as population density.

Two studies have emerged which do reveal some interesting relationships and provide some indirect support in field data for some of the laboratory findings mentioned above. Mitchell (1971) studied family life in high density areas of Hong Kong by surveying nearly 4,000 people and doing observational studies of family interaction. While 42% of his sample expressed some dissatisfaction with the amount of space available in their living units, Mitchell found that density had little or no impact on indices of emotional strain, worry, general unhappiness, personal unhappiness, emotional illness or withdrawal from social or work activities. These non-findings were maintained regardless of whether density was measured as floor area per person or rooms per dwelling.

However, two factors emerged which correlated significantly with indices of stress and strain and reported difficulties in family relationships. Emotional stress and conflict was reported significantly more often by families who shared their dwelling with another, unrelated family and/or whose dwelling units were located higher in high rise apartment blocks. Thus, interpersonal stress was determined more by social incompatibility (i.e., sharing a dwelling with non-kin) than density per se. The vertical location of suites in high rise buildings was interpreted as limiting the

possibilities of easy escape from stressful conflicts and clearly would remove children from easy supervision and parental control when the children usually play at street level. Neither of these factors has much to do with density in the sense that neither are invariable accompaniments of high population densities. The practice of living with non-related families introduces an element of potential attitudinal and behavioral incompatibility which has been shown experimentally to induce negatively valued states of arousal and attributions to crowding as the cause of this arousal. Despite the attribution, however, it is the incompatibility, not density, which is the cause of the discomfort. Also, vertical location in a building represents behavioral restraint and reduced freedom to leave a negatively arousing social situation which Sundstrom (1975) has shown to increase feelings of crowding. Once more, behavioral restraint and population density can hardly be considered synonymous.

The findings reported by Mitchell have been corroborated in detail by Hassan (1975) in a similar study performed in Singapore. Hassan devised a "worry index" which tapped a general dimension of felt malaise and worry regarding such things as concern with personal health, children's health, children's security, cost of living, et cetera. Just as for Mitchell, scores on this index were positively related to cohabitation of unrelated families and vertical location of the dwelling unit in high rise buildings. In view of the present discussion, a lamentable omission from both studies was the fact that neither researcher asked their respondents how crowded they perceived their living quarters to be.

From a North American viewpoint the habitation densities of the Orient are quite remarkable. The fact that unrelated extended families can live in the same dwelling unit with about as much space per person as most Canadians consider necessary for a large clothes closet, and to do this in relative harmony, is an extraordinary accomplishment of some sort. But the question remains open as to exactly what sort of accomplishment it is. Have such populations adapted to density in a psychological sense to such an extent that they literally do not perceive their surroundings as crowded? Alternatively, perhaps cultural mores have been evolved which structure social interaction to such an extent that aversive levels of overstimulation seldom occur. No controlled studies have been reported which directly address the issue of adaptation processes in the perception of crowding. However, some ethnographic reports provide anecdotal insight into culturally transmitted adjustive mechanisms which may ameliorate the effects of too many people in too little space and the attendant perceptions of density.

Anderson (1972) carried out anthropological observations of family interaction in Hong Kong, Singapore and Penang, Malaysia. He noted that in both Hong Kong and Penang, many people voluntarily occupy high density residential environments in spite of the fact that they have the economic resources to purchase additional living space for themselves. Interpersonal conflict could, of

course, be observed, although Anderson notes that it was rare. Incidents of outright violence were extremely rare. In Hong Kong, street crime in high density areas was present but it was totally under the control of well organized gangs who were highly visible to local residents and with whom appropriate rules for interaction were well established.

Anderson argues that the potential for stress which exists under such high density conditions was modulated by a variety of social norms and customs. First, there is a widespread cultural value in Chinese society that large numbers of people per household are to be desired. Tradition maintains that the fortunate man is one who can count five generations under his roof. When a family becomes affluent this is expressed by purchasing larger living quarters so that more family members can live together. If an affluent family has few members, "excess" space is rented to non-related families. Thus, there is a cultural bias toward perceiving space as an economic capital asset or a familial possession rather than a value in itself, as is customary in the West.

Chinese culture places a high value on tolerance and harmonious interpersonal relations. From an early age children are taught to defer rather than aggress. Furthermore, in a dwelling shared by more than one family, bedrooms are maintained as absolute and inviolable private territories for nuclear families. Strict sanctions are imposed even upon young children to refrain from

entering the bedroom of another family. In contrast, living rooms and kitchens are considered ceremonial common areas where families can mix and/or entertain visitors and celebrate religious ceremonies.

Another characteristic of Chinese society is the flexibility with which time is managed. Even working adults may leave or return to the home at irregular hours. This temporal flexibility tends to reduce congestion both within and outside Chinese homes. Rigid scheduling as is typical of Western societies tends to promote periodic intense congestion and tremendous waste of resources since traffic arteries are constructed to handle maximum flows while during the "off hours" they are practically empty.

The Chinese, while escaping the congestion of rigid schedules are nevertheless exposed to a continuous and unrelenting din of human activity. Happily, noise is viewed as a sign of lively activity and is either positively valued or benignly ignored most of the time.

Anderson also reports that unlike North American families, the Chinese family structure is largely intact. The status of all persons in Chinese families is clear and rigid thus practically eliminating debate and uncertainty regarding who must defer to whom in the use of a particular space. Also significant is the fact that all Chinese adults recognize the right of all other adults, related or not, to discipline all children. Even adults who disagree on a particular instance of infraction or punishment will not express

this disagreement openly when children are present.

Finally, there is a dominant social norm which dictates emotional neutrality toward non-relatives in public settings and an intricately developed tradition of etiquette both of which serve to minimize affect laden interactions between non-relatives. Practically all of the common instances of social encounter already have the terms of interaction established in advance. This renders the Chinese "social landscape" immanently cognizable and it presents a minimum of unpredictable social heterogeneity.

