EFFECTS OF OPEN-PLAN HOUSING ON PERCEIVED HOUSEHOLD CROWDING AMONG FAMILIES WITH CHILDREN

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(Abstract)

The purposes of this study were (a) to compare open-plan housing to semi-open and closed-plan designs on perception of crowding and reactions to crowding and (b) formulate a theoretical basis for explaining housing and human behavior. The objectives were to determine (a) if the number of people who could occupy open-plan housing without feeling crowded would differ from the number who could occupy semi-open or closed plans and (b) if the crowding accommodation time and reactions to crowding would be influenced by floor plan design. Analysis of Variance statistical techniques were used.

Forty-five women who worked outside the home and occupied households of four or more persons with at least two children under the age of 18 were were randomly assigned to one of the three floor plan groups. Three identical models constructed with varying degrees of openness to 1" = 1'-0" scale represented the public areas of a dwelling approximately 1,150 square feet in size. Figures and furniture were constructed to the same scale. Subjects

independently placed figures in the models in four typical family activity scenarios until one more figure was perceived as one too many. The scenarios, which represented goal-directed and non-goal directed activities, varied in the level of social interaction that was anticipated. After figures were placed to simulate crowding, subjects were asked questions related to their attitudes and responses to crowding.

At the .05 level of significance, subjects placed fewer figures in the open plan model than in the semi-open and closed plans when given a scenario in which low levels of social interaction (privacy) were desirable. Significant differences were also observed among the four different scenarios. When scenarios represented goal-directed behaviors, fewer figures were placed, accommodation time was less, and reaction to crowding was greater than when scenarios represented unstructured social activities.

The results suggest that small dwellings constructed for families with children should have some division of space in the living, dining, and kitchen area to support low-social interaction and goal-directed behaviors. Further research is needed to determine if uncontrollable high social interaction within a dwelling reduces goal-directed behavior.

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CHAPTER I

INTRODUCTION

From 1945 through 1985, the openness between the kitchen, living room and dining rooms of United States housing increased (Hasell, 1991). More open space increases the apparent size of a dwelling, but other information regarding the impact on family interaction and behavior is limited. Bernstein (1975) suggested that space contributes to social interaction in two ways: (1) subdivision of space differentiates people and activities thereby controlling their behavior, and (2) open space encourages flexible use and interaction between users and their use of space. When applied to housing, Bernstein's ideas suggest that traditional closed-plan housing with its walls separating each room would limit eating activities to the dining room; social activities to the living room; and food preparation to the kitchen. They also suggest that open plan designs would permit more flexible use of space without behavior restrictions as activities flow from one room to another, thereby increasing social interaction. Overall, there is an implied assumption that increased social interaction is desirable.

An aspect that needs to be considered is the ability of occupants to control social interaction at what *they* perceive to be a desirable level. A "person-per-room"

standard was developed by the American Public Health Association (APHA, 1971) to insure that sufficient space was available to enable family members to physically perform family activities. The ability to achieve a desirable level of interaction while performing those activities is known as privacy (Altman, 1975), and it is not addressed in the APHA standard. A closed floor plan design may restrict activities in a room, but it also provides privacy--the ability to control one's own behavior by restricting visual and auditory surveillance of others. As Altman points out, privacy allows self-analysis and self-determination and is essential for normal human development.

The trend to increased openness in United States housing has not been perceived as a problem for several reasons. First: the mean square footage of new housing increased as the openness of floor plans increased. The mean area of a new housing unit built in 1949 was 1,596 square feet and the mean area of one built in 1979 was 1,709 square feet (U.S. Bureau of the Census, 1987).

Second: as floor plan openness increased more ancillary spaces were added (Hasell, 1991). The U.S. Bureau of Census (1987) reported that the median number of rooms in dwellings increased from 4.9 in 1959 to 5.1 in 1980. A new census report shows the mean number of rooms in a dwelling in 1990 up to 5.3 (U.S. Bureau of the Census, 1990).

Third: household size decreased as birthrates declined, more young people formed single-person households, and more affluent elderly people lived independently for a longer time. In owner-occupied housing the median number of persons per housing unit declined from 3.1 in 1960 to 2.6 in 1980. A similar trend was observed in renter-occupied housing where the number decreased from 2.6 in 1960 to 2.0 in 1980 (U.S. Bureau of Census, 1987).

The statistics described above can obscure potential housing problems. The mean size of dwellings will increase when there is a redistribution of resources which allows wealthier Americans to buy bigger houses and poorer Americans to go homeless. The *median* size statistic is a more appropriate measure of distribution and the difference between mean and median is indicative of housing distribution trends. In 1949 the mean size of a new housing unit was 12.3% larger than the median size of a new unit. Between 1970 and 1974, during the Nixon Administration's moratorium on new subsidized housing construction, the difference rose to 31.9%, indicating construction of large expensive housing but very limited numbers of housing units for low- or moderate-income families. By 1979 the difference dropped to 12.2% but increased again in the 1980s to 15.8%. Both the mean and median size declined in the 1980s (U.S. Bureau of Census, 1987).

Use of the mean statistic has similar effects when applied to the number of rooms in a dwelling and to the number of people in a household. The increased numbers of small households reduces the *mean* number of persons per household and disguises the fact that families may live in a smaller number of rooms and at higher densities than the national average.

Justification of the Study

Currently over 4.5 million United States households (5 percent) have 1.01 or more persons per room (U.S. Bureau of the Census, 1990) which is considered "overcrowded" by the American Public Health Association housing standards (APHA, 1971). Overcrowding within a household has been associated with aggression (Rohe, 1981; Gove, Hughes, & Galle, 1979; Gove & Hughes, 1983; Booth & Edwards, 1976); withdrawal from the house (Smith, Downer, Lynch, & Winter, 1969; Gove, Hughes, & Galle, 1979; Rohe, 1981; Harshbarger, Inman, & Curtis, 1987) and poorer quality child care (Gove, Hughes, & Galle, 1979; Booth & Johnson, 1975). Household crowding has also been linked to poor mental health (Gove, Hughes & Galle, 1979) and to negative attitudes such as marital dissatisfaction (Gove, Hughes & Galle, 1979; Gove & Hughes, 1983; Baldassare, 1979).

Noise, another stressor associated with crowding

(Meiners, 1985) produces decrements in complex task performance (Glass, Reim, & Singer, 1971). Continued exposure to uncontrollable stressors is associated with learned helplessness (Seligman, 1975), a characteristic often observed among family members living in crowded conditions (Rainwater, 1970; Lewis,1961).

Young families with children represent the fastest growing poverty group in the United States. Because they have lower incomes, they will be housed in low- to moderate-cost housing. The trend toward open-plan housing is especially prominent in low- to moderate-cost housing. *Builder* (July, 1990) illustrated 13 "affordable" housing projects from various regions of the United States. *All* 13 projects (100%) combined at least two of the three public areas (kitchen, dining, and living rooms) and five projects (38%) combined all three areas into one large room.

Families with children have the largest households and, if they are increasingly housed in new low- to moderate-cost open-plan housing, they will have a greater person-per-room ratio than other households in the United States. As disintegration of the family becomes a societal concern, living conditions that influence the behavior of families and their children must be addressed.

Purpose of the Study

The purposes of this study were (a) to compare open-

plan housing to semi-open and closed-plan housing on perception of crowding, length of time crowding will be accommodated, and reactions to crowding and (b) to formulate a theoretical framework to explain the effect of housing on human attitudes and behavior. Four different, but typical, family situations were used to increase reliability of the results on each research question. The questions were tested in four scenarios. One scenario had high levels of desired social interaction (a party) and a second simulated a confidential conversation where low levels of interaction are usually desirable. A third scenario described a task oriented situation and the fourth was an unstructured situation where no goal directed behavior was specified.

Research Questions

Questions addressed in this study were:

1) Is the number of people who can occupy open-plan housing without feeling crowded fewer than the number who can occupy semi-open or closed-plan housing?
2) Is the length of time that people can accommodate short-term crowding less in open-plan housing than in semi-open or closed-plan housing?
3) Is the level of adjustment, adaptation, and withdrawal greater in open-plan housing than in semi-open or closed plan housing?

4) Is the length of time that people can accommodate long-term overnight crowding in an emergency situation less in open-plan housing than in semi-open or closed-plan housing?

Theoretical Framework

This study was based on the theory of perceived control (Averill, 1973; Langer, 1983) and an eclectic model of environment and behavior perspectives presented by Bell, Fisher, Baum, and Green (1990). The environment and behavior model identifies the objective physical environment along with individual and situational differences as elements that contribute to *perceptions* of the environment. If the physical environment is perceived to be optimal, homeostasis occurs. If it is perceived to be outside the optimal range, arousal occurs. When arousal occurs, the individual copes by making adjustments or adaptations that may or may not be successful. Unsuccessful coping strategies lead to negative aftereffects such as performance deficits, learned helplessness, and mental illness. The theory of perceived control contends that when a person believes that he or she has control, the person will be healthier, both mentally and physically (Langer, 1983; Selig, 1975). Various types of perceived control are discussed in the literature review presented in Chapter II.

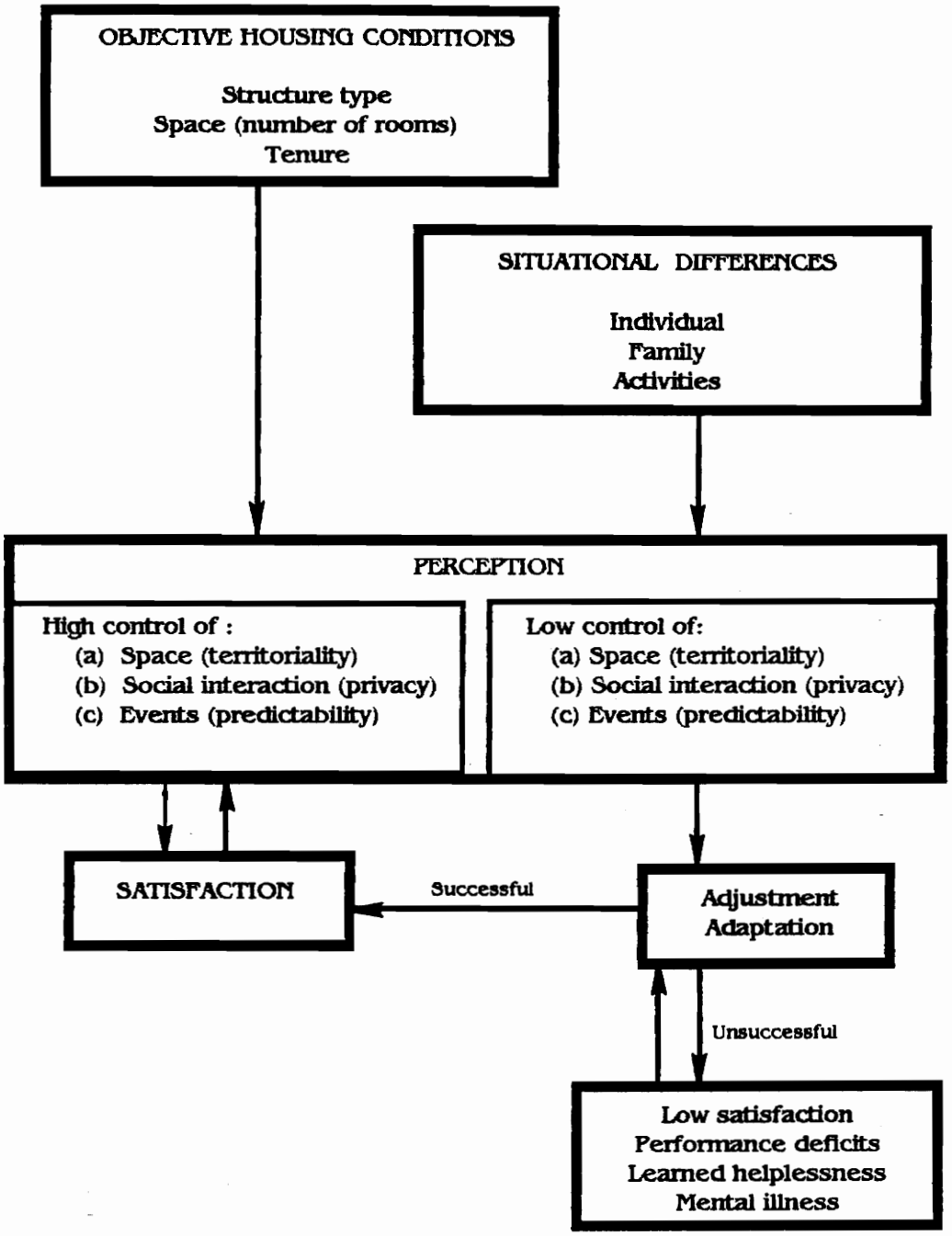


Figure 1. Theoretical framework used in this study of housing and human behavior.

The theoretical framework of housing and human behavior presented in Figure 1 assumes that housing is an objective physical environment which, along with individual, family, and situational differences, influences *perceptions of control*. Three theoretical constructs in environment and behavior studies which deal with perceived control are incorporated into the model. They are: (a) territoriality, the perceived control of physical space (Sebba & Churchman, 1983; Brower, Docket, & Taylor, 1983; Taylor, Gottfredson & Brower, 1984); (b) privacy, the perceived control of social interaction (Altman, 1975); and (c) predictability, the perceived control of events through advance knowledge (Staub, Tursky, & Schwartz, 1971).

When perceived control and its related theoretical constructs are applied to housing, the model identifies housing conditions, along with individual, family, and situational differences, as elements that influence perceived control of space, social interaction, and events in living environments. The perception of control influences the occupant's assessment of whether his or her housing is inside or outside an optimal range, which then affects the occupant's satisfaction level.

It is assumed that housing conditions which enhance an occupant's perceived ability to control space, social interaction, and events in various situations will be

perceived as within an optimal range. Housing conditions which reduce occupant perceptions of control will be perceived as outside an optimal range, requiring adjustment and adaptation. If adjustment and adaptation are unsuccessful, negative consequences will occur.

Three housing conditions which appear to influence occupant perceived control are related to three of the six housing norms described by Morris and Winter (1975): structure type, number of rooms (space), and tenure. A single-family structure provides greater separation between family units, thereby it is likely to enhance one's ability to control social interaction at an optimal level--especially when interaction is high within a family unit. Occupants are less likely to be exposed to uncontrollable interaction of neighbors through shared walls and the space between single-family units usually results in neighborhoods with fewer households than in multi-family structure neighborhoods. When greater social interaction is desirable, multi-family units are likely to enhance one's ability to increase social interaction because neighbors are closer and shared entrances provide interaction opportunities.

The number of rooms in a dwelling influences occupant ability to control social interaction at an optimal level within the family unit. As the number of rooms increases,

the number of available space choices increases. If the social stimulation is too great in one room, an occupant may find a more satisfactory level in another room if visual and acoustical separation is provided between rooms (Sebba & Churchman, 1983).

Ownership tenure increases one's control over space and permits greater personalization, an element of territoriality (Taylor, Gottfredson, & Brower, 1984). However, home ownership is also associated with maintenance requirements which may reduce perception of control if one does not have adequate skills to meet those requirements. This suggests that elderly persons (especially women) would perceive greater control and experience greater housing satisfaction in rental units where maintenance was handled by others. Evidence of increased levels of satisfaction has been reported among elderly renters when compared to younger renters (Whiteford & Morris, 1986).

Within the framework shown in Figure 1, this study assessed the influence of space (number of rooms) and situational differences (activities) on perception of ability to control social interaction (privacy). Uncontrolled social interaction at a level of stimulation higher than desired is subjective crowding. The density at which crowding is perceived when space is not divided into separate rooms (open floor plan) was compared to the density

at which it is reported when space is divided (semi-open and closed floor plans). Theoretically, occupants of open-plan housing (which provides limited opportunities for visual or acoustical separation in the public areas) will experience crowding at lower densities. As a result, occupants of open-plan housing will experience higher levels of adjustment and adaptation behavior and will accommodate crowding for shorter periods of time.

Hypotheses

Four hypotheses which address perceptions of ability to control social interaction in open space compared to perceptions of control in divided space were tested in four different typical family situations: (a) an unstructured situation where the subject determines the activities; (b) a complex task performance situation; (c) a private conversation situation; and (d) a ceremonial (party) situation. The null hypotheses were:

$H_0$1: The number of people who could comfortably live and interact in the open floor plan model until crowding is perceived will be no less than the number of people in the semi-open or closed plan models in the four typical family situations.