All of these cultural mores can be seen in one way or another to establish conditions of interaction which experimental research suggests would minimize the experience of crowding. Consequences of density which cannot be avoided (e.g., noise) are revalued. Congestion is minimized by adaptively redistributing human interactions in time by flexible scheduling. Minimum spaces have been reserved over which occupants still exercise absolute sovereignty (bedrooms) and behavioral control. Intrusion upon these mini-territories is strictly regulated through enculturation of the young. Group structures within the society are clear and unambiguous (e.g., the family, criminal gangs, et cetera). The amount, type, frequency and content of many interactions is heavily determined in advance by rules of kinship relations and the etiquette to be shown toward non-kin.

A report of a totally different society has been submitted by Draper (1973). Having an average population density of 10 persons

per square mile, the !Kung bushmen do not immediately present themselves as candidates for studies of crowding until their settlement densities of 188 square feet per person are considered. A !Kung encampment thus represents a human aggregation about 20 times more dense than Manhattan.

While the spatial density of !Kung camps is relatively high, the group size (social density) is relatively low consisting of 30 to 40 persons per camp most of whom are related. The nuclear families comprising this group construct individual huts arranged in a circle which open on a common central courtyard. The huts are spaced so close together and the court is so small that conversations between huts can be carried on in normal tones and items can be passed from one cooking fire to another without the interacting persons having to get up. No interior architectural features such as walls or screens block the view of hut interiors from neighboring huts. Encampments of such high density are voluntarily created with no apparent ecological or economic incentive to do so, nor are they associated with any indications of stress or pathology.

The !Kung are a tribe of hunter-gatherers but their way of life requires only about three days per week of labour from each adult. On any given day Draper reported that 65% of the camp population remains in the camp (children, adolescents, the aged, adults without foraging responsibilities for the day). Time sampled observation of children's play showed that females spent 77%

of their time within the camp circle and males spent 50% of their time within this perimeter. Furthermore, all members of the camp experience and enjoy a large amount of touch contact.

Draper argues that tolerance for these high density living arrangements is mediated by a social norm which resolves irreconcilable interpersonal conflict through band fission. Thus, the !Kung simply move away from serious disputes which threaten the harmony of the camp rather than being constrained to tolerate them. Also, while individual camps have very high internal densities, such camps are widely separated from each other and the total !Kung population is very small (only a few hundred persons). Finally, the daughter camps which result from band fission may visit other !Kung encampments and join their band. Since the total population is small, almost all !Kung are related and the culture is highly homogenous. As a consequence, behavioral restraint is minimal, the likelihood of intrusion by unwanted others is remote, surveillance (except for anthropologists) is non-existent and the world of social relations is stable and structured heavily by kin relationships. Again, these findings are at least superficially consistent with laboratory research.

The findings of both Anderson and Draper suggest that (a) culturally transmitted adjustive strategies may modify responses to high population densities, (b) may increase tolerance for such densities, (c) may even change the way density is perceived and (d) despite the Western intellectual bias which insists upon viewing

density as negative, stressful and aversive, evidence has been reported from two cultures where high density living arrangements are apparently adopted voluntarily and positively valued.

Unfortunately, neither of these reports can be accepted as proof of a cultural influence on the perception of density because neither has established a causal relationship. The investigation of the role of culture as well as psychological adaptation in response to density thus promises to be a fertile area for future research. Success in establishing cultural differences as a source of variance in the perception of crowding would effectively hold out the possibility that tolerance for crowding can be learned and is not an invariant source of stress in all high density populations.

Concluding Remarks

Lawrence (1974) reviewed the literature on human crowding available at that time and arrived at the following conclusion:

"The field is confused---by definitions, by conflicting data, and, as psychology often is, by popular conjecture. The animal data are most easily interpreted and possibly of least interest to man. The urban findings are inconclusive, demonstrating no unequivocal relationships between population density and social ills. Finally, clinical and experimental models are at odds, and the results of experiments are again inconclusive. (p. 717)

Elsewhere he adds:

"It is obvious from the exploratory range of these definitions of density that simple causal statements about urban crowding have little validity. It is also apparent that crowding as a psychological concept is still in its infancy. (p. 716-717)

In 1973 there were 17 studies mentioned in Psychological Abstracts which covered research on the full range of "over-population" issues, i. e., not only studies on the perception of crowding (1) but on related topics such as affective and behavioral responses to density (3), animal research (3), correlational studies relating density to pathology (4) and research on attitudes toward overpopulation and contraception (6). In 1974, the number of studies reported increased to 26; in 1975 there were 20; in 1976 there were 44 studies reported, 10 of these appearing in Dissertation Abstracts International suggesting that young researchers were developing an interest in problems of density. Five studies appeared in the Journal of Personality and Social Psychology and the Personality and Social Psychology Bulletin which more or less signalled the "official legitimacy" of psychological studies of crowding. In 1977, 28 studies appeared and in the first eight months of 1978, 31 studies were reported. Furthermore, in 1975 a separate index category was created in the Psychological Abstracts for studies of crowding per se and they were no longer listed together with the more global and sociological research on attitudes, family planning and the epidemiological studies. Despite this obvious growth in interest and activity among psychologists, Lawrence's conclusions are still essentially appropriate.

An exhaustive survey of the available research on the perception of crowding indicates a welter of unrelated and often

contradictory findings. In cases where research methods appear to be sound, many findings remain uncorroborated. There is considerable heterogeneity of measurement techniques which render the findings from different studies difficult or impossible to compare. Sometimes crowding is treated as a dependent variable and sometimes as an independent variable. No standard measurements have yet emerged (with the possible exception of the Desor technique which has been used in six studies) which measure perceptions of density and density-related responses. Thus, investigators are often thrown back on constructing their own measurement devices which have unknown psychometric properties and which probably yield results of dubious comparability across studies. Under these circumstances, it would be foolish to draw any global conclusions about the influence of density on human well being or the perception of crowding itself, although at least one researcher has not hesitated to do so (Freedman, 1975).

This is not to say, however, that no headway has been made in understanding the perception of crowding or problems which require research attention in the future. Investigations which have been reported so far clearly indicate that population density per se is not a very useful psychological concept. The relations between density, density-associated phenomena and the psychological experience of perceiving too many people in too little space are obviously complex and multidimensional. It can even be

stated tentatively that many of the psychological responses which are customarily associated with crowded settings are probably caused by factors other than density itself but which are often confounded in reality with high population densities. In this context, the concern with crowding and the ominous expectations of its effects which riddle psychological literature may be pre-occupations peculiar to Western culture---a culture which has not yet fully exploited all available adjustive and adaptive mechanisms which can be used to modulate the impact of density. The results of studies performed on animals which are applied to human populations may have as little relevance in this connection as studies of human linguistics have in understanding "animal cognition". The singular flexibility and adaptability of humans may render density a stressor of relatively minor importance when compared to other consequences of modern urban life styles such as pollution, noise, decreased individual freedom, anonymity, the disintegration of the family and community, et cetera.

A major criticism of the research on the perception of crowding is the same as is leveled at many psychological experiments. Experimental research is usually cross-sectional and a-temporal whereas life is by definition, longitudinal. Questions of any relevance to real life human existence cannot be answered easily by one shot exposures to high density for periods of a few hours at most. The important questions arise when one

considers what are the effects of high population densities when a person must grow up in them, mate in them, foster offspring in them, find some career, aesthetic and personal satisfactions in them. Viewed in this way, both the probability of "goal blocking" and decisional overload as well as the opportunities to work out behavioral and perceptual adaptations to density are maximized. In the longitudinal perspective, the effects of density on human life and its perceptual impact on human cognitive functioning become maximally potent and exert their primary effects on behavior and culture. These are precisely the perspectives which future research should attempt to address.

It will be recalled that Stokols (1973) has asserted that studies of crowding at the "micro" or interpersonal level may lead to different conclusions than studies of crowding at the "macro" or social level. Practically all existing research addresses the perception of crowding in limited spaces with relatively few others present for short periods of time. The distinction drawn by Stokols suggest that even at the individual level, different perceptual phenomena may be involved at the relatively intimate level of interpersonal encounter versus the "football game and traffic jam" level of impersonal, mob encounter.

A related consideration consists of the fact that no one knows what are the differential effects of continuous versus intermittent exposure to high population densities and how this

affects the perception of density. It may be that continuous exposure produces different effects both in terms of perception and stress responses to crowding than would a history of intermittent exposure.

A further concern arises from the fact that very little is known about individual differences in crowding perception. Burch (Note 1) attempted to related measures of crowding threshold to scores on A-trait and extroversion scales with negative results. However, a large number of other questions remain to be answered in terms of how personality factors and individual differences serve to mediate perceptions of and responses to density.

Finally, it is of vital importance that better measurement instruments be devised for research in this area---instruments which are easy to use, flexible, of good psychometric properties and which are able to discriminate the multiple dimensions which contribute to perceptions of density. Some instrument or family of instruments must be devised which will reliably differentiate between perception of spatial and social density. Furthermore, the same instrument must discriminate between the perceptual-cognitive activities which lead to judgments that a setting is crowded and the affective-behavioral responses which result from (precede?) such judgments. Existing research seems to indicate that the cues which lead to perceptions of density vary with the situational context as well as features of the physical environment and that the perception of crowding itself is a discriminable

process from the affective and behavioral responses which also occur in high density settings. Until such instruments are constructed, studies of crowding phenomena in humans will continue to be vague in definition and difficult to relate to one another in terms of their results.

Reference Notes

1. Burch, M. A. Room "colour", trait anxiety and extroversion effects on crowding threshold and interpersonal distance. Unpublished manuscript, 1978.

References

- Anderson, E. N. (Jr.). Some Chinese methods of dealing with overcrowding. Urban Anthropology, 1972, 1, 141-150.
- Baldassare, Mark The effects of density on social behavior and attitudes. American Behavioral Scientist, 1975, 18, 815-825.
- Baum, A., & Davis, G. E. Spatial and social aspects of crowding perception. Environment and Behavior, 1976, 8, 527-544.
- Baum, A., & Greenberg, C. I. Waiting for a crowd: The behavioral and perceptual effects of anticipated crowding. Journal of Personality and Social Psychology, 1975, 32, 671-679.
- Baum, A., Harpin, R. E., & Valins, S. The role of group phenomena in the experience of crowding. Environment and Behavior, 1975, 7, 185-198.
- 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.
- Booth, A., & Cowell, J. Crowding and health. Journal of Health and Social Behavior, 1976, 17, 204-220.
- Booth, A., & Edwards, J. N. Crowding and family relations. American Sociological Review, 1976, 41, 308-321.
- Booth, A., & Johnson, D. R. The effect of crowding on child health and development. American Behavioral Scientist, 1975, 18, 736-749.

- Burch, M. A., & Walker, J. L. Effects of population density and information overload on state anxiety and crowding perception. Psychological Records, 1978, 28, 207-214.
- Cappon, D. Mental health in the high rise. Canadian Journal of Public Health, 1971, 62, 426-431.
- Cassel, J. Health consequences of population density and crowding. In R. Gutman (Ed.) People and Buildings. New York: Basic Books, 1972, pgs. 249-262.
- Choi, S. C., Mirjafari, A., Weaver, H. B. The concept of crowding: A critical review and proposal of an alternative approach. Environment and Behavior, 1976, 8, 345-362.
- Cohen, J. Statistical power analysis for the behavioral sciences. New York: Academic Press, 1969.
- Cohen, J. L., Sladen, B., & Bennett, B. The effect of situational variables on judgments of crowding. Sociometry, 1975, 38, 273-281.
- Desor, J. A. Toward a psychological theory of crowding. Journal of Personality and Social Psychology, 1972, 21, 79-83.
- Draper, P. Crowding among hunter-gatherers: The !Kung bushmen. Science, 1973, 182, 301-303.
- Eoyang, C. K. Effects of group size and privacy in residential crowding. Journal of Personality and Social Psychology, 1974, 30, 389-392.