$H_0$2: The length of time that a crowded household condition is accepted will be no less in the open floor plan

model than in the semi-open or closed plan models in the four typical family situations.

$H_0$3: The level of adjustment and adaptation that is experienced in crowded household conditions will be no greater in the open plan model than in the semi-open or closed plan models in four typical family situations.

$H_0$4: The number of nights that crowded conditions can be accommodated in an emergency situation will be no less in the open-plan than in the semi-open or closed-plan models in four different typical family situations.

Delimitations of the Study

This is a simulation of conditions in small housing units and the results are generalizable to units in which the kitchen, living, and dining areas total approximately 600 square feet. The conditions are comparable to most lower-cost units in multi-family multi-story apartments. The results are not applicable to smaller households where initial "persons per room" density is low, and may not be applicable in large dwellings which provide more space choices through larger bedrooms, basements, patios, decks, and family rooms.

Because females are less likely than men to perceive crowding and because perception of crowding increases as the

length of exposure time increases (Freedman, 1975), only women who worked outside the home were asked to participate. Volunteer subjects were women who worked away from home at least 50 percent of the time, lived in households of four or more persons, and lived with at least two children under the age of 18 years. The subjects, all of whom were employed at East Tennessee State University, represent a variety of middle socio-economic levels through employment in academic, professional, clerical, and maintenance positions. While the geographic area represented is small, because of its university association, the population had diversity in geographic background, education, and income.

Since all subjects were women who spend much of the day away from their dwelling and may have had personal spaces at work, they are assumed to represent a segment of the United States' population that is least influenced by household crowding. Men and women who do not work outside the home and who spend more time in their dwelling may perceive crowding at lower density levels than the participants of this study.

Limitations of the Study

This study was limited to an assessment of differences in behavior and attitudes toward the number of people who could occupy dwellings with varying degrees of openness

between rooms. The research design controlled for unidentified variations through random assignment of subjects, but it did not specifically address differences in perceptions of crowding or privacy related to scale models, age, sex, culture, or socio-economic conditions. Furthermore, the study did not include other housing features which may influence perceived control such as structure type, neighborhood, accessible outside space, tenure, quality, soundproofing, or management policies. There is no evidence to suggest that when these variables are controlled, the effects attributed to floor plan design will differ from those observed in this study.

CHAPTER II

LITERATURE REVIEW

This chapter focuses on the evolution of housing floor-plan design, research on crowding and perceived control, and the relationship of perceived control to freedom of choice, privacy, territoriality, and predictability in housing. These concepts are integrated into a discussion of housing by relating them to three of six typical United States family housing norms: (a) tenure; (b) structure type; and (c) space. The purpose of this chapter is to present the basis of theory for explaining the influences of housing on human attitudes and behavior.

A Historical Perspective

Housing Floor Plan Design

Major changes have occurred in the design of housing floor plans since 1945. The kitchen is more open to other rooms and the relationship between rooms has changed (Hasell, 1991). In *Classic Old House Plans: Three Centuries of American Domestic Architecture*, only one of 35 houses built before 1930 combined any of the three public rooms (Grow, 1984). Craftsman homes, which are often smaller than the classic old houses, show more openness between rooms and more combination of rooms. In *Craftsman Homes*, Stickley (1979) illustrates 36 plans. Of these, 52% have wide door

openings or combined living and dining rooms. However, most have pocket doors between rooms that can be closed if additional separation is needed. In the same publication, 17% of the kitchens are open to, or combined with, the dining room; never are all *three* rooms open or combined, insuring that each house will have at least two distinct and separate public rooms.

Housing built in the 1990s is more likely to have two rooms combined and often has all three combined. In *Builder* (July, 1990) 13 "affordable" housing projects from various regions of the United States were featured. All 13 projects (100%) combined at least two of the three public areas (kitchen, dining, and living rooms) and five projects (38%) combined all three areas into one large room. The affordable projects depicted in this issue were intended to meet the needs of limited income families. Since families with children are frequently in limited income or poverty groups, it is likely that many families with children will be living in housing where food preparation, eating, and socialization are all performed in one room.

When family size remains constant, the open-plan concept increases the persons per room density ratio and, according to standards established by the American Public Health Association (1971), 1.01 or more persons per room is "crowded." Currently there are over 4.5 million households

with 1.01 or more persons per room (U.S.Bureau of Census, 1990). This measure, however, is considered faulted because the size of rooms is not taken into consideration (Morris & Winter, 1978). Evidence to substantiate or refute whether the number of rooms has more influence on occupant behavior and crowding than the size of rooms when dwelling area remains constant is lacking. The research presented later in this report was designed to address that issue.

Crowding: Animal Studies

Crowding became an issue in the 1960s and continued into the 1970s as "babyboomers" matured and tried to establish households or entered college and lived, three and four, in dorm rooms built for one or two. Ehrlich (1968) warned of impending population problems and Frejka (1973) calculated that the world population would double in 50 years. Animal studies provided support for the cause for concern. Both laboratory methods and naturalistic observations with animals suggested that crowding produced pathological effects. In naturalistic observations Dubos (1965) observed lemmings destroy themselves by migrating into the sea when their population reached a certain level, and Christian (1963) observed natural changes in a deer population.

In a laboratory setting, Calhoun (1962) was able to

demonstrate population growth and social behavior in a rat colony by manipulating social density. Rats were allowed to multiply naturally within an ideal living environment. When the density of the colony was low, the rats ate, slept, mated, built nests, and raised young normally, without fighting. When the colony became extremely crowded, social order disintegrated. However, dead-end rooms on each end of the pens had less traffic, lower densities, and more control by the occupying rats. In pens where density could be controlled, the mortality rate among pregnant females and the young was lower and their behavior was closer to normal. This ability to exercise control over physical space was identified as territoriality.

Other animal crowding studies revealed other negative results. Both increased aggression (Southwick, 1967) and withdrawal (Anderson, Erwin, Flynn, Lewis & Erwin, 1977) were observed in populations of monkeys. Poorer performance on complex tasks (but not on simple tasks) was shown in rat studies (Goeckner, Greenough, and Maier, 1974). It was observed however, that humans did not respond to crowding in the same way as animals. At a sporting event, excitement is often intensified in crowds and more subdued in an empty stadium.

Crowding: Human Studies

Along with the growth in population was an urbanization trend that was predicted to intensify the crowding caused by an expanding population (Frejka, 1973). Rioting exploded in growing United States cities and residential crowding was thought to be a contributing cause. Dire predictions based on animal research spurred the study of human crowding on college campuses and in the nation's cities.

Results were mixed. Early correlational studies using census tract data did not show consistent relationships between neighborhood densities and the pathologies observed in animal studies (Freedman, 1975; Galle, Gove, & McPherson, 1972; Schmitt, 1966). Later studies showed relationships between dwelling unit densities and numerous negative events such as poor child care (Gove & Hughes, 1983) and withdrawal from the home (Gove et al., 1979; Rohe, 1981). But, the significance of these studies was often disputed because of unexplainable and conflicting results. Some of the results are now attributable to variations in measuring techniques (Beeghley & Donnelly, 1989) and others to the moderating factors such as control (Bell et al. 1990).

The concern about human crowding diminished as population growth rates declined with acceptance of oral contraceptives and the legalization of abortion. Furthermore, publication of Newman's (1972) work on

"defensible space" placed more emphasis on the concepts of control and perceived control (territoriality) as factors influencing human behavior and well-being in high density conditions. Freedman's (1975) laboratory studies on human crowding may also have contributed to a sense of immunity to crowding within the human population. Freedman disputed the generalizability of animal studies to human populations and cited his own research as evidence. The research included evaluations of task performance and emotional reactions among male and female subjects under varying density levels. The subjects were studied in laboratory settings for specified periods of time. The results showed crowding to be a positive experience for females and negative for males, with both groups feeling more intense reactions (either positive or negative) when the density of the room was increased.

Weaknesses of Freedman's research are the artificiality of the laboratory setting and short-term exposure to high densities which prevented over-stimulation. A real-life comparison could be a mother who spends three hours in an average five-room house helping her neighbor give a birthday party for 15 pre-schoolers. She knows it will be over in three hours! The ability to predict that a scheduled short-term high-density situation will end within a reasonable period of time provides a sense of control over the

situation. Normal living and work situations, however, expose people to high densities over long periods of time without the predictability of reducing the density at any specified time. The emotional reaction of a mother living in a five-room house with 15 children is likely to be entirely different than that of the mother who spends a short time in that same-size house during a birthday party.

Evidence relating dwelling unit density and crowding began to accumulate through the 1980s but most housing studies addressed it from a "propensity to move" perspective (Lam, 1985; Memken & Stainaker, 1987; Memken, Morris & Winter, 1988; Morris & Jakubczak, 1988). The effects of crowding on families that could not move received less attention.

Current Perspectives

Crowding and Perceived Control

Recent authors have addressed the mediating factor of perception, especially perceived control, on crowding (Bell et al. 1990). Excessive social contact, reduced behavioral freedom, unregulated interaction, and disruption of goal-directed behavior have been identified as critical causes of crowding. Each of these causes implies a lack of control in some aspect of interaction with others. In a crowded elevator, subjects closest to the control panel felt better

and thought the elevator was larger than subjects in the rear of the elevator (Rodin, Solomon, and Metcalf, 1978). Seligman (1975) showed that when individuals believed they had no control over the outcomes of their actions, their actions became ineffective or they did nothing. The phenomenon is called "learned helplessness."

Empirical evidence linking residential crowding to learned helplessness is provided by Rodin (1976) who demonstrated in one experiment that children who lived in high density conditions were less likely to try to control the administration of rewards than children who lived in low density situations. In a second experiment she showed that when first exposed to an unsolvable problem, children living in high density situations did worse on a subsequent solvable problem than children from low density situations. In a third study of children and household density, Saegert (1982) found evidence of greater distractibility and hyperactivity among children from high density homes, along with lower reading scores and vocabularies. These studies suggest that more evidence is needed on the relationship between housing characteristics and control, the ability to regulate interaction within high density households. Behavioral responses, control, crowding, and density may be related to housing. A review of these concepts is provided on the following pages.

Behavioral Responses

Numerous responses to aversive stimuli have been identified in the literature. For this study, three responses are being defined and will be measured. They are: (a) adjustment, (b) adaptation, and (c) withdrawal (Montano & Adamopoulos, 1984).

Adjustment. Adjustment refers to changing the environment or the stimulus while *adaptation* is a change in one's response to a stimulus (Sonnenfeld, 1966). Adjustments may enable an individual to continue performing a task or may require that he or she abandon the task. For example, in a noisy housing environment, putting the children to bed is an adjustment which illustrates control over the stressor (noise) and over the interaction in the environment. An alternative adjustment in a noisy housing environment might be to change the environment by closing a door or moving oneself to another room. The adjustment could permit completion of a household activity or it could result in the abandonment of the activity.

Leaving the house is an adjustment which provides a totally different environment. It suggests that control over stimuli in the original environment is limited. This type of adjustment will likely result in the abandonment of an activity that was being performed in the house.

Adaptation. Adaptation to stressors such as crowding,

noise, and shock occurs when sensitivity to a stimulus becomes weaker (Bell, Fisher, Baum, & Greene, 1990). While adaptation is beneficial because almost all life events involve some degree of stress, it may be costly if the stressor is prolonged or excessive. The authors noted that

> Our information-processing capacity becomes so overloaded by the stressor that we ignore other important stimuli, including other human beings and stimuli relevant to job performance, safety, and health. Some costs of adaptation may occur during exposure to the stressor, including performance decrements and physiological wear and tear. Other costs may occur after the stressor is no longer around. . . . . Cognitive deficits associated with stress may be caused by behavioral strategies that are used for coping with stress--"tuning out" or narrowing one's field of attention (p. 121).

An example of adaptation to noise is cited by Cohen and associates (Cohen, Evans, Krantz, & Stokols, 1980, 1981). The authors found that children who attended noisy schools near an airport exhibited more signs of helplessness than children from quieter schools. High density residential settings have produced similar results. Rodin (1976) found that children from high density homes were less able to control their ability to receive rewards. Seligman (1975)

demonstrated that when people believe they can't control outcomes by responding appropriately, they no longer respond.

Withdrawal. To withdraw is to remove oneself from social interaction by such behaviors as reducing eye contact (Baum & Koman, 1976) and keeping a greater physical distance from others (Baum & Greenberg, 1975). Evidence that men spend less time in a home as density of the home increases (Harshbarger, Inman, & Curtis, 1987; Smith, et al, 1969) suggests that crowding and withdrawal behavior occur in the home.

Control and Perceived Control

Control is a psychological construct that can be categorized into three parts: (a) behavioral, (b) cognitive, and (c) decisional (Averill, 1973). Perceived control is a subconscious assumption about the control of one's environment or life events that produces a generalized expectancy. When one believes or behaves in a certain way, reinforcement of that belief or behavior acts to strengthen the expectancy that a similar belief or behavior in the future will be followed by similar reinforcement (Langer, 1976; Rotter, 1975). Rotter categorized perceived control into internal and external locus-of-control. In each of the following three categories, control may be actual or perceived.

Behavioral control. Behavioral control is the ability to affect the environment while cognitive control relates to thinking about events. For example, an individual can have behavioral control over the temperature in a room by changing the thermostat setting (Averill, 1973). The ability to produce desired changes in other aspects of the household environment is assumed to be evidence of behavioral control.

Cognitive control. Cognitive control is the ability to understand a situation and change one's perception about it based on knowledge (Averill, 1973). Cognitive control, also referred to as predictability has been studied using aversive stimuli such as noise and electrical shock. Knowledge about the intensity and onset of loud noise and electrical shock reduces stress-related effects (Glass & Singer, 1973; Staub, Tursky & Schwartz, 1971).

Decisional control. Decisional control, also referred to as freedom of choice (Barnes, 1981), is the ability to choose between distinguishable alternatives. When individuals perceive that a choice is available, they will tolerate higher intensities of aversive stimuli for longer periods with less perceived discomfort (Sherrod, 1974; Glass, Singer, Leonard, Krantz, & Cohen (1973). An example of this concept in housing is the success of housing vouchers. The higher satisfaction among voucher recipients

(even with lower quality housing) suggests that freedom of choice may be a contributing factor to housing satisfaction (Struyk & Bendick, 1981; Friedman & Weinberg, 1982).

Control Related Constructs

The constructs of control and perceived control are closely tied to three other constructs: (a) privacy, (b) territoriality, and (c) predictability.

Privacy. Privacy is a dialectic and optimizing process which serves to control and manage social interaction (Altman, 1975). An important aspect of privacy is that there are desired levels and achieved levels. When the achieved level is equal to the desired level, an optimum state of privacy exists. Figure 2 illustrates the concept of privacy in graphic form. For any given situation, each individual may have his or her own level of desired (optimum) privacy. Fisher, Bell and Baum (1984) state, "When others impinge on our privacy, we try to restore our desired level by backing off, avoiding eye contact, or erecting barriers. When we have too much privacy, we try to increase social interaction, maintain eye contact, and remove barriers" (p. 69).

The term "privacy" is frequently interpreted to mean social interaction at an optimum level. Meiners (1985) asked subjects to record and describe characteristics of their "private" and "non-private" times. Private times were

described with adjectives such as "sharing activities," "alone to think," "quiet," and "alone with someone to talk." Non-private times were described with words like "interrupted" and "noise, crowds, and annoyance." Lack of privacy is linked to crowding in that the terms used by subjects to describe crowding are similar to those used to describe non-private time (Baum & Greenberg, 1975; Meiners, 1985). In this study, privacy is defined as a dialectic and optimizing process for managing and controlling social interaction at an optimum level. It is assumed that subjects will have varying levels of desired interaction and that they will be able to communicate that level in different situations.

Territoriality. Territoriality refers to the personalization or marking of areas and to ownership (perceived or real) of a place by a person or group (Edney, 1974; Altman, 1975). Territoriality increases an individual's ability to control a physical space (Sebba & Churchman, 1983; Brower, Docket, & Taylor, 1983; Taylor, Gottfredson, & Brower, 1984) and the control of physical space increases his or her ability to regulate interaction with others (Sundstrom & Altman, 1974; Sebba & Churchman, 1983). In other words, territoriality enhances privacy.