- Fisher, J. D. Situation-specific variables as determinates of perceived environmental aesthetic quality and perceived crowdedness. Journal of Research in Personality, 1974, 8, 177-188.
- Freedman, J. L. Crowding and behavior. San Francisco: W. H. Freeman & Co., 1975.
- Freud, S. Group psychology and the analysis of the ego. (Transl. London: International Psychoanalytic Press, 1922).
- Galle, O., Grove, W., & McPherson, J. Population density and pathology: What are the relations for man? Science, 1972, 176, 23-30.
- Glass, D. C., & Singer, J. E. Urban stress. New York: Academic Press, 1972.
- Glass, G. V., & Stanley, J. C. Statistical methods in education and psychology. Englewood Cliffs, N. J.: Prentice Hall, Inc., 1970.
- Gochman, I. R. Causes of perceived crowding unrelated to density. Dissertation Abstracts International, 1977, 37(7-B), 3675-3676.
- Greenberg, C. I. Intimacy overload as a function of intrusion, surveillance and behavioral restriction: An interpersonal distance equilibrium approach to the experience of crowding. Dissertation Abstracts International, 1977, 37(11-B), 5879.
- Greenhouse, S. W., & Geisser, S. On methods in the analysis of profile data. Psychometrika, 1959, 24, 95-112.

- Hall, E. T. The anthropology of space: An organizing model. In H. M. Proshansky, W. H. Ittelson & L. G. Rivlin Environmental psychology, Man and his physical setting. New York: Holt, Rinehart and Winston, 1970.
- Harburg, E., Erfurt, J. C., Hauenstein, L., Chape, D., Schull, W., & Schork, M. Socio-ecological stress, suppressed hostility, skin color and black-white blood pressure, Detroit. Psychosomatic Medicine, 1973, 35, 276-296.
- Harburg, E., Schull, W. J., Erfurt, J. C., & Schork, M. A. A family set method for estimating heredity and stress: I. A pilot survey of blood pressure among Negroes in high and low stress areas, Detroit. Journal of Chronic Diseases, 1970, 23, 69-81.
- Hassan, R. Social and psychological implications of high density in Hong Kong and Singapore. Ekistics, 1975, 39, 382-386.
- Iwata, O. Empirical examination of the perception of density and crowding. Japanese Psychological Research, 1974, 16, 117-125.
- Kutner, D. H. (Jr.) Overcrowding: Human responses to density and visual exposure. Human Relations, 1973, 26, 31-50.
- Lawrence, J. E. S. Science and sentiment: Overview of research on crowding and human behavior. Psychological Bulletin, 1974, 81, 712-720.
- Le Bon, G. Psychologie des foules. Paris: F. Orlean. (Transl. The crowd. London: T. Fisher Unwin, 1896.)

- Loo, C. Important issues in researching the effects of crowding on humans. Representative Research in Social Psychology, 1973, 4, 219-226.
- Mackintosh, E., West, S., & Saegert, S. Two studies of crowding in urban spaces. Environment and Behavior, 1975, 7, 159-184.
- Marsella, A., Escudero, M., & Gordon, D. Dwelling density and psychological disorder. Journal of Health and Social Behavior, 1970, 11, 288-294.
- Martin, E. D. The behavior of crowds. New York: Harper, 1920.
- McCarthy, J. D., Galle, O. R., & Zimmern, W. Population density, social structure and interpersonal violence. American Behavioral Scientist, 1975, 18, 771-791.
- McClelland, L. Interaction level and acquaintance as mediators of density effects. Personality and Social Psychology Bulletin, 1976, 2, 179-182.
- Milgram, S. The experience of living in cities. Science, 1970, 167, 1461-1468.
- Mitchell, R. E. Some social implications of high density housing. American Sociological Review, 1971, 36, 18-29.
- Moore, N. C. The personality and mental health of flat dwellers. British Journal of Psychiatry, 1976, 128, 259-261.

- Proshansky, H. M., Ittelson, W. H., & Rivlin, L. G. Freedom of choice and behavior in a physical setting. In H. M. Proshansky, W. H. Ittelson, & L. G. Rivlin (Eds.) Environmental psychology: People and their physical settings. New York: Holt, Rinehart and Winston, 1975.
- Rapoport, A. Toward a redefinition of density. Environment and Behavior, 1975, 7, 133-158.
- Ross, E. A. Social psychology. New York: Macmillan, 1908.
- Saegert, S. Crowding: Cognitive overload and behavioral constraint. In W. F. E. Preiser (Ed.) Environmental design research. EDRA 4, Vol. 2; Strassbourg, PA.: Dowden, Hutchinson and Ross, 1973, pgs. 254-260.
- Schiffenbauer, A. I., Brown, J. E., Perry, P. L., Schulack, L. K., & Zanzola, A. M. The relationship between density and crowding: Some architectural modifiers. Environment and Behavior, 1977, 9, 3-14.
- Schmidt, D. E., & Goldman, R. D. Physical and psychological factors associated with the perception of crowding: An analysis of sub-cultural differences. Journal of Applied Psychology, 1976, 61, 279-289.
- Selye, H. The stress of life. New York: McGraw-Hill Book Co., 1956.
- Sherrod, D. R. Crowding, perceived control, and behavioral after-effects. Journal of Applied Social Psychology, 1974, 4, 171-186.

- Sidis, B. The psychology of suggestion. New York: D. Appelton, 1898.
- Sighele, S. Psychologie des sectes. (Transl. Paris: V. Girard et E. Briere, 1898.)
- Smith, S., & Haythorn, W. W. 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, 67-79.
- Solar, D. L. Some determinants of the feeling of being crowded. Dissertation Abstracts International, 1973, 34(4-B), 1781.
- Stokols, D. On the distinction between density and crowding: Some implications for future research. Psychological Review, 1972, 79, 275-277.
- Stokols, D. the relation between micro and macro crowding phenomena: Some implications for environmental research and design. Man-Environment Systems, 1973, 3, 139-149.
- Stokols, D., Rall, M., Pinner, B., & Schopler, J. Physical, social and personal determinants of the perception of crowding. Environment and Behavior, 1973, 5, 87-115.
- Stokols, D., Smith, T. E., & Prostor, J. J. Partitioning and perceived crowding in a public space. American Behavioral Scientist, 1975, 18, 792-814.
- Sundstrom, E. An experimental study of crowding: Effects of room size, intrusion and goal blocking on non-verbal behavior, self-disclosure, and self-reported stress. Journal of Personality and Social Psychology, 1975, 32, 645-654.