Predictability. Predictability is the perception of an ability to determine the onset or termination of a stressor,

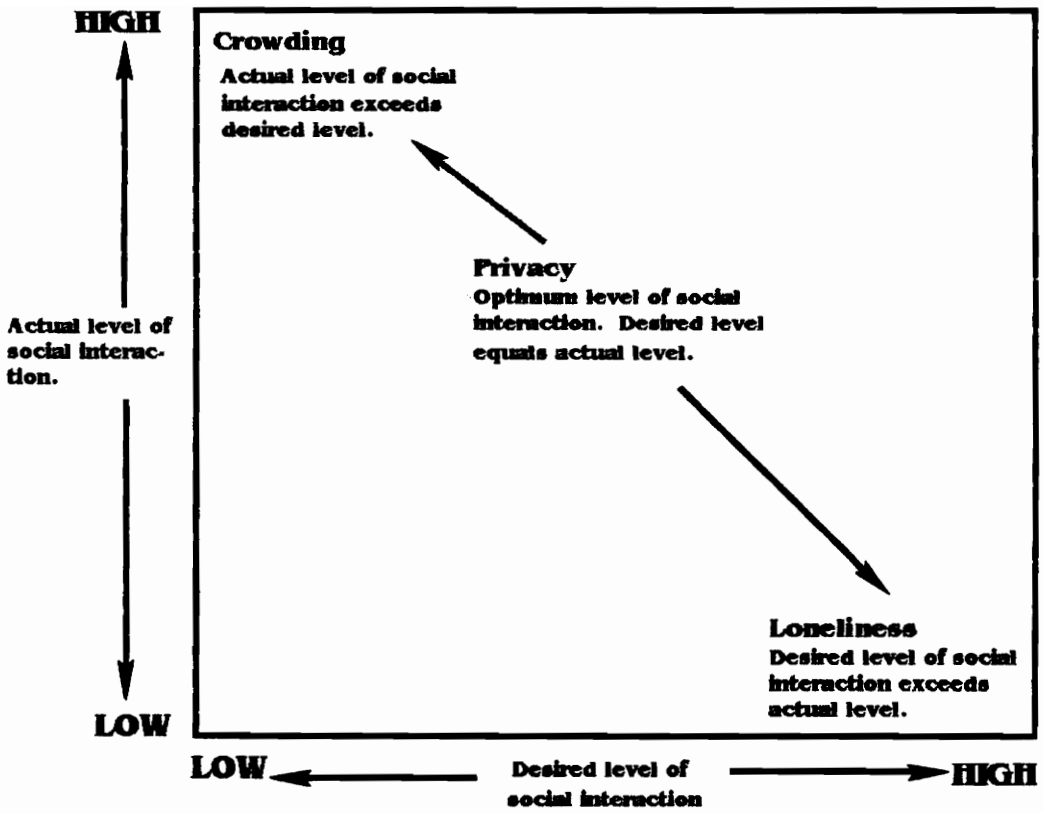


Figure 2. Levels of social interaction in a dialectic and optimizing process presented by Altman (1975) and referred to as privacy.

thereby giving the individual a sense of control over the stressor (Glass & Singer, 1973). Even though the onset of an event cannot be controlled, the perception of ability to

determine its onset and duration reduces the negative impact of the event (Staub, Tursky, & Schwartz, 1971). Housing environments which have few aversive events (such as crime) are perceived as safe and are more satisfying (Rent & Rent, 1978; McCarthy & Saegert, 1978).

Crowding

Crowding has been difficult to define because the definitions often contained a response in the meaning (Beeghley & Donnelly, 1989, p. 89). The authors state:

> Gove et al. (1979) defined crowding as involving an `excess of social stimuli, generally in the form of demands, combined with an inability to regulate or control when one is expected to respond to them' (p.11). Similarly, Booth and Cowell (1976) defined crowding as a situation `where people must engage in verbal and nonverbal communication and accommodate the movements and activities of others more or less constantly in the course of their daily lives' (p. 205). In both cases, the definition built a response to the condition into its meaning. A good definition of crowding should exclude such reactions.

A criterion for crowding recommended by Beeghley and Donnelly (1989) is that it distinguish between objective and subjective crowding. While objective crowding may be defined as too many people for too little space, somewhere

in the past there was a value judgement that determined how many was too many. For example, Greenfield & Lewis (1969) developed an "overcrowding" index using five basic value assumptions and standards set forth by the Housing Assistance Administration (cited in Greenfield & Lewis, 1969). The standards, too, were based on value assumptions. Since standards are likely to vary from culture to culture, objective crowding is ultimately a subjective variable. Therefore, any reference to crowding as an objective variable needs to be clarified with a clearly stated density ratio.

Subjective crowding. Subjective crowding is a feeling of being crowded (Beeghley & Donnelly, 1989). When the definition for subjective crowding is used, crowding can be easily measured empirically. Measures of perceived lack of privacy and perceived excess of demands have been used (Gove et al.1979) as well as questions about "lack of space" and "not enough room to move around in." In this study crowding is a subjective variable measured by subjects' perception of too many people in a space.

Near crowding. Near crowding occurs when crowding, measured as the perception of too many people for a specified space, has not been reached, but one more person in that space would produce feelings of crowding (Desor, 1972).

Density

Density is the ratio of number of people to amount of available space. It is obtained by focusing on or manipulating one or the other components of the ratio. When the number of people is manipulated, social density changes. When the amount of space is manipulated but the number of people remains constant, spatial density changes (Jain, 1987; Fisher, Bell, & Baum, 1984; Loo, 1977).

Spatial density. Spatial density is further classified by the type of space being considered. Numerous types have been studied including: rooms (Rohe, 1982); dormitory rooms (Bickman, Teger, Gabriele, McLaughlin, Berger, & Sunaday, 1973); bedrooms (Wiesenfeld, 1987); and structures (McCarthy & Saegert, 1978; Rodgers, 1982). Structures per area and persons per square mile (Galle, Gove, & McPherson, 1972) have also been used to classify density.

There is some confusion between the term density and the term crowding which may originate from the work of Jacobs (1961). Jacobs argued that a large number of units per acre was good for a city but a large number of persons per room had negative effects. The latter became known as overcrowding and the former as density. Recently researchers have been able to reduce some of the confusion by using a descriptive term to identify a specific type of density; however, even that is not always consistent.

Wiesenfeld (1987) used the term residential density to mean the number of people per bedroom, while McCarthy and Saegert (1978) used it to mean the number of families per structure and Spaulding (1973) used it to mean distance between dwellings (1973).

Social density. Social density was used in this study because the focus was on manipulation of the number of household members in a specified area of a housing plan. Household size was manipulated while the area remained unchanged. Other terms used in the past to identify this type of density include: density within a dwelling (Bickman et al, 1973); inside density (Jain, 1987); dwelling density (Marsella, Escudero, & Gordon, 1970); residential density (Rosenberg, 1968); and overcrowding (Jacobs, 1961; & Galle, Gove, & McPherson, 1972).

Perceived Control and Housing Norms

Evidence of an association between perceived control and housing norms is suggested in housing satisfaction and mobility research. According to a model of housing adjustment (Morris, Crull, & Winter, 1976) there are two standards which families use to assess the adequacy of their housing: (a) cultural norms, the housing standards of a culture, and (b) family norms, "standards for housing developed by the family itself that may or many not correspond closely with cultural norms for housing" (1976,

p. 309). The norms that families seek are placed into six categories; space, structure type, quality, neighborhood, tenure, and expenditure. Each of the first four categories is related to some physical housing characteristic found to be more satisfying by occupants. Evidence also suggests that each of the first five norms is related to some type of perceived control which is also related to the control of social interaction (privacy and crowding). Floor plan design, which is part of the housing norm of space, will be addressed in this study.

Floor plan design

A floor plan design refers to the location of rooms in relationship to other rooms in the design of a dwelling. Three different floor plan designs are addressed in this study. They are: (a) an open-plan design, (b) a semi-open plan design and (c) a closed-plan design. Figures 3-5, shown on the following pages, illustrate the type of floor plan as well as the furniture layout used for scale models in this study.

Open-plan design. Open-plan housing refers to a style of floor plan in which activity areas are undifferentiated with walls (Raskin, 1974). Activities generally associated with living, dining, and kitchen areas are performed in one large room. Figure 3 illustrates the open plan used to construct the scale model for this study.

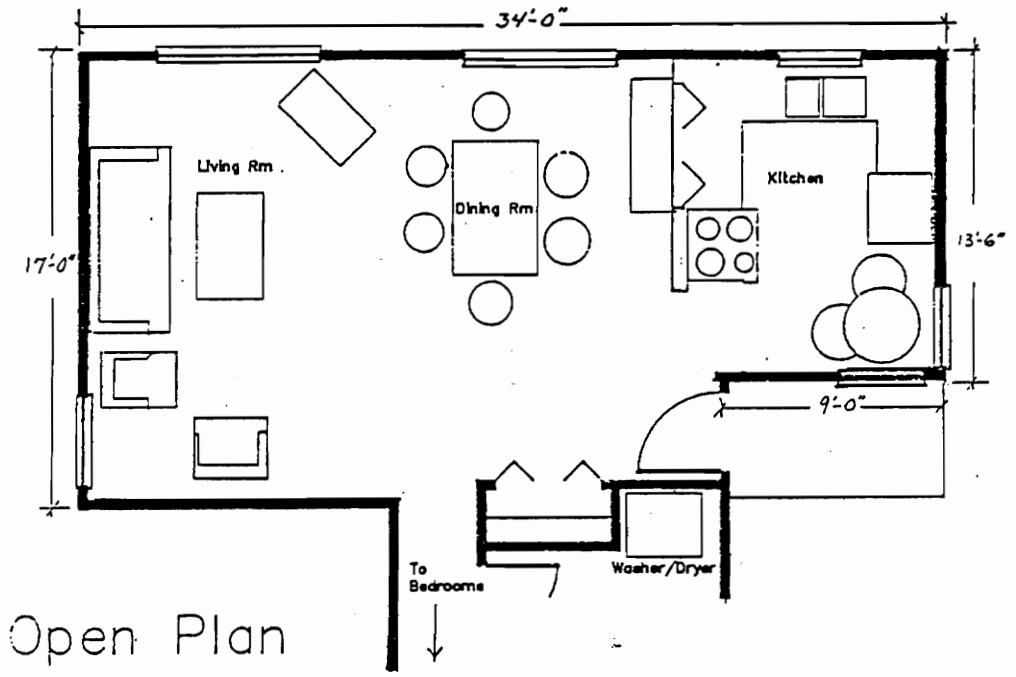


Figure 3. Open-plan design with no visual separation between the kitchen, living, and dining rooms.

Semi-open plan design. The semi-open plan in this study was designed to provide visual and auditory separation between activity areas if desired by closing doors or dividers. The plan is flexible in that walls can be opened to allow a flow of social interaction from one activity space to another. The semi-open plan used to construct the model for this study is illustrated in Figure 4.

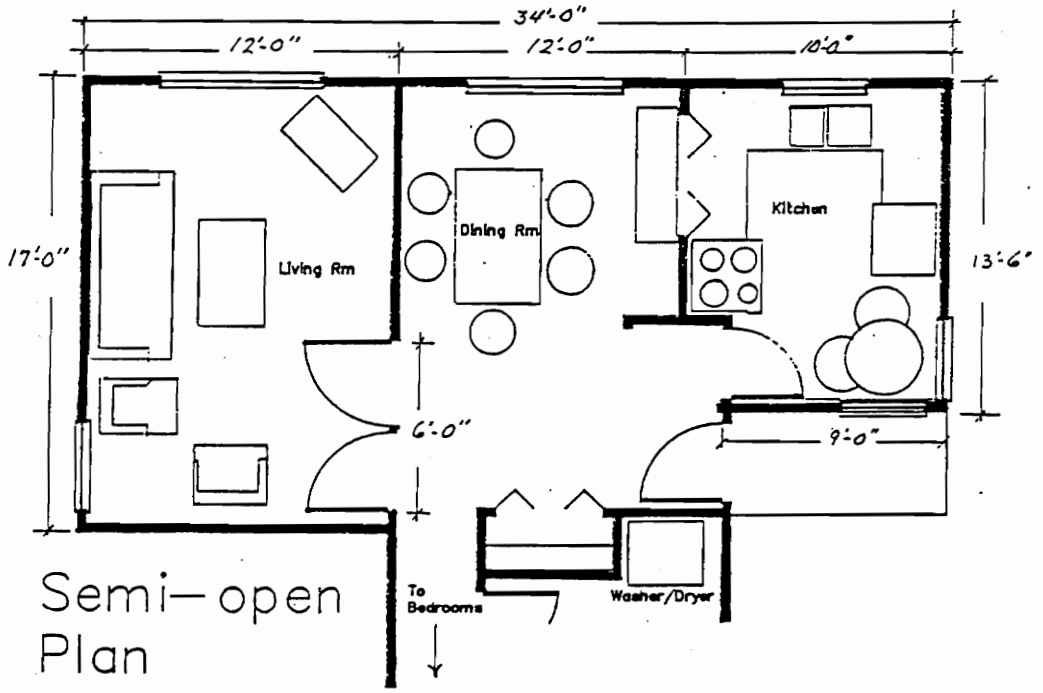


Figure 4. A semi-open plan in which visual and auditory separation is possible by closing doors.

Closed-plan design. Closed-plan design housing refers to a traditional style of floor plan in which walls provide visual and auditory separation between activity areas. Activities such as food preparation, dining, and socialization are usually performed in rooms designated for each activity. The closed plan used for the model is illustrated in Figure 5.

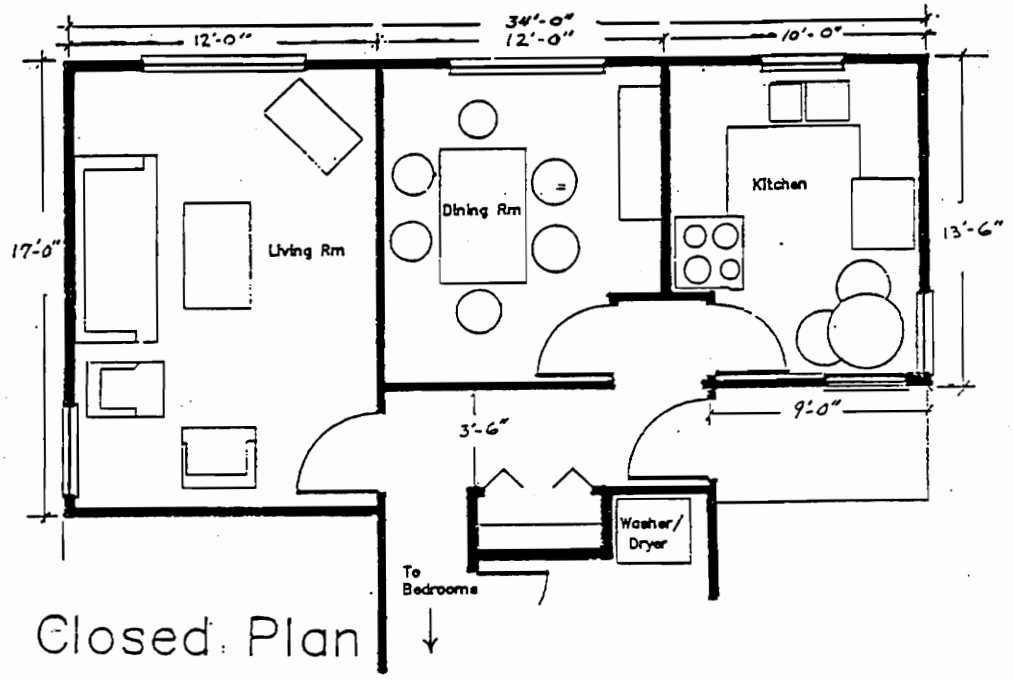


Figure 5. A closed plan has the kitchen, living, and dining rooms separated by walls and doors that can be closed for visual and auditory separation.

Perceived Control and "Freedom of Choice"

Langer wrote "Control is the active belief that one has a choice among responses that are differentially effective in achieving the desired outcome" (1983, p. 20). The concept of perceived control, as previously discussed, is the belief that one's outcomes are influenced by one's actions. When linked to "freedom of choice," perceived control is further defined by the need for clearly visible differences in outcomes. If differences in outcomes are not visible, no choices are perceived and no control is perceived.

Other authors have identified "freedom of choice" as a unifying concept between privacy, territoriality, and crowding. Proshansky, Ittelson, & Rivlin (1970) suggested that privacy is the ability to choose what information will be conveyed to others and territoriality is the ability to choose what occurs within a given space. They imply that crowding results from the inability to choose. Langer (1983) stated that control is a belief in the availability of choice and Proshansky et al. suggested that having a choice is having control. In both references, perceived control is linked to choice.

Using architectural elements in a laboratory setting, Barnes (1981) was able to demonstrate that perception of choice is related to the availability of distinct options.

Furthermore, when distinct options are available, decisions are internalized (i.e., attributed to preference) which promotes a belief in the ability to overcome future uncertainties (Harvey & Harris, 1975).

The perception of control that is generated when choices are available enhances physical and mental health. In a survey of housing deficits among female headed households (Baillie, 1986), lack of "freedom to change interior" was found to be a housing deficit associated with psychological stress. In a nursing home setting (Langer, 1983), perceived control was generated among a randomly selected group of residents by making them aware of the fact that they had the option to take more control of their lives. No other treatments or conditions were imposed. Residents who were in the "choice" group were more physically active and more satisfied than those in the group unaware of a choice.

In housing, the initiation of a government housing allowance system (Hays, 1985) provided greater freedom of choice by allowing low-income families to find and secure their own housing rather than to accept an assignment from a public housing authority. HUD's evaluation of the system indicated that it is an efficient method of providing housing assistance and it is often more satisfactory to the occupants than public housing. The higher satisfaction

among voucher recipients (even with lower quality housing) suggests that perceived control through choice may be a contributing factor to housing satisfaction (Struyk & Bendick, 1981; Friedman & Weinberg, 1982). Additional empirical evidence is needed to better understand the relationships between housing (interior and exterior) and freedom of choice or perceived control.

Freedom of Choice and Housing Norms

The following two housing norms are linked to perceived control through "freedom of choice."

Tenure. Ownership is a tenure norm in housing (Morris & Winter, 1975). Ownership is associated with greater housing satisfaction than rental tenure among all groups except elderly home owners (Whiteford & Morris, 1986). It is also associated with more freedom of choice in that ownership can be transferred, used as collateral, or passed on to others after death (Jennings, 1985). Residential leases often prohibit transfer from party to party.

Structure type. The single-family-detached home is a housing norm linked to "freedom of choice." Single-family-detached housing is located in many neighborhoods throughout most urban, suburban, and rural areas, providing a wide choice in location. The amenity choices also vary widely (Shlay, 1985). Multi-family housing is often restricted by

zoning to areas on the edge of commercial districts and amenities may be limited by location, price range, or style, thus reducing the distinct and acceptable choices in multi-family housing.

Perceived Control and Privacy

Altman (1975) conceptualized privacy as a process by which social interaction is regulated and controlled by an individual. Important features of privacy are that it is dialectic and optimizing and involves different types of social units, including household units. Meiners (1985) revealed that the term "private time" is interpreted by subjects to mean time in which they could be "alone with another to communicate thoughts, feelings, etc.;" "sharing activities;" and "alone to do something active or think." "Non-private times" were described as "wanting to be alone away from others;" "activity interrupted;" "noise, crowds, activity produced annoyance"--descriptions which suggest lack of control over social interaction.

Descriptive reports by subjects in dense living situations reveal that "lack of privacy" is a condition characterized by interruptions and restrictions on behavior. Oscar Lewis (1961) described a child's account of life in the ghetto, revealing social withdrawal and restricted behavior. Goodwin (1964) reported conditions that suggest

lack of control such as the inability to talk with friends, listen to the radio, and read. Lack of control in social interactions is associated with physical characteristics of a dwelling. Sebba and Churchman (1983) interviewed 45 families in identical housing units and asked all occupants if there was a place in the dwelling where nobody would disturb them. Among the interviewees who occupied a glass-walled porch as a bedroom, 71% indicated there was no place they could go where they would not be disturbed. Only 27% of those who occupied a traditionally walled bedroom responded similarly.

The importance of privacy and private time in the home are not well documented, but some studies suggest that privacy may have a substantial impact on family behavior. More pleasant communication (Meiners, 1985), increased social interaction (Sebba & Churchman, 1983; Mercer, 1980), and more positive attitudes (Baum & Davis, 1980) are some of the positive aspects of being able to control social interaction. Since men spend less time in the home as density increases (Smith et al, 1969; Harshbarger, Inman, & Curtis, 1987), withdrawal from the home may be one of the important negative aspects of reduced privacy.

Privacy and Housing Norms

The following three housing norms are linked to the ability to control social interaction.

Space. The number of rooms (especially bedrooms) is a housing norm related to the number of persons in a household (Morris & Winter, 1975). When home-owner shoppers were asked to list their major reasons for wanting to purchase a different home, the four reasons most frequently given were: (a) more privacy (87.0%), (b) private yard (84.0%), (c) no common walls (82.2%), and (d) larger home (70.8%) (Fletcher, 1987). Each of the reasons implies that greater control of social interaction is desirable.

Structure type. The single-family-detached home provides greater privacy than any other structure type because it has no common walls, the nature of its structure reduces overall neighborhood densities, and it usually has a transitional territory (yard) which enhances the ability to control social interaction.

Quality. Quality of construction is a physical feature and housing norm that influences housing satisfaction. It has been linked to the control of social interaction by Hintz and Null (1988) who found privacy to be a concern due to the lack of soundproofing in a condominium project.

Perceived Control and Predictability

Predictability enables an individual to determine onset and/or termination of a stressor, thereby giving the individual a sense of control over the stressor (Glass &

Singer, 1973). When one can predict the onset of some aversive event, the event is less uncomfortable (Staub, Tursky, & Schwartz, 1971). The authors surmise that:

> Uncertainty or unpredictability may become intrinsically aversive (Berlyne, 1961), because it is likely to be associated with the inability to fend off aversive experiences. It is difficult to deal with the unpredictable. For this reason, uncertainty and lack of control may be intimately related. Lack of control represents a condition of helplessness; the ability to predict events may reduce the subjective experience of helplessness, even when control is not possible, and thereby reduce tension or anxiety. (p. 161).

If one can predict an aversive event, even though onset cannot be controlled, predictability is believed to have the following effects: (a) it increases perceived ability to control onset, and (b) it reduces the negative impact of the aversive event (Staub, Tursky, & Schwartz, 1971).

Predictability and Housing Norms

The following four housing norms are linked to the perceived ability to control future events through advance knowledge.

Tenure. Ownership tenure usually provides greater predictability than rental tenure. Fixed rate mortgage contracts establish a payment that does not change from year

to year, giving predictability to a major household expense. Also owners are not dependent on yearly lease renewals. Although owners will have unpredictable maintenance expenses, these are under the owner's control in that he or she can decide if the maintenance will be completed or not (Wedin & Nygren, 1979).

Structure type. Single-family-detached homes are usually zoned to be located with other similar structures in the same price range. As a result, occupants have similar incomes and interests. Homogeneous populations are associated with greater control (Taylor, Gottfredson, & Brower, 1981).

Neighborhood. The most preferred and satisfying neighborhoods are usually suburban neighborhoods which have owner-occupied, well-marked single-family-detached dwellings with homogeneous populations (Cook, 1988). Perceived homogeneity of a neighborhood population is a significant factor related to problems (i.e., crime) that indicate a lack of control or predictability (Taylor et al., 1981). As homogeneity increases, perceived control increases.

Quality. Morris and Winter (1975) suggested that quality involves "subjective orientations to essentially subjective matters" (p. 83). Although quality refers to the physical setting, the concept has social and psychological implications. "High quality" implies less unpredictable

maintenance costs and fewer performance interruptions. It implies a prediction of reasonable resistance to natural elements such as wind and rain. The greater vulnerability of mobile homes in windstorms may link that structure type to "lower quality," lower predictability, and lower satisfaction (Lam, 1985).

Perceived Control and Territoriality

Territoriality refers to the control (and perceived control) of physical space through personalization, marking of areas, or defensive behavior (Altman, 1975). According to Altman, it is a behavior that helps individuals or groups achieve a desired level of privacy because it helps to regulate contacts between people. Empirical research indicates that territoriality is an effective mechanism for controlling space in that it is related to a reduction of occupant fear (Patterson, 1978), reduction of crime and vandalism (Brown, 1979), and enhanced social interaction (Edney, 1975; Edney & Uhlig, 1977; Sebba & Churchman, 1983). Areas in a household where a family member experiences the most control are likely to be areas in which socialization is most likely to occur (Sebba & Churchman, 1983). Control of an area is impaired if it is very small and must be shared; it does not have clear physical boundaries; or it does not have visual or auditorial separation from other

areas.

Territoriality and Housing Norms

The following three housing norms are linked to territoriality.

Space. Housing norms suggest that each family must have a specific number of bedrooms (based on family size and composition) to be satisfied. Studies of privacy and control indicate that people need some defined space to call their own (Sebba & Churchman, 1983); however, resources are not always available to provide every individual with a room of his or her own. More information is needed on minimum spatial requirements that meet a family member's need for personal territory.

Tenure. Ownership gives occupants greater legal control of their housing than rental (Jennings, 1985). Rental agreements often restrict the number of occupants, the interior and exterior decoration that can be done, and the activities of the occupants. While zoning ordinances can also be restrictive to owners, when everything else is equal, an owner will have usually have more flexibility to personalize and decorate than a renter (Wedin & Nygen, 1979).

Structure type. The single-family-detached home provides more opportunity for territorial behavior because it usually has a yard that can be fenced, personalized, or

maintained in a way that inhibits territorial invasions (Brown, 1979).

Summary

Figure 6 illustrates control concepts and the link to housing norms. Writers in the fields of housing, environmental psychology, psychology, and sociology suggest that housing is a physical environment that influences an occupant's perception of his or her ability to control social interaction through the control of physical space, events, and cognitive decisions. The existence of housing norms which increase perceived control supports this theory. Elements of housing that have been associated with high occupant satisfaction are also associated with high occupant control.

The experimental part of this study examines the housing norm of space in relationship to occupant control of social interaction (privacy). Space was chosen as the housing norm to study because it currently lacks distinctive perimeters. According to the U.S. Bureau of Census (1990), 1.01 or more persons per room is considered overcrowded but this standard does not consider the size of rooms, area of the dwelling, or composition of the household. Even though area can remain constant, the number of rooms can change, thus changing the density of a dwelling. For example, two

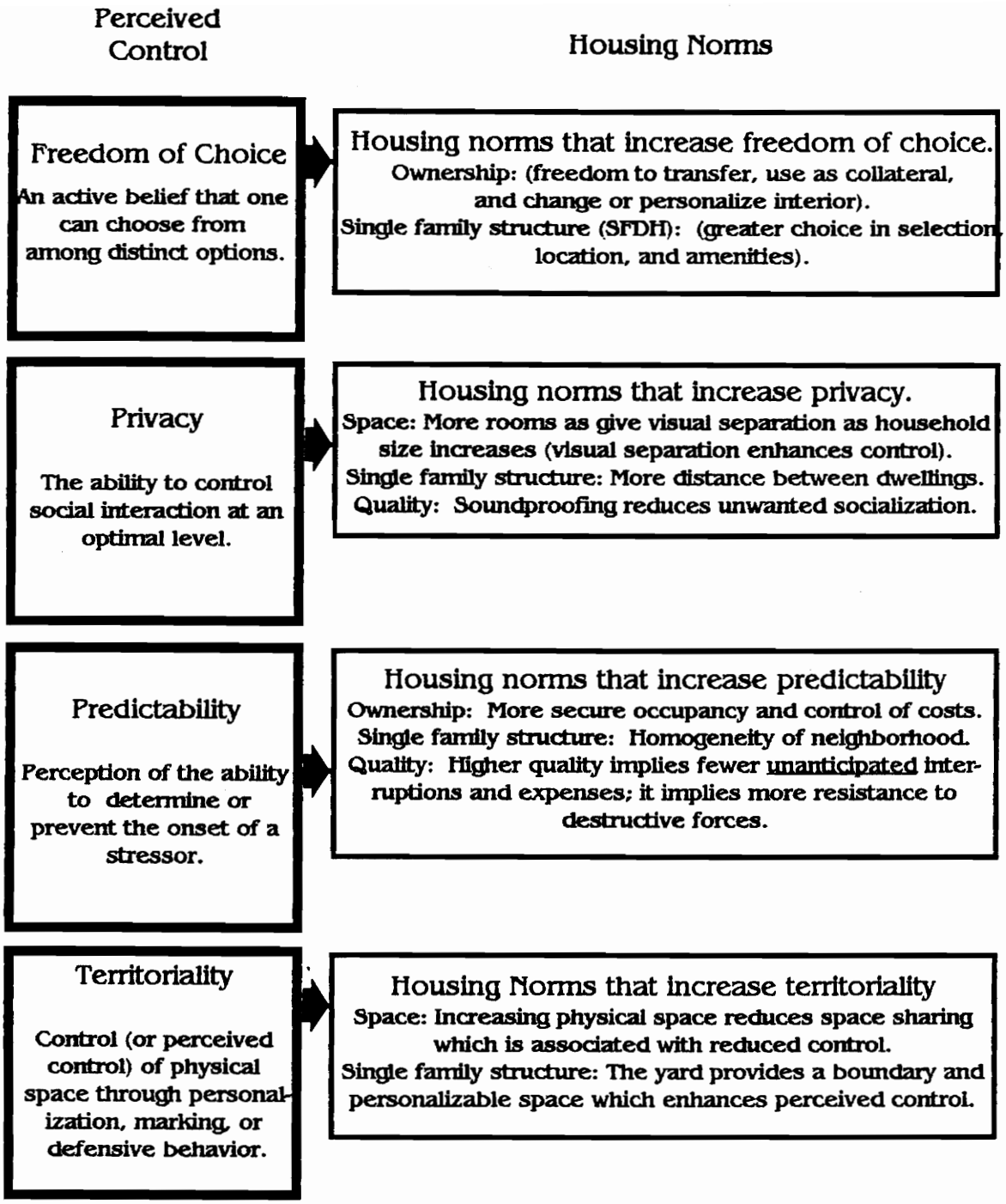


Figure 6. Categories of perceived control and related housing norms.

similar size houses, each with two bedrooms and four occupants, may have two different density ratios because of the floor plan design. One may be overcrowded while the other is not. In an open plan, the dining room, living room, and kitchen are combined, producing a three-room dwelling with a density of 1.33 persons per room. But in a closed plan, the living room, dining room, and kitchen are considered separate rooms making it a five-room dwelling with a density of .8 persons per room. While one dwelling may be considered overcrowded, there currently is no clear evidence to suggest that the number of rooms in a dwelling has a greater influence on human attitudes toward crowding than the total dwelling area. While housing norms have contributed greatly to the understanding of family mobility, social problems such as homelessness, childcare, and poverty need to be addressed in the context of restricted housing adjustment. In these cases, human behavior and attitudes in relationship to perceived control--"freedom of choice," privacy, predictability, and territoriality--are worthy of consideration.

CHAPTER III

METHODOLOGY

A randomized, three-group posttest only research design was used in this study to assess differences in crowding reactions among three different floor plan designs. Forty-five volunteer subjects were randomly assigned to either a control group (open-plan housing model) or one of two treatment groups (semi-open and closed-plan housing models). Subjects assigned to the control and treatment groups were evaluated with four identical family activity scenarios. A forced-response questionnaire was administered to assess crowding reactions in each scenario. One-way Analysis of Variance was used to compare the mean number of scale-size figures placed by each group in each scenario. The same procedure was used to evaluate crowding reactions.

The operational model illustrated in Figure 7 indicates that housing conditions and situational differences are independent variables that influence perception, adjustment, or adaptation reactions. It was assumed that if subjects stopped placing figures into the scale-model house before crowding occurred, they would be satisfied with the number of figures in the house. It was also assumed that if subjects placed figures into the scale-model house until one more was one too many, the addition of two more figures would produce a perception of crowding. Reactions to

crowding were then solicited from the subject along with the length of time that they willingly would accommodate the crowding.

Previous work on residential crowding suggests that scale models, scale human figures, and activity situations characteristic of day-to-day family life provide an appropriate laboratory setting for assessing the impact of dwelling floor plan design on perceived household crowding. Both Sommer (1969) and Delong (1976, 1977, & 1991) illustrate that spatial perception in scale models is very close to that of full-size space. Desor (1972) illustrated that crowding was induced in scale-size structures with scale figures representing occupants. Hasell (1991) has also successfully used scale-size models to simulate spatial concepts.

While a field study provides the advantage of observations in a natural day to day setting, it does not permit the high degree of control over activities, architectural elements, psychological attachment, and density that can be achieved in a laboratory setting. Families in field studies differ on other variables known to influence housing attitudes such as type of tenure (Morris & Winter, 1975); length of tenure (Carp, 1966); territoriality (Sebba & Churchman, 1983); neighborhood satisfaction (Cook, 1988); and household size.

Instruments

The instruments used in this study included models of interior space, furniture, and figures constructed to scale (1" = 1'-0"), along with a brief questionnaire on crowding perceptions. The instruments were supported with materials such as activity scenarios, instant photographs, and video photography.