- Van Groenou, W. Crowding: A report on India. Indian Journal of Social Work, 1977, 38, 27-36.
- Webb, S. D., & Collette, J. Urban ecological and household correlates of stress alleviating drug use. American Behavioral Scientist, 1975, 18, 750-770.
- Wener, R. E. Non-density factors in the perception of crowding. Dissertation Abstracts International, 1977, 37(7-B), 3659.
- Wohlwill, J. F. Human adaptation to levels of environmental stimulation. Human Ecology, 1974, 2, 127-147.
- Worchel, S., & Teddlie, C. The experience of crowding: A two factor theory. Journal of Personality and Social Psychology, 1976, 34, 30-40.
- Zajonc, R. Social facilitation. Science, 1965, 149, 269-274.

PRE-EXPERIMENTAL QUESTIONNAIRE

S. No. _____

NAME: _____ TELEPHONE: _____

1. What is your sex? () Male () Female
2. What was your age at last birthday? _____
3. In what country were you born and raised? _____
4. In what countries have you lived and how long did you live in each one including Canada?

Country	Which Years Lived There?	How Many Years Lived There?
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

5. In what year of university are you now enrolled?
 - (1) First Year
 - (2) Second Year
 - (3) Third Year
 - (4) Fourth Year
6. What kind of dwelling did you live in longest before coming to university?
 - (1) Single family detached home
 - (2) Duplex (Two single family homes, side-by-side)
 - (3) Fourplex (Four single family homes in one building)
 - (4) Low-rise Apartment (Less than 5 floors)
 - (5) High-rise Apartment (More than 5 floors)
 - (6) Low-rise Student Residence
 - (7) High-rise Student Residence
7. What kind of dwelling do you live in now?
 - (1) Single family detached home
 - (2) Duplex (Two single family homes, side-by-side)
 - (3) Fourplex (Four single family homes in one building)
 - (4) Low-rise Apartment (Less than 5 floors)
 - (5) High-rise Apartment (More than 5 floors)
 - (6) Low-rise Student Residence
 - (7) High-rise Student Residence
8. What occupation has your father had the longest? _____
9. What is your father's present occupation? _____
10. Please circle the number which matches the estimated annual income of your family:
 - (1) Less than \$10,000
 - (2) \$10,001 to \$15,000
 - (3) \$15,001 to \$20,000
 - (4) \$20,001 to \$25,000
 - (5) \$25,001 to \$30,000
 - (6) \$30,001 to \$35,000
 - (7) \$35,001 to \$40,000
 - (8) More than \$40,000

POST-EXPERIMENTAL QUESTIONNAIRE

S. No. _____

1. With regard to the dwelling you lived in the longest before coming to university:
 - (a) How many persons lived there including yourself? _____
 - (b) How many rooms were there in your dwelling? _____
 - (c) Did you have a yard or private outdoor space which was usually used only by the persons living in your dwelling? Yes
 No

2. With regard to the dwelling you live in now:
 - (a) How many persons live there including yourself? _____
 - (b) How many rooms are there in your dwelling? _____
 - (c) Do you have a yard or private outdoor space which is usually used only by the persons living in your dwelling? Yes
 No

3. Was the dwelling you lived in the longest typical of the other dwellings in the neighborhood? Yes No.

4. When you were putting figures into the "public lounge area", what sort of place did you imagine the "public lounge area" to be?

5. What do you think was the goal of this research?

6. How do you think the experimenter expected you to behave in this experiment?

7. Was there anything in the experimental procedures which made you feel embarrassed, upset or anxious?

Appendix B

Summary of Responses to Open-ended Question Four.

Q 4 "When you were putting figures into the 'public lounge area', what sort of place did you imagine the 'public lounge area' to be?"

<u>S. No.</u>	<u>Response Summary</u>
1	- a university.
2	- an area for the public.
3	- a waiting room at a cinema.
4	- place where people are socializing.
5	- City Hall of Hong Kong.
6	- Hotel lounge area.
7	- Lobby of cinema, cafeteria.
8	- a small canteen.
9	- a place used by people.
10	- West lounge of Tache (Hall) during a party.
11	- a circulation node where people do not stay long.
12	- Administrative Studies lounge.
13	- a resting room for people to rest and talk.
14	- cafeteria, waiting room.
15	- a lounge.
16	- a place where people could gather.
17	- a cinema hall.
18	- a general place for a social meeting or small party.
19	- a general place where people can talk and relax.
20	- lounge area in a restaurant.
21	- a pub.
22	- our school lounge.
23	- a restaurant.
24	- student lounge.
25	- a party.
26	- a crowded and noisy place.
27	- a social.
28	- a place full of people doing various things.
29	- lounge in University Center.
30	- the upper level of UMSU.
31	- a typical waiting room.
32	- a place where there is a formal party or gathering.
33	- student lounge.
34	- living room at a party.
35	- a lounge in university residence.
36	- a waiting room.
37	- a crowded, noisy place.
38	- a room where a party was being held.
39	- a bar or cocktail lounge.
40	- a student lounge.

- 41 - a place where a party or meeting would be held.
 - 42 - lounge in a bus terminal.
 - 43 - a lobby.
 - 44 - Winnipeg airport lounge; busy university lounge.
 - 45 - Science lounge.
 - 46 - any lounge on university campus.
 - 47 - basement of a house where a social gathering was taking place.
 - 48 - a fairly large area, cold, not too friendly.
 - 49 - a small closed-in area similar to downstairs canteen in UMSU.
 - 50 - bus depot; lounge in hotel.
 - 51 - U of W Collegiate cafeteria.
 - 52 - a crowded place with groups of people standing around.
 - 53 - home economics lounge.
 - 54 - a general (space for) meeting people with no real assigned purpose; simply a place to go when there's nothing to do.
 - 55 - an area of conversation and mingling.
 - 56 - a university lounge.
 - 57 - waiting room in a dentist or doctor office.
 - 58 - staff room at the Bay where I work.
 - 59 - area just outside a theater or student lounge.
 - 60 - a party in a living room.
-

Summary of Responses to Open-ended Question Five.

Q 5. "What do you think was the goal of this research?"

<u>S. No.</u>	<u>Response Summary</u>
1	- man with relations to his environmental spaces.
2	- to study social interaction.
3	- to find out our ideas about congested areas and how they are affected by our background.
4	- study on personal space.
5	- to see the degree of crowdedness in Asian people.
6	- to know about crowded people.
7	- to analyze one's point of view of crowdedness in urban areas with one's past experience.
8	- to understand something about the living conditions in Hong Kong.
9	- measure personal space in public and private areas.
10	- to find the definition of 'crowded' amongst people (who) grow up in different density backgrounds.
11	- to find relation between living area of each person and feelings of capacity.
12	- I don't know.
13	- to observe our behavior.
14	- how people of different living environments react to a crowded place.
15	- to find out feelings of crowdedness of people living in high density countries.
16	- how environment affects feeling of space around a person.
17	- ability to withstand crowdedness.
18	- living environment with respect to population.
19	- each individual's concept of spacing with some connection to living quarters (housing).
20	- study feelings of crowd(ing) from those people who come from foreign countries.
21	- to find the most popular spot in a room.
22	- how comfortable I feel in a crowded area.
23	- to determine how big an area most people want to live in.
24	- to find out about what people feel about their environment.
25	- to study crowds.
26	- differences of living environment in different areas.
27	- social interaction.
28	- to see if different races would feel different under certain degree of crowdedness.
29	- to study the living standard.
30	- to find out whether race had to do with personal space.

- 31 - to discover effects of child development on home dwellings.
 - 32 - personal distance and personal background.
 - 33 - to prove that your 'comfortable level' is dependent on your mind, not the setting.
 - 34 - to see when people begin to feel uncomfortable to crowdedness.
 - 35 - how background affects when you feel crowded.
 - 36 - to see how people feel about being with a lot of other people.
 - 37 - to compare the dwelling in which I lived with an area I considered crowded.
 - 38 - to find out how comfortable you feel with a number of other people.
 - 39 - to find out about crowding.
 - 40 - how people react in public private environments.
 - 41 - to see how people feel around other people in different settings.
 - 42 - to see if subject is used to having other people in his or her dwelling in regard to his or her family's social position.
 - 43 - to find relation between our past and the number of people we are most comfortable with.
 - 44 - to determine patterns for people in rural-urban settings.
 - 45 - to compare how I would react imagining a different size room.
 - 46 - to test claustrophobia.
 - 47 - to see if home dwelling size has any affect on how many people a person feels comfortable with.
 - 48 - to see at what point people begin to feel uneasy with other people around.
 - 49 - to see where you felt most comfortable---in an open area or in your home surroundings with a number of people.
 - 50 - to find out about living conditions, crowdedness.
 - 51 - a comparison between the effects of over-crowding of populations on Canadian and Chinese.
 - 52 - to discover how people think of places as crowded.
 - 53 - to find out people's reactions to crowded rooms.
 - 54 - the number of people we feel comfortable with in regards to public and private meeting places.
 - 55 - to relate type of dwelling one lives in with their social behavior.
 - 56 - to find out how crowded a room can be before people feel uncomfortable.
 - 57 - to see changes in people who move away to a new place.
 - 58 - to see how people from larger families adjust in crowded conditions.
 - 59 - how physical environment affects our later thinking of crowds and social awareness.
 - 60 - something to do with association with other people.
-

Summary of Responses to Open-ended Question Six.

Q 6. "How do you think the experimenter expected you to behave in this experiment?"

<u>S. No.</u>	<u>Response Summary</u>
1	- No idea.
2	- The experimenter expected me to put more figures in this experiment.
3	- I shall put more figures than a Canadian living and born in Winnipeg. I shall put more figures in my home than a public lounge.
4	- To put more people in the lounge than in the living room.
5	- The goal was to see the degree of crowdedness in Asian people.
6	- I think he wants to know how many people I feel is crowded.
7	- I don't think the experimenter would expect any particular behavior from the experiment.
8	- Just what I experienced.
9	- To imagine when I was in Hong Kong.
10	- Answer in regard to the most honest manner.
11	- The experimenter would expect me to put a few persons in a room since in my case I have 13 people in 7-room house.
12	- Blank.
13	- To see what is our behavior in our daily life.
14	- Put more figures in the 'public lounge'.
15	- I don't know.
16	- To experiment with the wooden people and find out how many of them would crowd the space.
17	- Being able to put many figures in the living room.
18	- Cooperative.
19	- According to my own concepts.
20	- He expected me to behave in the actual feeling of being crowded.
21	- He would expect me to fill people up in the room.
22	- I think he expected me to behave in the way I normally would.
23	- To testing me (on) how big (of an) area I would like.
24	- Honestly.
25	- As I am in that situation.
26	- Honestly express my true experience.
27	- Normally.
28	- He would expect me to really imagine that I am in the given situation and to give my honest opinion.
29	- To reflect the living situation.
30	- Normally as if I was in the room.

- 31 - If I were a long-time city dweller, I would become crowded with more people present. As a small town person, I should feel crowded with less people present.
- 32 - By arranging the figures until you felt the room was crowded you would show what you felt the personal distance was.
- 33 - More people in a lounge.
- 34 - He expected you to feel more crowded sooner in the room which was to be from your own dwelling place.
- 35 - Honestly.
- 36 - Honestly to determine my reactions.
- 37 - If I lived in a crowded dwelling I could tolerate a more crowded environment.
- 38 - No idea.
- 39 - As directed on the sheet given.
- 40 - Put more people in the public setting than the private.
- 41 - He expects me to act as I would under normal circumstances.
- 42 - If you come from a relatively well to do family (i.e., they frequently have a lot of guests or parties) you will probably place more people in the living room. The opposite holds if you come from a middle to low class family which are not used to having many people around.
- 43 - If you've lived the longest in an apartment or crowded city, he would expect you to place more people in the rooms.
- 44 - To be careful and think about the situation or the two environments.
- 45 - I would place more people in the public lounge.
- 46 - Probably to put more people in the lounge area than the living room space.
- 47 - As one felt, he himself would feel comfortable in the setting.
- 48 - He expected me to place a lesser number of people in the room than in the lounge.
- 49 - I thought that you would place more people in your living room than in the public lounge area.
- 50 - I imagine he thought I'd put down the way I live in a dwelling.
- 51 - Typical for the questionnaire form category I fitted into.
- 52 - I don't think any required behavior was expected.
- 53 - As I really felt about crowded rooms.
- 54 - I think he expected less people to be put in the living room than in the public lounge area.
- 55 - I think he expected me to behave as I did.
- 56 - To put less people in the living room than the lounge.
- 57 - He expected to see a certain pattern in behavior.
- 58 - I think I'm expected to feel comfortable in a room with many people because of my large family size.
- 59 - Naturally.
- 60 - The way he told me to.
-

 Summary of Responses to Open-ended Question Seven

Q 7. "Was there anything in the experimental procedures which made you feel embarrassed, upset or anxious?"