Scale Models

Houses

The public areas of scale model houses were constructed of 1/8" foam board in a scale of 1" = 1'-0". The public area is the area in which friends and acquaintances are welcomed and entertained. In this study the public area refers to the living, dining and kitchen areas of the models. It does not include bedrooms. Subjects were informed that sufficient bedroom space would be designed into the actual house to accommodate whatever size family could be accommodated in the public areas. The models have a short hall with an arrow suggesting the bedroom location.

Each of the three models was exactly the same size, shape, and layout as the other two. Each had a living area that was approximately 12" x 16" in size and a kitchen that was approximately 9" x 12". There was a small eating area in the kitchen and a larger dining area between the living and kitchen areas in all models. Figure 8 shows a

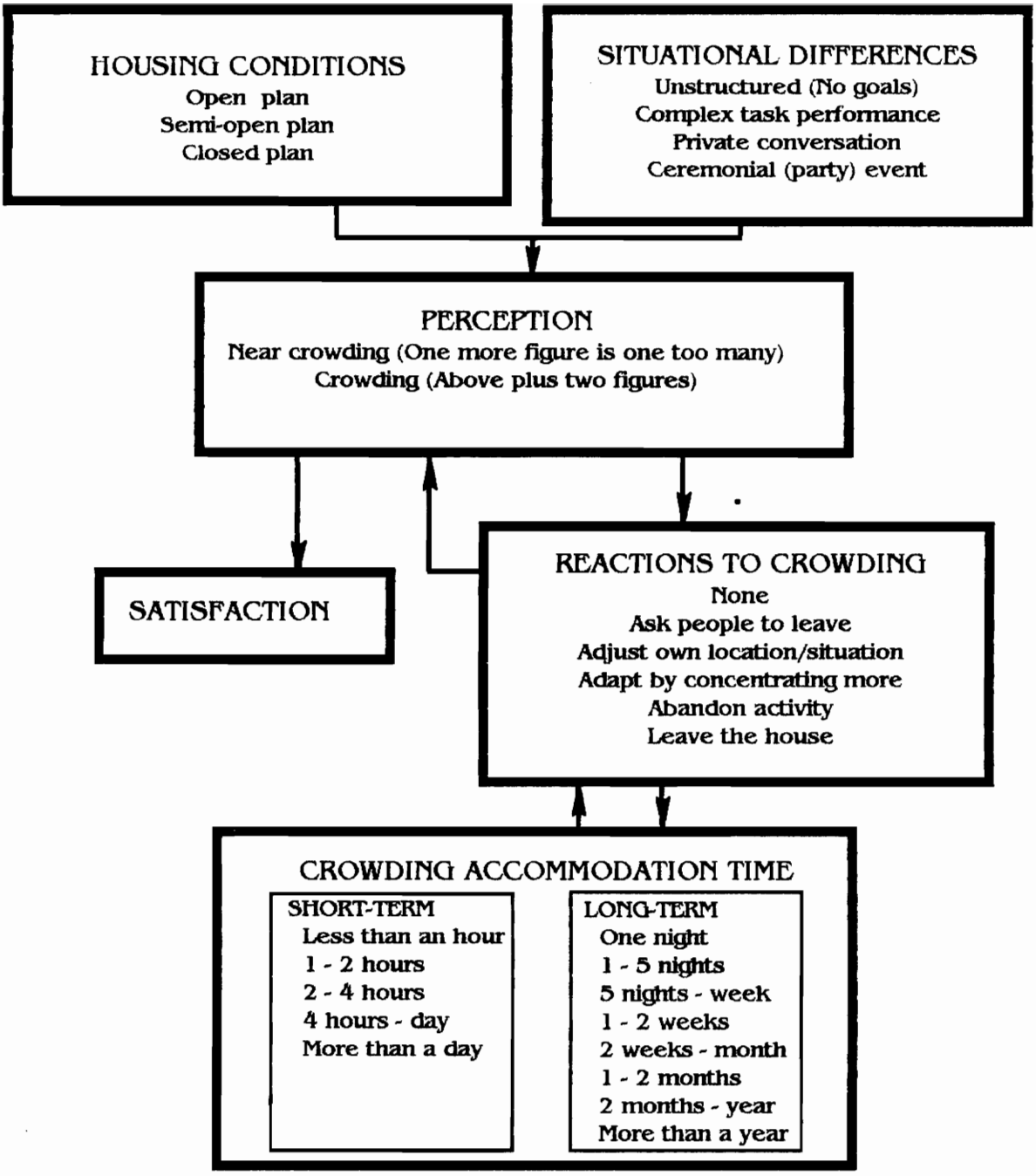


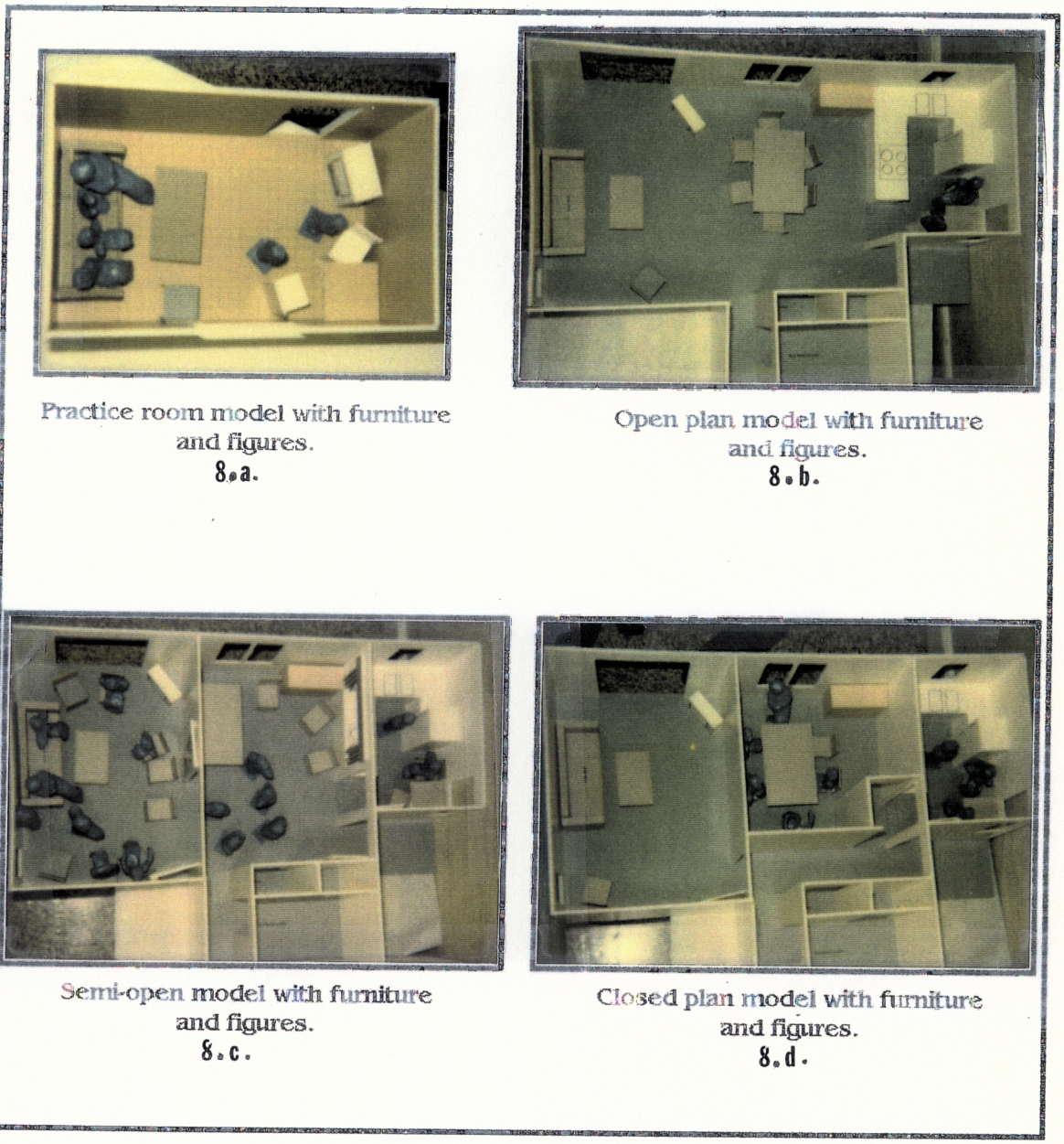
Figure 7. Operational model of housing conditions, situational differences, perception, and reactions.

photograph of the practice room and each of the three house models.

Open-plan. This model had no wall between the kitchen and dining area and no wall between the living and dining area. As Figure 8.b illustrates, the only architectural features separating space in the entire public area of this model was the kitchen base cabinets. People in the kitchen could interact freely with people in the living and dining areas. The degree of openness illustrated in this plan is commonly provided in moderately priced multi-family housing (Builder, 1990).

Semi-open plan. This model was similar to the closed plan; however, the wall separating the kitchen and dining area had a folding partition above the kitchen base cabinets that could be opened for group interaction or closed for privacy. As illustrated in Figure 8.c, the wall between the living and dining areas had double French doors that allowed approximately one-third of the wall area to open. When the doors were closed, a high level of privacy was available in the living area.

Closed-plan. This model had a wall separating the kitchen from the dining area and a door that could be closed providing a high level of privacy in the kitchen. There was also a wall between the living and dining areas which had a door that, when closed, provided a high level of privacy in



Practice room model with furniture and figures.
8.a.

Open plan model with furniture and figures.
8.b.

Semi-open model with furniture and figures.
8.c.

Closed plan model with furniture and figures.
8.d.

Figure 8. Photographs of the scale models with furniture and figures.

the living area. Privacy was also insured in the dining area by the addition of a wall which formed a hallway for traffic between rooms. Figure 8.d illustrates the separation of activity areas in this model which is typical of houses constructed before the 1960s (Hasell, 1991).

Major differences between the models included: (a) the number of places in each model for privacy, and (b) the ability to interact with others from one end of the public area to the other. The semi-open plan provided two areas of the home where people could obtain privacy. They could close a door in the living room or in the kitchen and not be distracted by others coming and going through the house. The closed plan provided three areas of privacy while the open plan had none.

The open plan had no separations in the public area to impede interaction. People in the kitchen could easily carry on a conversation with others at the far end of the living room. In the closed plan, the walls between rooms effectively inhibited interaction between rooms. The semi-open plan permitted interaction from one end to the other if desired. However, it also provided privacy when doors were closed, but not as many places as in the closed plan. One privacy area was eliminated when the wall separating the dining area and the hall was removed.

Construction methods of each model were similar. Walls

were 8 inches high to represent 8 foot ceilings, but ceilings were omitted to permit visibility and access. Wall surfaces were represented by white foam board with no other finish. Openings were cut in the walls for standard size doors and windows as illustrated on the floor plans in Figures 3-5. No attempt was made to simulate exterior window glass. Floors were constructed of white 1/8" foam board and then finished with a light grey mat board to obtain a more realistic appearance. Squares were drawn on the kitchen floor to represent 12" floor tile. The general form of kitchen cabinets was constructed of 1/8" foam board. Circles were drawn on part of the surface to represent a 30" range and squares on another surface to represent a double sink. A refrigerator was constructed of foam board and identified with lines to suggest a top freezer and handles.

Doors were constructed of materials cut from door openings. The doors were hinged with white vinyl tape. They were held in the open position with a 1/4" piece of Velcro attached to the back of the door and to the wall that they swing against. They were held in a closed position by a small white map tack inserted in the door thickness to provide friction between the door and the door frame. The folding partition above the kitchen base cabinets was constructed of mat board partially cut along 1/4" lines to enable easy folding and expansion. Velcro was used as a

latch to hold the doors closed. Transparency film for overhead projectors was placed over the openings in the French doors and lines were added to illustrate small panes of glass. Nothing was used to simulate glass in the exterior doors or windows. It was believed that subjects would not assess the exterior details as closely as they would interior details.

Practice room. A room approximately the same size as the living room in the house model is illustrated in Figure 8.a. It was constructed using the same methods and materials as used for the model houses. This room provided an opportunity for subjects to become familiar with the process in a practice session.

Figures.

Thirty-six scale-size figures were constructed of wadded newspaper wrapped in stove-pipe wire and formed into both seated and standing human-like shapes. The shapes were made to represent adult human figures of various sizes as well as children. After forming, each shape was covered with thin strips of paper dipped in a paste made from flour and water. When the shapes were dry, standing figures were glued to a flat base of 1 inch mat board so they would stand straight. To protect the figures from soiling, each figure was sprayed with a blue-grey latex paint. Blue-grey was chosen to provide a color contrast between the figures and

the interior of the models and because it does not have racial connotations.

Furniture

Scale-size furniture was constructed of mat board. Neutral tan and grey colors that blend with wall and floor colors of the models were chosen to insure minimal impact of furnishings on the subjects. One set of furniture consisting of a sofa-bed, coffee table, arm chair, game table, two side chairs, and a console television was constructed for the practice room. A similar set, with the addition of a dining room table, six chairs, and a side board, was constructed to be used with the house models. Two extra chairs were available if needed. The sofa-bed was an important furniture element because it provided additional sleeping space for additional household members. The sofa-bed was labeled to insure recognition of the additional sleeping accommodation.

Family Activity Scenarios

The dynamics of crowding were assessed in each of four different scenarios that represent typical family life experiences and social interactions. Rosenthal (1983, p. 48) stated, "It is important to assess the structure of the interpersonal relationships of the S's [subject's] participation ..... before an accurate and sophisticated

understanding can be had of the nature and dynamics of the crowding process involved." The situations provide settings for a range of affective and behavioral responses (Montano & Adamopoulos (1984). The four situations in this study are: (a) an unstructured situation where no demands were placed on the subject in the scenario; (b) a goal directed situation where a task needed to be performed; (c) a situation in which low levels of interaction were desirable; and (d) a ceremonial or party situation where high levels of social interaction were desirable. The full script of each situation is provided in Appendix A.
Each subject received the four situations in a different sequential order after completing the practice scenario. The practice scenario used a "pre-test" practice living-room model and asked subjects to "imagine coming home to a house with this size living room each evening and doing whatever you like to do. Place figures in the model room one-by-one until one more figure would be one too many."

The four scenarios used with the model houses provided situational differences that ranged from low to high levels of social interaction. The same scenarios were repeated with each model to insure reliability.

Unstructured situation.

Situation A was the least structured. In this

situation the participant was given the framework of a long rainy weekend when everyone must remain indoors for the entire weekend. It permited the participant to identify the types of activities that would occur most frequently in that setting, thereby reducing researcher influence.

Complex task situation. This was a situation which required mental concentration and activity directed toward the resolution of a task or problem (Rosenthal, 1983; Montano & Adamopoulos, 1984). Examples used in this study included balancing one's checkbook, reading a difficult to understand report, and telephoning and scheduling people for a volunteer event. In this situation, subjects were asked to imagine themselves performing a series of complex tasks that require a great deal of concentration. It was suggested that the tasks might be something like balancing the checkbook, reading some important report, and making telephone calls for a church or volunteer organization. Previous studies have indicated that there is a link between crowding and complex task performance. Decrements in task performance were observed among students in three-person dormitory rooms built for two (Walden, Nelson, & Smith, 1981) when compared to students in two-person rooms. In laboratory studies, errors in maze performance increased when density increased (Evans, 1979). In this situation, it was assumed that subjects would be able to perceive the

maximum level of social interaction at which task performance would not be hindered.

Privacy (Low level of social interaction). In this situation privacy represents what Westin (1967, p. 22) refers to as intimacy. The participant was asked to counsel a distraught friend. It was indicative of an event where very low levels of social interaction are desirable--that of two individuals interacting without interruptions, noise, or interference. It was socially constraining in that the presence of others (rather than their actions) would be aversive. It assumed that subjects would be able to perceive the maximum level of household social interaction at which the intimacy and solitude in the household would not be affected.

Ceremonial (party) situation. The ceremonial situation was a setting where interpersonal relationships were those of affection, warmth, closeness, and support (Montano & Adamopoulos, 1984). It represented a social engagement between friends, intimate associates, or close relatives. It was anticipated that a greater number of people would be accommodated in the same amount of space without participant feelings of crowding. In this scenario, high social interaction between the subject and others in the house was desirable. It represented a celebration such as a birthday party, reception or other social gathering where everyone

was happy and having a good time. It was a situation where crowding from excessive social stimulation was unlikely, but crowding caused by the limitation of physical space might occur (Montano & Adamopoulous, 1984).