<u>S. No.</u>	<u>Response Summary</u>
1-14	- No.
15	- I felt hesitated (sic) with the strange environment.
16-22	- No.
23	- Anxious.
24-32	- No.
33	- Trying to imagine you are one of the people in the setting---which one?
34-36	- No.
37	- See(ing) two-way mirror made me feel uncomfortable.
38-45	- No.
46	- I would have liked a chair. Other than that, nothing.
47-50	- No.
51	- Nothing particularly except that I was slightly anxious as I had not partaken in an experiment before and was anxious at being observed.
52	- The window was a little disconcerting but other than that, everything was fine.
53-57	- No.
58	- Maybe the part about being see through a window, but not really.
59	- No.
60	- The two situations were almost the same to me. I was thinking perhaps you were looking for a difference.

Footnotes

1. Iwata (1974) has reported what he claims to be differences in perceptions of crowding between Japanese Americans and Caucasian Americans who live in Hawaii. Similarly, Schmidt & Goldman (1976) report modest differences in the perception of crowding between whites, Blacks and Chicanos living in one city in California. However, while these studies are interesting, they represent analyses based on race (Iwata, 1974) or sub-cultural/racial differences (Schmidt & Goldman, 1976) rather than genuine cultural differences. In both instances all subjects were probably exposed to more or less the same cultural milieu despite what effects might be attributed to skin colour and "ghettoization".
2. Burch (Note 1) and Baum & Davis (1976) have shown that room hue, brightness and decoration schemes may all influence perceptions of crowding and spatial density on a Desor test of crowding threshold. In the present study, therefore, these factors were controlled.
3. It is appreciated that the method of choice in performing this analysis would be to enter Past Residential Density as a factor in a four way ANOVA which crosses Culture with Present Residential Density, Past Residential Density and Setting. However, Past Residential Density was controlled rather than analyzed directly because no Canadian controls could be found who had histories of high Past Residential Density, so ubiquitous is

the Canadian single family fully detached house. In view of this fact, the cells of the design which would have been occupied by high Past Residential Density Canadians would have been empty, render tests of some interactions impossible and tests of the Past Residential Density main effects dubious.

4. For relatively large N's, the discrepancy between Pearson, Biserial and Phi coefficients approaches zero and has little or no impact on the p values calculated for the coefficients. The only consideration which commends the Biserial coefficient over the Pearson is that it assumes that only one variable of the pair being examined is continuous and normally distributed. The Phi coefficient, of course, assumes that both variables being correlated are dichotomous. The determination of p values for both Biserial and Phi coefficients is complicated by the fact that these coefficients will attain maxima of +1.00 if and only if the proportionate cell frequencies are equal for the dichotomous variables involved. When such equal cell frequencies have not been obtained, the p values calculated for the coefficients must be considered approximate and interpreted accordingly.

Table 1
Sex of Subject

Sex	Chinese		Canadian	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
Male	16	59.9	16	59.9
Female	14	41.1	14	41.1
Total:	30	100.0	30	100.0

Table 2
Age of Subject

Age in Years	Chinese		Canadian	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
16	1	3.3	0	0.0
17	1	3.3	1	3.3
18	4	13.3	16	53.3
19	9	30.0	6	20.0
20	5	16.6	3	10.0
21	4	13.3	3	10.0
22	4	13.3	1	3.3
23	0	0.0	0	0.0
24	1	3.3	0	0.0
25	1	3.3	0	0.0
Total:	30	99.7	30	99.9

Table 3
Country of Birth & Rearing

Country	Chinese		Canadian	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
Canada	0	0.0	30	100.0
Hong Kong	19	63.3	0	0.0
Malaysia	5	16.6	0	0.0
Indonesia	2	6.6	0	0.0
Mainland China	1	3.3	0	0.0
Thailand	1	3.3	0	0.0
Singapore	1	3.3	0	0.0
Burma	1	3.3	0	0.0
Total:	30	99.7	30	100.0

Table 4
Year in University

Year Level	Chinese		Canadian	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
First Year	26	86.6	26	86.6
Second Year	1	3.3	2	6.6
Third Year	2	6.6	0	0.0
Fourth Year	1	3.3	2	6.6
Total:	30	99.8	30	99.8

Table 5
 Father's Longest Occupation

Occupational Classification	Chinese		Canadian	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
Unskilled	1	3.3	1	3.3
Skilled	4	13.3	12	40.0
Managerial/ Technical	8	26.6	6	20.0
Business/ Entrepreneurial	15	50.0	9	30.0
Professional	2	6.6	2	6.6
Retired	0	0.0	0	0.0
Total:	30	99.8	30	99.9

Table 6
 Father's Present Occupation

Occupational Classification	Chinese		Canadian	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
Unskilled	1	3.3	1	3.3
Skilled	4	13.3	10	33.3
Managerial/ Technical	8	26.6	7	23.3
Business/ Entrepreneurial	12	40.0	8	26.6
Professional	1	3.3	2	6.6
Retired	4	13.3	2	6.6
Total:	30	99.8	30	99.7

Table 7
Income

Income Level	Chinese		Canadian	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
Less than \$10,000	6	20.0	4	13.3
\$10,001-\$15,000	3	10.0	2	6.6
\$15,001-\$20,000	8	26.6	14	46.6
\$20,001-\$25,000	6	20.0	7	23.3
\$25,001-\$30,000	1	3.3	0	0.0
\$30,001-\$35,000	1	3.3	1	3.3
\$35,001-\$40,000	1	3.3	0	0.0
More than \$40,000	4	13.3	2	6.6
Total:	30	99.8	30	99.7