Documentation

Instant Photographs

An instant self-developing photograph of figure placement in each situation was made and shown to subjects. The photograph provided subjects with another perspective of the model and an opportunity to reassess the number of people by comparing "near crowding" to the number perceived as "ideal." The photographs provided a measure of subject reliability and a permanent visual record of figure placement.

Video Tape

A video tape was made at the completion of figure placement in each situation. It was used to record the subject's brief explanation of the interaction and activities occurring in the models. It also was used to record the subject's placement of additional figures to create crowding and her response to the open-ended verbal question, "Is there anything you would change to make this house more comfortable for this number of people?" While the instant photos provided a permanent visual record of

figures before crowding occurred, the video tape recorded the situation and interactions after two more figures were added.

Questionnaire

Several forced-choice questions were developed to measure a) the subject's level of satisfaction with the number of people and amount of space in the setting, b) the length of time crowding might be accommodated in normal every day situations, c) the subjects' reaction to crowding; and d) the length of time the subject might accommodate overnight crowding (see Appendix B).

First, after the subject had placed figures in each situation, she was asked to respond to a seven-point Likert satisfaction scale question, "If your family was this size and you lived for a long time in a house this size, how satisfied would you be with the amount of space for ... (*identify the activity)*?" The satisfaction question further defined the subjects' perception of "near crowding." High satisfaction with a high number of figures reinforced the notion that the subject was comfortable with the number of figures placed in the model before crowding was perceived. Low satisfaction indicated the subject felt crowded *before* placing the "one too many" figure. Then, after two additional figures had been added to invoke crowding, three questions regarding the length of time and means of

accommodating the crowding were presented to the subject in written form.

Question one measured short-term increments of time that the subject might accommodate crowding in each typical family situation. The five choices ranged from less than an hour to more than a day.

Question two asked the subject to select from six possible crowding reactions that represented various levels of control, adjustment, adaptation, activity abandonment and withdrawal.

(1) Do nothing different. Two more people wouldn't bother me too much in this situation.

(2) Gently ask the two relatives (friends) to leave (and perhaps ask them to come back another time)?

(3) Continue to *(whatever you are doing)* but change my location from the _____ (room) to the _____(room). (Or ask other people to move to someplace else in the model (not bedrooms).

Explain_____

(4) Continue to *(whatever you are doing)*, but I'd have to concentrate more and I might feel crowded.

(5) Give up on trying to *(whatever you are doing)* until there are less people in the house (room).

(6) Stop *(whatever you are doing)* and go for a walk

(or visit a neighbor; or attend an evening meeting; or go shopping, etc.) or do something that would give me a reason to leave the house for a while.

(7) Other (Explain) _____

A Level 1 response indicated the subject perceived no crowding, even with the two additional people; therefore, privacy was maintained. In the theoretical model presented in Figure 1, Level 1 represents homeostasis.

A Level 2 response indicated that the subject was able to control the level of privacy desired by requesting that others leave the dwelling. Individuals who perceive themselves to be in control are less likely to experience negative effects from a stressor (Averill, 1973; Corah & Boffa, 1970; Langer, 1983; & Staub, Tursky, & Schwartz, 1971); however, Sebba & Churchman (1983) found that housing design can reduce ability to control interaction. In the theoretical model (Figure 1), Level 2 represented a successful coping strategy that produced positive aftereffects such as increased self-esteem.

A Level 3 response represented an adjustment in the location where an activity was performed. By moving to a different part of the room, the occupant perceived less distraction than in the original location, and thereby successfully coped with the crowding while continuing to

perform an activity. Level 3 recognized that adjustments were made, but it assumed they were successful.

In a Level 4 response, the subject coped with the stimulation from more social interaction, but arousal continued and more energy was used to perform an activity. In the theoretical model, continued arousal is associated with performance deficits. Performance deficits have been identified as a negative consequence of unsuccessful adaptation in studies using noise as a stressor (Glass, Reim & Singer, 1971). Other stressors such as crowding produce similar results (Paulus, Annis, Seta, Schkode, & Matthews, 1976; Evans, 1979b).

In a Level 5 response, the subject indicated an activity was abandoned. It cannot be determined in this study if activity abandonment is a successful or unsuccessful coping strategy; however, it is known that continued inability to accomplish intended behavioral objectives leads to poor self-esteem and learned helplessness (Seligman, 1975). Since the situations used in this study were common and frequently occurring family activities, it is reasonable to assume that the reaction identified by the subject would occur frequently in real life situations if the household is perceived as crowded.

A Level 6 response indicated that not only was an activity abandoned, but there was withdrawal from the house.

It was assumed that withdrawal from the house by a family member disrupts family social interaction. Evidence of male withdrawal from the home as density increases is available through a field study (Harshbarger, Inman & Curtis, 1987) and through laboratory studies (Smith, Downer, Lynch & Winter, 1969; Montano & Adamopoulous, 1984). In this study, it cannot be determined if withdrawal is a successful or an unsuccessful coping strategy (i.e., does it reduce stress?); but this question is designed to provide evidence to support or disprove the paradigm of open-plan housing for promoting social interaction (Nielson & Taylor, 1990; Midwest Plan Service, 1988).

Question three asked the subject to consider her ability to accommodate the addition of two more homeless relatives or friends in a house comparable to the model. The responses are in increments of days, weeks, months, and a year or more and assess the impact of floor plan design on an occupant's ability to accommodate long-term crowding.

The scale size models and figures in this study were designed to determine if the number of people that can be accommodated in a designated dwelling area changes when the layout of the area changes. The questionnaires were designed to assess perceptions, attitudes, and feelings of the subjects in each situation. The entire format of the questionnaire is provided in Appendix B.

Data Collection Procedures

Female employees at East Tennessee State University were asked to volunteer if they occupied households of four or more people with two children under the age of 18 years. The first 45 respondents were randomly assigned to a floor plan group and scheduled for a 45 minute interview. During the interview, the subjects (a) provided demographic information about the size of their house and their family; (b) placed figures in the scale model room and house; and (c) responded to a questionnaire on crowding.

This section explains the procedures that were used to select subjects, randomly assign subjects to study groups, collect data, and analyze data. A description of the research setting is also included. To reduce travel and incentive costs, subjects were recruited from the East Tennessee State University (ETSU) campus. To reduce the possibility of research setting bias, all interviews took place in one location on campus.

Instruments and Procedures Testing

Instruments and procedures were first pretested with four graduate committee faculty members at Virginia Polytechnic Institute and State University. As a result of the pretest, 12 additional scale figures were added to bring the total supply to 36 figures. Carpet was removed from the practice model and replaced with a simulated tile floor

finish drawn to scale.

The instruments and procedures were then piloted with three faculty members and three students from East Tennessee State University. As a result of the pilot study, a question regarding the level of "comfort" the subject might experience if the situations were real was changed to the level of "satisfaction." The same seven-point Likert Satisfaction Scale which was used to measure housing satisfaction in several regional housing surveys (Cook, Morris & Winter, 1988; Fulbright, 1984) was used to measure the subject's satisfaction with the figure/space relationship they identified.

Selection of Subjects

After receiving Institutional Review Board "Use of Human Subjects" acceptance, permission for employee participation was obtained from the University administration. With administration permission, a mailing list of all ETSU female employees (a total of 712) was obtained by department and postal box number. A letter, coded with the mailing list, was developed and sent to each employee. The letter briefly described the project and included an acceptance form that asked the recipient to check "yes" or "no" on the following questions: (a) "Do you live in households of four or more people?" and (b) "Do you have at least two children under the age of 18 years living

in the household?" (Appendix C). If she met the requirements, she was asked to volunteer for the project by signing her name and giving a phone number. The researcher contacted the volunteer by phone to set up an interview appointment.

If supervisory permission was required for the subject to participate in the study, the researcher sent a letter briefly describing the project to the supervisor (see Appendix C) and followed up with a phone call three days later. Then the volunteer was contacted to schedule an appointment.

A total of 46 female employees were recruited. One employee was eliminated from the study because she exhibited substantial prior knowledge of the research project proposal.

Random Assignment of Subjects to Groups

Subjects were assigned an identification number in the sequence that their acceptance forms were received by the researcher. The numbers began with number one for the first form received and ended with number 45 for the last form to be received (or used). The numbers (1 through 45) were placed in a hat and one number at a time was drawn blindly. The first number drawn was assigned to the open-plan group; the second number to the semi-open plan group; and the third number to the closed-plan group. The sequence was repeated

until the numbers of all 45 subjects were assigned to one of the three groups of 15 subjects.

Interview Environment

All interviews were conducted in part of a room in the Department of Applied Human Sciences at East Tennessee State University. The subject was seated with a wall on the left, models in front of her on a 10" high platform (flat cardboard box), and a two-shelf cart on her right. The cart provided a writing surface on one shelf and a place for the scale-size figures as well as extra furniture pieces on the second shelf. A video camera was permanently mounted above the models. A step-ladder located on the right side of the model enabled the researcher to position the instant-photo camera over the model in each situation. The two sides of the step-ladder which were exposed to the subject were enclosed in white paper to provide a neater work area. Figure 9 illustrates the interview environment.

Scripted Guide Sheet

A guide sheet containing all instructions, researcher comments, and details was used to insure consistency from one interview to another. The guide sheet summarized the purpose of the research, then outlined the activities that would be performed. It provided a script and instructions for the practice situation and each of the four situations used with the models (see Appendix D).

Interview Procedures

The subject was contacted by telephone on the same day that the acceptance form was received. An appointment for the interview was scheduled and the subject was given

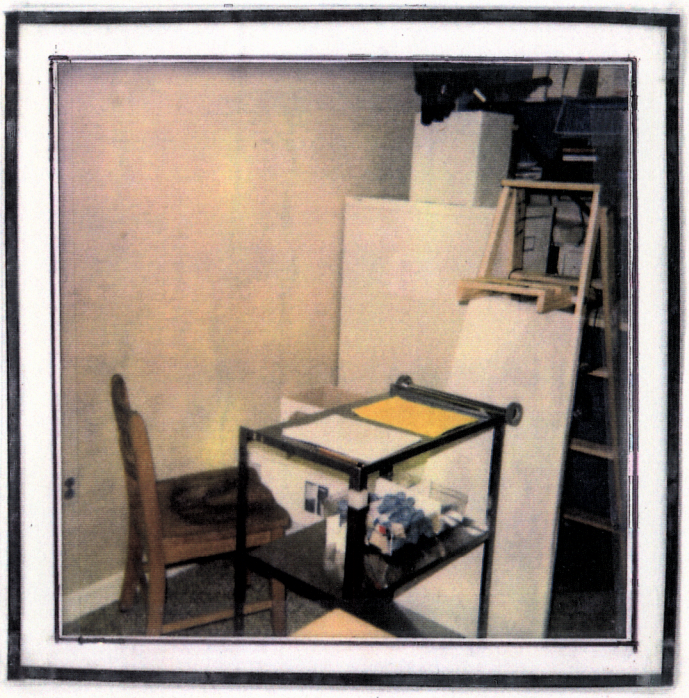


Figure 9. Photograph of the interview environment. The table served as a writing surface and allowed the figures to be within easy reach of the participant.

directions to the faculty office for the interview. If the appointment was more than two days in the future, on the day before the interview, the subject was again contacted to determine if the appointment time was still acceptable.

Set up. Before the subject arrived, the area was set up for the interview. For each set up, the appropriate model was placed on the 10" high platform and checked to insure that all furniture was properly located and doors were in the open position. Then a piece of white mat board, which covered the entire top of the model, was placed over the model to form a platform for the practice room. The practice room was placed on the platform with all furniture in the same position for each interview. The scripted guide, along with the interview materials in order of use, were placed on the cart. The interview materials included: (a) a demographic survey (Appendix E); (b) A 4" x 10" photograph identification card for each scenario coded with the subject's number, group, and the scenario; (c) coded "reaction to crowding" questionnaires organized by the scenario sequence used with each subject (Appendix B), and (d) a large-print copy of each scenario (Appendix A).

Introduction. When each subject arrived, she was greeted and directed to the set-up area by the same researcher. A brief description of the research purpose and an outline of the activities of the interview were read to the subject from the scripted guide sheet (Appendix D). She was asked if she would like to continue. All subjects agreed to participate.

Survey. Completion of the demographic survey

requesting information on the subject's current dwelling and household was the subject's first activity. She was given a copy of the survey and instructed to circle or fill in the best answer on each question, ask for clarification if needed, and advise the researcher when she was finished. Each survey form was pre-coded with the subject's identification number, group, and situation sequence (see Appendix E).

Practice session. After completing the survey, the subject was presented with a practice session using the model room and scale-size figures. She was instructed that:

> This is only the living room in a small house. Imagine yourself coming home from work each evening and spending most of the evening in a room like this doing whatever you like to do in the evening. Place figures in the room one-by-one until one more figure each evening in a room this size would be one too many. Imagine that the first figure is yourself. All other figures can be imaginary rather than your real family. Think about living for a long time in a house with this size living room--ten years or more.
>
> 1. You can open or close doors or dividers,
> 2. You can move, remove, or add furniture (attention is directed to extra furniture).
> 3. There is no right or wrong number of figures.

Think of your feelings as more are figures added.

4. Feel free to ask questions at any time.

5. Tell me when you are finished.

When the subject finished placing figures in the practice room, her attention was directed above the model to a large-print chart which had seven levels of satisfaction in a Likert scale. She was asked, "On the satisfaction chart above you, how satisfied would you be with this number of people in this size room if you frequently spent evenings like this?" The chart had the following values: 1 = Extremely Dissatisfied; 2 = Dissatisfied; 3 = Somewhat Dissatisfied; 4 = Mixed; 5 = Somewhat Satisfied; 6 = Satisfied; and 7 = Extremely Satisfied.

The satisfaction level was temporarily recorded on the cue card and the subject was informed that the model was to be photographed. The instant photo was made first. While the photo developed, the cue card was placed on the model to identify the segment and the video camera was turned on. The subject was asked, "Would you briefly explain where you are and what you imagine people doing in this situation?".

After the explanation, she was instructed, "Please add two more figures to the model. These are close friends or relatives that visit frequently." The placement was recorded on the video tape.

After the figures were added the subject was asked, "Is

there anything you would change about this room to make it more comfortable to accommodate this number of people each evening?" The subject's response was recorded on video tape. If she indicated that she would make the room larger, she was asked, "If you had a choice between making the room larger or adding another room, which would you prefer?" If her response to the original question was that she would add another room, she was asked to give a preference between another room or a larger room.

The video tape was turned off at the end of the subject's response and she was asked to answer questions on her reactions and feelings to the number of people now in the model. She was advised to consider the number of people, the size of the space, and the situation as she answers the questions. While the subject responded to the written questions, the researcher (a) counted the number of figures placed in the model (from the photograph); (b) coded the photograph with the number of figures, satisfaction level, identification number, group number, and situation sequence; and (c) removed the practice room and uncovered the house model beneath it.

After the subject finished the reaction questionnaire, she was shown the photograph and instructed,

> When I had you place figures in the model, you placed them until one more would have been one too many. Now

look at the photograph and tell me what would be an ideal number of people for this size room each evening. It might be more, less, or the same as you have now.

The number was recorded on the photograph and the subject was informed that the procedures of the practice session would be repeated with the model house and four situations.

Model procedures. When introducing the model, the researcher stated,

> This is the model you will be working with. It has a kitchen with eating space, a dining area, and a living room area. The number of bedrooms in this house would be sufficient to accommodate the number of people comfortably accommodated in this living area; however, the bedrooms would be small and would not have space for recreation, desks, and other activities.

If the model had doors that opened or closed, the subject's attention was directed to the doors. The subject was then handed the first situation of her randomly assigned sequence and instructed,

> This is the first of four situations. I'll let you read the situation and imagine that the first figure that you place in this model is yourself in this situation. Continue placing figures one-by-one until one more in this situation is one too many. Tell me when you are finished.

When the subject finished placing figures, she was presented with the same satisfaction chart used in the practice session and asked, "How satisfied would you be with this number of people in this size house when (*...identify the situation...*) occurs?". The interview continued following the same sequence of activities and questions used in the practice session. While the subject completed the written questionnaire, the researcher returned the figures to the shelf and replaced furniture and doors to their original positions.

Photographs were presented to the subject when all four situations were completed. She was asked to determine from the photographs if more, less, or the exact number of figures placed in the model would be an "ideal" number for each situation. The response was indicated on the photographs which were then attached to the questionnaire. After assessing the photographs, the subject was thanked for her participation.