Table 8
Length of Residence in Canada

Length of Residence	Chinese		Canadian	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
1 Yr.	9	30.0	0	0.0
2 Yrs.	9	30.0	0	0.0
3 Yrs.	6	20.0	0	0.0
4 Yrs.	1	3.3	0	0.0
5-7 Yrs.	5	16.6	0	0.0
Life	0	0.0	30	100.0
Total:	30	99.9	30	100.0

Table 9

Analysis of Variance Summary for Crowding Threshold Scores

Source	<u>df</u>	<u>MS</u>	<u>F</u>	<u>P</u>
Culture (C)	1	567.2	6.42	.014
Present Density (P)	1	126.1	1.43	.237
C x P	1	114.1	1.29	.261
Error	56	88.36	-	-
Setting (S)	1	745.0	46.25	.0001
C x S	1	49.4	3.07	.085
P x S	1	7.0	.44	.512
C x P x S	1	6.1	.38	.542
Error	56	16.10	-	-

Table 10

Analysis of Variance Summary for Crowding Threshold Scores
Controlling for Past Residential Density

Source	<u>df</u>	<u>MS</u>	<u>F</u>	<u>P</u>
Culture (C)	1	46.00	1.05	.310
Error	43	43.75	-	-
Setting (S)	1	544.27	62.47	.0001
C x S	1	46.00	5.28	.026
Error	43	8.71	-	-

Table 11
 Non-redundant Correlation Coefficients
 and Associated p Values for the Selected Post-hoc Measures.

	Present In- Dwelling Dens.	Past In- Dwelling Dens.	Present Room Density	Past Room Dens.	Present Pri- vate Space.	Past Private Space	Typical	Culture	Private Setting Score	Public Setting Score
Present In- Dwelling Dens.	-	+ .116 (.378)	+ .588 (.001)	+ .038 (.772)	-.489 ^a (.001)	+ .040 ^a (.760)	-.039 ^a (.765)	+ .207 ^a (.113)	-.127 (.332)	+ .026 (.843)
Past In- Dwelling Dens.		-	-.106 (.422)	-.057 (.668)	+ .012 ^a (.928)	+ .184 ^a (.160)	+ .104 ^a (.429)	+ .208 ^a (.111)	+ .227 (.081)	+ .085 (.518)
Present Room Density			-	+ .561 (.000)	-.619 ^a (.000)	-.335 ^a (.009)	-.176 ^a (.179)	-.333 ^a (.009)	-.227 (.081)	-.302 (.019)
Past Room Density				-	-.264 ^a (.041)	-.589 ^a (.000)	-.128 ^a (.330)	-.662 ^a (.000)	-.275 (.033)	-.407 (.000)
Present Private Space					-	+ .360 ^b ($<.01$)	+ .150 ^b ($<.30$)	+ .234 ^b ($<.10$)	+ .088 ^a (.504)	+ .172 ^a (.190)
Past Private Space						-	+ .157 ^b ($<.30$)	+ .734 ^b ($<.00$)	+ .223 ^a (.087)	+ .287 ^a (.026)
Typical							-	+ .250 ^b ($<.1$)	+ .303 ^a (.019)	+ .374 ^a (.003)
Culture								-	+ .201 ^a (.124)	+ .385 ^a (.002)
Private Setting Score									-	+ .714 (.000)
Public Setting Score										-

^aPoint Biserial Correlation Coefficient; p values are approximate.

^bPhi Coefficient of Association; p values are approximate.

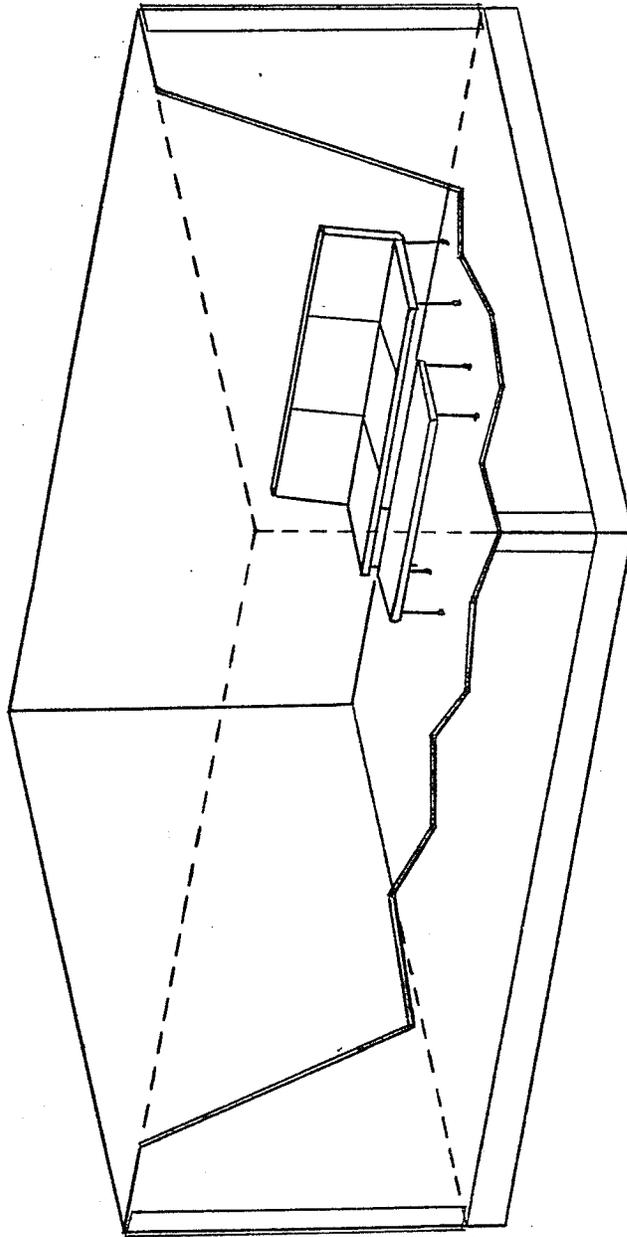


Figure 1.
Sketch of Experimental Apparatus is Orthogonal Projection. Scale = 1/3.