Data Analysis

Analysis of Variance was used to test the equality of means on (a) the number of figures placed before crowding was perceived in the three floor-plan groups with the four different situations; (b) the length of time crowding was accommodated; (c) the level of behavior reactions; (d) the length of time over-night guests would be accommodated; and

(e) the number of figures perceived as ideal for the size house. Normal distribution as well as homogeneity of variance was assumed because of random assignment of subjects to treatment and control groups. Open-ended responses were recorded on video tape but were not needed to support data.

Validity. The subject's satisfaction with the number of figures in the model was used to support the subject's ability to distinguish between "nearcrowding" and "one too many" figures. In addition, a correlation between the number of figures representing nearcrowding and the number representing ideal, was used to validate the subject's ability to distinguish between that which is "nearly too many" and that which is ideal.

The sequence in which family situation scenarios were presented was varied to prevent maturation effects. Testing was done over a three-week period of time and the 45 subjects were drawn from a pool of over 700 women. Since subjects were from many different departments and buildings, it is unlikely that subjects were influenced by previous participants. A scripted guide sheet was used to insure consistency of instructions. A practice session was given at the beginning of each interview to prevent confusion over procedures from contaminating the results. The same researcher administered all the tests.

External validity was addressed by using a 1:12 scale for the models and figures. This scale has been used successfully by numerous researchers (Sommer, 1969; Delong 1976, 1977, & 1991; Desor, 1972; Hasell, 1991) and closely simulates the reactions of subjects in full-size environments.

Reliability. Coefficient of Equivalence was used to assess reliability. The four family scenarios serve as four alternate forms of the same test. The number of figures placed in complex task and privacy scenarios was less than the number of figures placed in the ceremonial and unstructured scenarios in all three groups tested indicating consistency of the measurement instruments.

CHAPTER IV

DESCRIPTION OF THE SAMPLE

This chapter contains information on the participants, their housing, and their households. It also includes the results of reliability testing and validity assessment.

Participant Housing and Households

Participant Characteristics

All participants in this study were women living in households of four or more people. Their different employment positions represent a variety of positions such as administrative, teaching, clerical, and maintenance. The participants were between the ages 25 and 56 years. One-third (37.8%) were between the ages of 25 and 35; two-thirds (62.2%) were between the ages of 36 and 55. Two (4%) of the participants represent minority groups, which is representative of the minority population in the geographic area.

Household Characteristics

Participants were required to have at least four people in their households as a condition of participation in the study. Over three-fourths (75.6%) had four people in their household and eight households (17.8%) had five people. The largest household had seven members.

Participants were also required to have at least two

children under the age of 18 currently living in their household. Children most frequently were reported in the age group of "5 through 11 years of age." Figure 10 illustrates the frequency of household size and age groups.

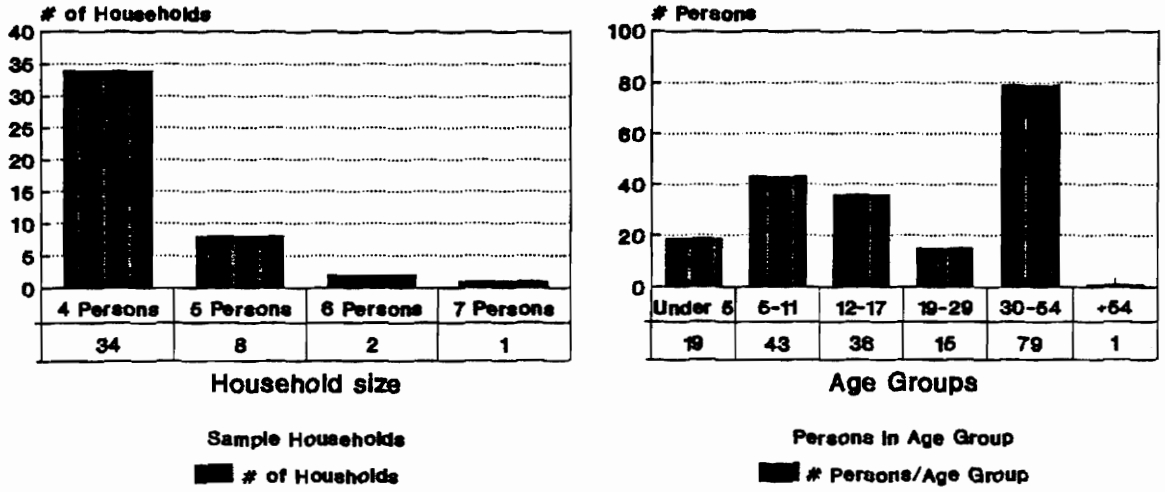


Figure 10. Household size and number of persons in age groups, among 45 participant households.

Current housing characteristics. Information obtained on the participant's housing suggests that this sample was somewhat homogeneous and that their current housing was above average. Over 90 percent (93.3%) were living in a single-family detached house.

Sixty percent (60%) of the participants lived in dwellings with six to eight rooms (not counting bathrooms).

Two households (4.4%) had a density of more than 1.01 persons per room which is considered overcrowded (Morris & Winter, 1978) and is comparable to the percentage of households (4.9%) considered overcrowded by the U. S. Bureau of Census (1990). An additional four households (8.8%) had a density of 1.0 persons per room. Nearly one-fourth (24.4%) lived in dwellings with nine or more rooms. Nearly three-fourths (71.2%) had two or more bathrooms. Only 13.3% had only one bathroom. The remaining households had one full bathroom plus a partial one.

No correlations were observed between the subject's current housing characteristics and the number of figures placed in the scale-model room. Figure 11 illustrates in

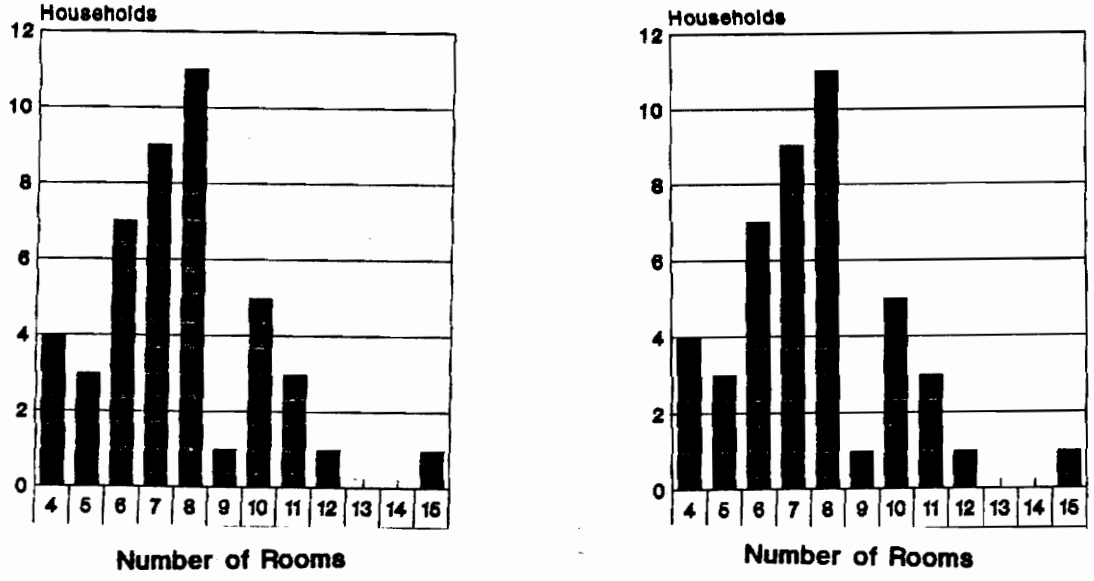


Figure 11. Number of rooms and number of bathrooms in dwellings of the 45 study participants.

graphic form the frequency of housing characteristics such as number of rooms and number of bathrooms in each dwelling. Descriptive statistics are provided in Tables 1-3, Appendix F.

Correlations Among Household Characteristics

A positive correlation was observed between the number of rooms in a dwelling and the number of bathrooms (r = 0.60, $p<0.001$). No other correlations among housing and household characteristics were observed in this sample.

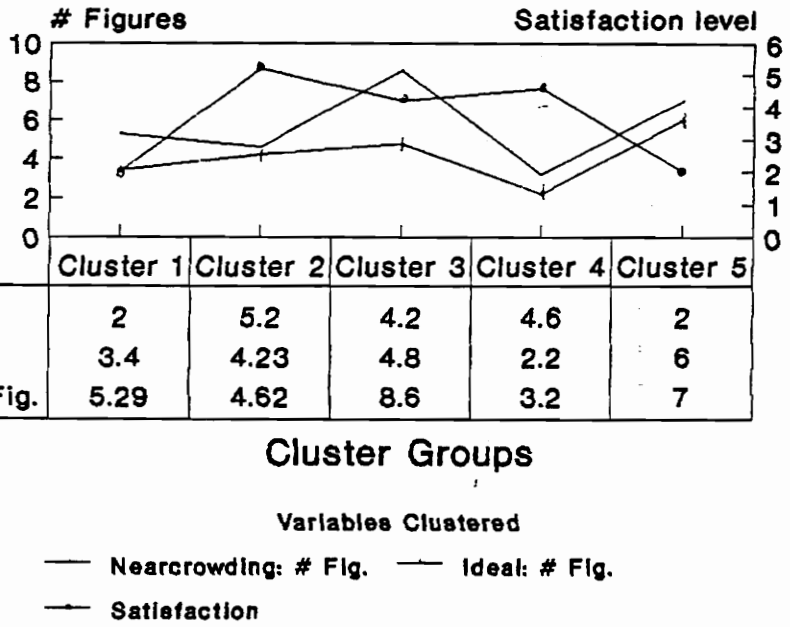
Reliability

To assess reliability of nearcrowding measures, a coefficient of equivalence was obtained by comparing the number of figures placed in a scale-model practice room until "one more was one too many" with the number of figures considered ideal in the same situation. It was anticipated that a "moderately high" ($r = .65$), rather than "high" ($r = .90$ or more) positive correlation (Touliatos & Compton, 1988) would be observed because "ideal" would imply fewer figures to some people. A *correlation coefficient* of .66 was obtained using Pearson's Product-moment correlation (r).

To further assess reliability of the nearcrowding measure, participants were asked to rate their level of satisfaction with the space and number of figures placed in the scale-model practice room. It was hypothesized that a moderately high negative correlation would be observed

between the number of figures placed in a model and the level of satisfaction participants experienced. Pearson's Product-moment correlation coefficient of $r = -.29$ was observed.

Since correlations of $r = .66$ and $r = -.29$ are only moderately high measures, cluster analysis, illustrated in Figure 12, was used to analyze characteristics of the



Satisfaction levels: 1=Extremely dissat; 2=Dissat; 3=Somewhat dissat; 4=Mixed; 5=Somewhat Sat; 6=Sat; 7= Extremely Sat.

Figure 12. Cluster grouping of nearcrowding, satisfaction, and ideal in a scale-model room: All floor plan groups.

variables. The clustering technique used was the K-means algorithm developed by Hartigan and Wong (Hintz, 1990, p. 211). The objective of this technique is to divide N observations with P dimension (variables) into K clusters so that the within-cluster sum of squares is minimized. The variables used were: (a) number of figures placed (Nearcrowding); (b) number of figures considered ideal; and (c) satisfaction with space and figures. Five clusters were used to explain 85% of the variance.

A summary of the variables in each of the five clusters is as follows: 1) moderate number placed, moderate low ideal, and low satisfaction; 2) moderate number placed, moderate ideal, and high satisfaction; 3) high number placed, moderate ideal, and moderate satisfaction; 4) low number placed, low ideal, and moderate satisfaction; 5) high number placed, moderate ideal, and low satisfaction. Figure 13 illustrates the relationship between the number of figures placed, number of figures considered ideal, and satisfaction levels. Generally, as the number of figures placed in a model increased, satisfaction with the space decreased. Mean values of Nearcrowding, Satisfaction, and Ideal are presented by floor plan groups and by clusters in Tables 4 and 5, Appendix F.

Discussion of Reliability

Reliability tests show that considerable variation

exists among individuals in the number of figures that are perceived as "one too many" (Nearcrowding). However, two conclusions can be drawn: (a) Participants judged the number of figures they perceived as "one more would be one too many" to be more than the ideal number of figures for a specified space, and (b) satisfaction with a living space decreased as the number of figures considered to be near-crowding increased.

Internal Validity

The study was conducted during November-December, 1992. There were no changes in experimenters, location, or weather. While Northeast Tennessee has a mild climate that permits outdoor living, the climate at this time of the year is too cold to use outdoor space such as patios and decks. If participants were influenced by weather conditions, it would have been to reinforce the limitations of indoor space.

There was no indication that participants in the beginning of the study exchanged information with those scheduled near the end. The sample of 45 was drawn from a pool of over 700 women located in numerous buildings on a university campus with approximately 15,000 students and employees. One participant was eliminated due to extensive knowledge of the project proposal because she was a member the Research and Development Committee and had reviewed the

research proposal.

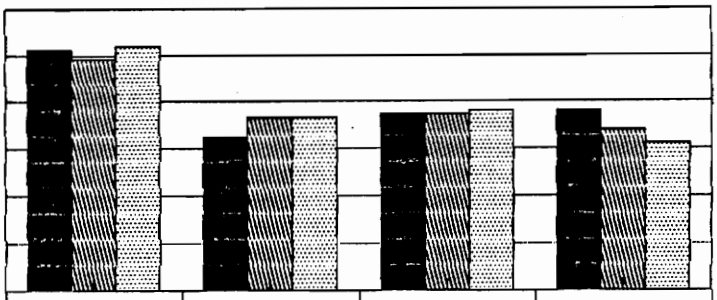
While all participants were first presented with a scale-model room in which to place figures, there is no indication that this procedure inflated or deflated subsequent numbers. To avoid maturation effects appearing on any particular scenario, participants received the scenarios in randomly assigned sequences. Some received the ceremonial scenario first; others received it as the second, third, or last scenario.

No participants dropped out of the study. All those who initially volunteered kept their appointment and completed the experiment. Statistical regression and differential selection were controlled through random assignment of participants. Figure 13 illustrates that there are no significant differences among the control and treatment groups on: a) the number of figures placed in a scale-model room; b) crowding accommodation time; c) reaction to crowding level; and d) overnight crowding accommodation time. Table 6 in Appendix F presents the means of each group on the four variables listed above.

External Validity

All participants were currently living in Northeast Tennessee and working at East Tennessee State University. However, the University employs a diverse group of people and the employment status of the participants included

clerical, secretarial, administrative assistants, managers, technicians, supervisors, administrators, and faculty. All



	# Figures	Acc Time	Reaction	# Nights
Open (Control)	5.13	3.267	3.73	3.8
Semi-open(Treatment)	4.93	3.667	3.73	3.4
Closed (Treatment)	5.2	3.667	3.8	3.13

Figure 13. Comparison of control and treatment groups in scale-model room pre-test situation.

participants were representative of regional women working outside the home with households of four or more people with at least two children under the age of 18 years.

Since the use of scale models in studying housing

behavior is new, it is uncertain how much, if any, the experimental procedures affected the participants' behavior. The effect of multiple treatments in the use of four scenarios was reduced by altering the sequence in which the scenarios were presented. Since all participants were subjected to the same experimental procedures, differences between control and treatment groups appear to be valid.

CHAPTER V

FINDINGS AND DISCUSSION

Statistical analysis of the data is presented in this chapter by hypotheses. A significance level of .05 was used throughout the study. Newman-Keul's Range Test was used to identify differing groups. Findings on each hypothesis are followed by brief discussions, conclusions, implications, and recommendations for further research related to the specific hypothesis. Figures illustrating the results of statistical analyses are presented with each hypothesis and tables of data are presented in Appendix F.

Hypothesis One:

The number of people who can comfortably live and interact in the open floor plan model until crowding is perceived will be no less than the number of people in the semi-open or closed plan models in four typical family situations.

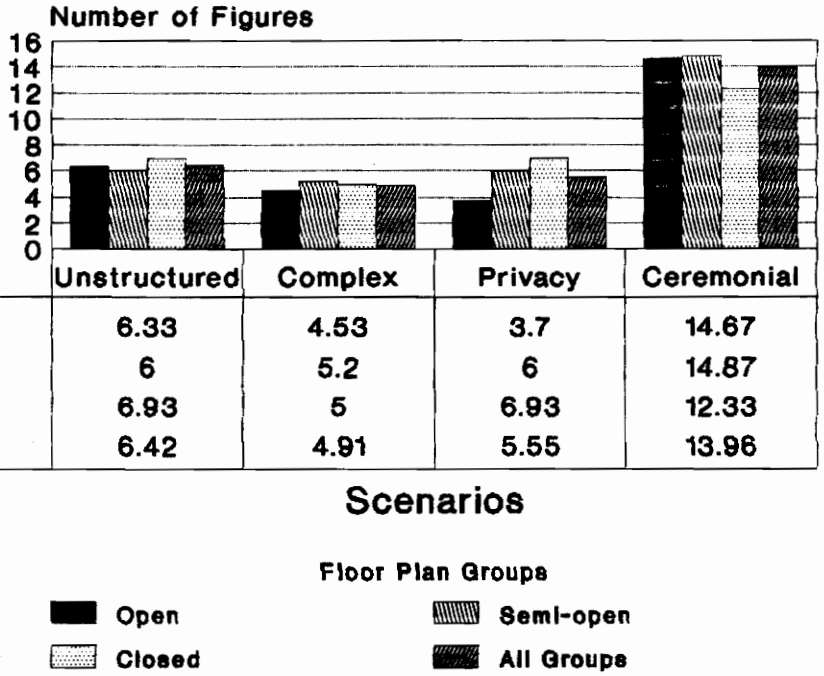
Participants, who were randomly assigned to one of the three floor-plan groups, were presented with the model for their group and given instructions to place scale-size figures in the model, one-by-one, until one more in a specified family-activity scenario would be one too many. They were also given 36 scale-size figures representing adults and children. After they placed figures in the model in each scenario, the models were photographed and the

figures were counted.

The null hypothesis that the number of figures placed in the open-plan model would be no different than the number placed in the semi-open and closed plans in four typical family scenarios was rejected because, at the .05 level of significance, fewer figures were placed in the open-plan model than in the semi-open and closed-plan models in the privacy scenario. Table 7 in Appendix F presents a summary of means for each group along with the standard error, F-ratio, and probability at the .05 level of significance. Figure 14 illustrates the differences by floor-plan groups in each scenario. The mean number of figures placed in the open plan in the privacy scenario was 3.73 and in the semi-open and closed plans, 6.00 and 6.93 respectively--38 and 53 percent more.

Discussion

The lack of significant differences among floor plan groups in the other three scenarios suggests that: (1) the performance of activities in which high levels of social activity are desired will not be as easily influenced by a lack of visual or auditory separation as a situation in which low levels of interaction are desired; and (2) situations where activities are not goal directed may not be as easily influenced by visual and auditory separation as those that are goal directed. In the privacy scenario,



	Unstructured	Complex	Privacy	Ceremonial
Open	6.33	4.53	3.7	14.67
Semi-open	6	5.2	6	14.87
Closed	6.93	5	6.93	12.33
All Groups	6.42	4.91	5.55	13.96

Figure 14. Mean values of figures placed until Near-crowding in floor plan groups by four typical family activity scenarios.

performance of an activity requiring low levels of social interaction was hindered by the absence of visual and auditory separation. A significantly lower number of figures placed in the open plan in the privacy scenario

suggests that control of interaction in this plan was attained by keeping the number of people lower. Placement of more figures in the semi-open and closed plans indicates that the control of social interaction was supported through the use of visual and auditory separations (walls); therefore, the number of people that was perceived as controllable was higher.

Failure to observe a difference in the number of figures placed in the models in the complex task scenario was not anticipated and is more difficult to explain. Results were in the direction hypothesized and the complex task scenario involved a goal directed activity. Since all subjects had children in the home, they may have been acclimated to handling the interruptions associated with higher levels of social interaction. However, an analysis of the accommodation time, addressed in the discussion of Hypothesis Two, reveals that even though a similar number of figures was placed in the complex scenario as in the unstructured one, the length of time that participants would accommodate that number of figures was less in the complex task scenario.

Failure to observe differences among the three floor plan groups in the unstructured and ceremonial scenarios suggests that control of social interaction was not as important in these scenarios. Both of these scenarios are

indicative of situations that do not involve goal-directed activities. In the ceremonial scenario, high levels of social interaction are likely to be desired; therefore, more figures in one particular model would be indicative of enhanced ability to control social interaction. While no difference was observed with a sample size of 15, based on the standard error in the ceremonial scenario, doubling the sample size to 30 subjects would have produced significance. With 30 subjects, the number of figures placed in a closed plan in a ceremonial situation would have been less than the other two plans, suggesting that the presence of visual and auditory separation does hinder the ability to control social interaction when high levels are desired. This supports the theory of privacy and perceived control of social interaction as presented in the literature review. When high levels of social interaction are desired, as they would be in a party situation, visual and auditory separation reduce the number of people that can interact simultaneously.

Significant differences were also observed among scenarios. Figure 15 illustrates the differences between scenarios in each floor plan group and Table 8, Appendix F, presents the means, standard error, F-ratio, and probability at the .05 level of significance. More figures were placed in the ceremonial scenario in each floor plan group.

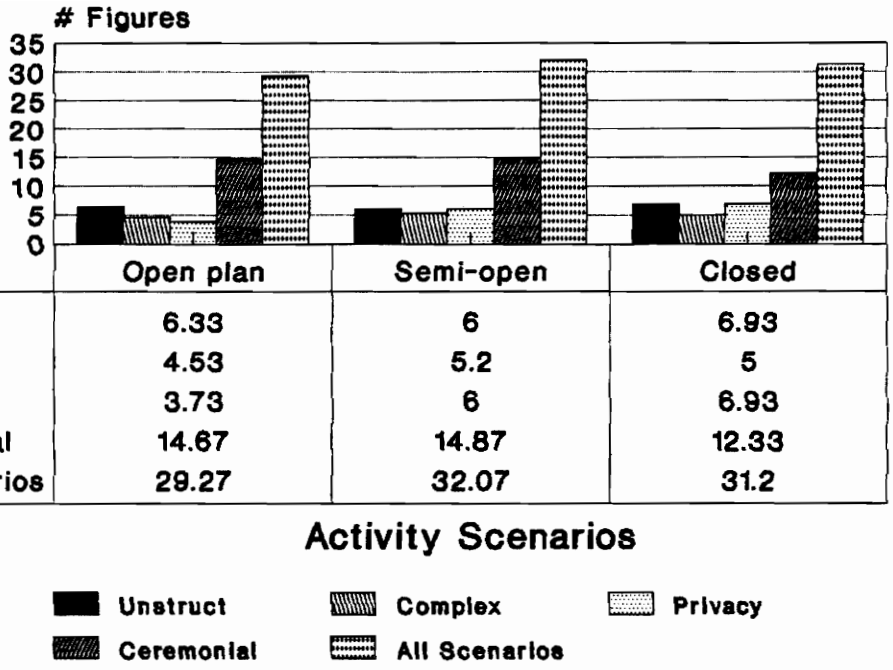


Figure 15. Mean values of figures placed in four typical family-activity scenarios by three floor plan groups.

Differences in numbers of figures placed in the scenarios indicate that participants perceived their desired level of social interaction to change as the situation changed.

Overall, the findings support the notion presented in

the theoretical framework; that housing space (as defined by the number of rooms in this study) and situations (family activities) influence perceptions of control in a household.

Implications

The findings imply that, among families with children, perceived crowding is more likely to occur in open plan designs than in semi-open or closed plans if no other rooms such as a den, family room, or multi-activity bedrooms are available. Furthermore, the findings suggest that crowding is more likely to occur when situations require low levels of social interaction.

Recommendations for Further Research

While the findings on this hypothesis support the notion that the separation of floor space influences the ability to control social interaction in a dwelling, they do not address the effect of actual square feet. The housing area represented in this study is approximately 600 square feet which approximates that recommended by the American Public Health Association (APHA, 1950) as optimum for a family of four for food preparation, dining, recreation, and extra-familial association. It does not address differences that might occur in similar style housing built to HUD minimum standards. The APHA optimum space recommendations used for the models represent 45 percent more space than the HUD minimum standards of 330 square feet. The effect of HUD

minimum standards on occupant perceived control, crowding, and behavior needs to be addressed in further research.

Hypothesis Two

The length of time that a crowded household condition is accommodated will be no less in the open floor plan model than in the semi-open or closed plan models in four typical family situations.

After participants placed figures in a model until they felt that one more figure would be one too many in each scenario, they were asked to add two more. It was assumed that the addition of two more figures would create a crowded situation. Participants were then given a questionnaire and asked to respond to three questions regarding crowding. The full questionnaire is presented in Appendix B.

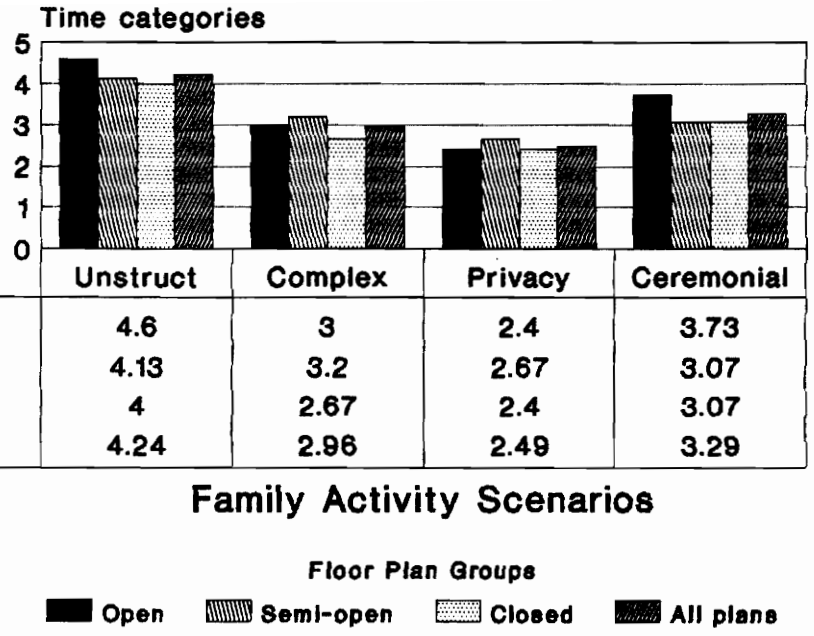
The first question on the questionnaire asked them to indicate the length of time they might accommodate the number of figures now in the model in each activity scenario. Five short-term increments of time were provided on a forced-choice response form. They included: 1= less than an hour; 2 = more than an hour but less than two hours; 3 = more than two hours but less than four hours; 4 = more than four hours but less than a day; and 5 = more than a day.

It was theorized that, because the open plan model did not have any other public rooms in which to perform an activity, when crowding occurred, it would be associated with a higher level of activity abandonment and withdrawal

than the semi-open or closed plans. Analysis of variance was used to determine differences in mean accommodation times among floor plan groups. The null hypothesis that accommodation time among participants of the open plan group would be no different than the semi-open and closed plans could not be rejected. Table 9 in Appendix presents the means and standard error for each floor plan group. Figure 16 illustrates the mean accommodation times for each model. While no differences in crowding accommodation time were observed among floor plan groups in any one scenario, differences were observed among scenarios. Table 10, Appendix F, provides the means and stardard error term for accommodation time by scenario. Figure 17 illustrates differences in crowding accommodation time among the four scenarios. One-way analysis of variance reveals that accommodation time is significantly greater in the unstructured scenario than in any of the other three scenarios. It is also greater in the ceremonial than in the privacy scenario.

Figure 18 shows crowding accommodation time compared to the number of figures placed in each model. It illustrates the effect that the number of figures had on the accommodation time.

In scenarios without goal directed behavior (unstructured and ceremonial) the number of figures is



	Unstruct	Complex	Privacy	Ceremonial
Open	4.6	3	2.4	3.73
Semi-open	4.13	3.2	2.67	3.07
Closed	4	2.67	2.4	3.07
All plans	4.24	2.96	2.49	3.29

Short-term time categories (hours):
1=less than hour; 2=1-2; 3=2-4;
4=4-24; 5= + 24.

Figure 16. Mean crowding accommodation time by floor plan groups in four typical family activity scenarios.

smaller than in those with goal-directed activities (complex and privacy) and the accommodation time is less. In the ceremonial scenario, no goal directed behavior had been specified and both the number of figures and the

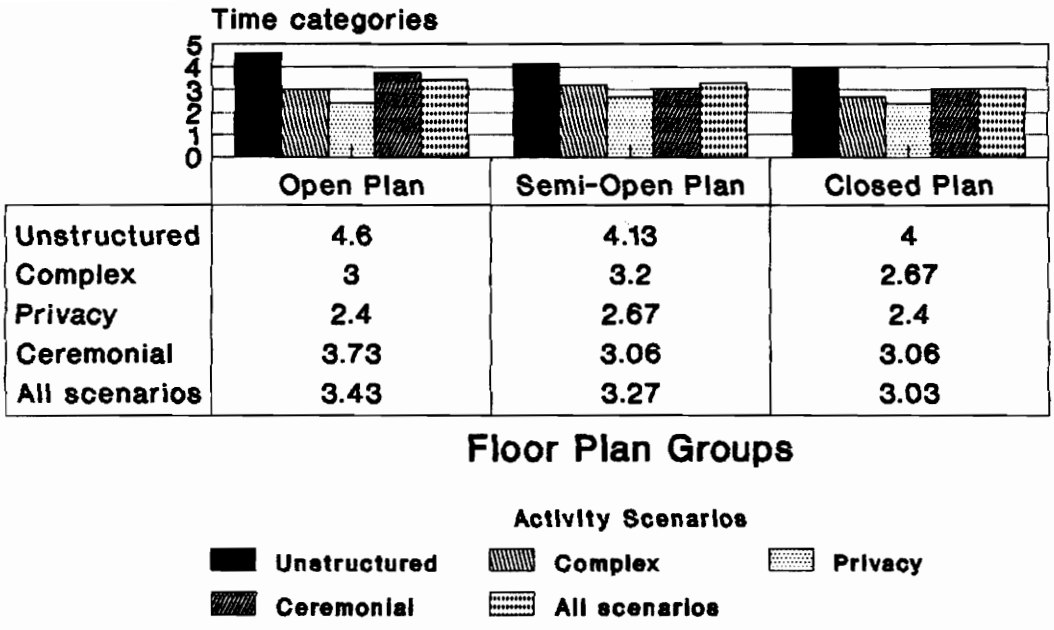
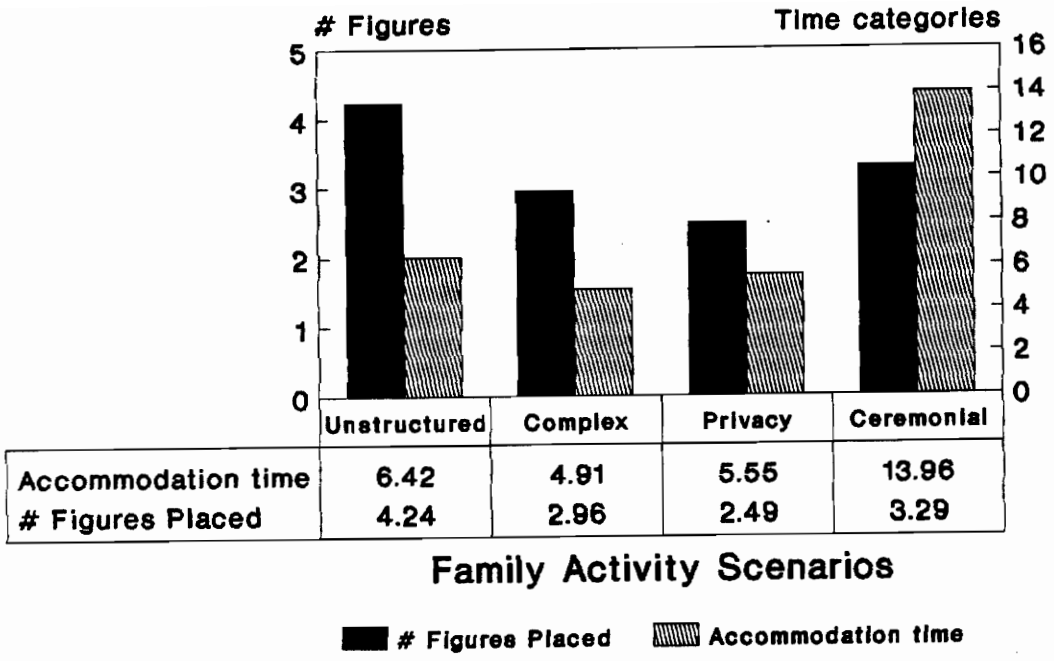


Figure 17. Mean accommodation time by scenario in three floor plan groups.

accommodation time in this scenario are high. In the unstructured scenario, the number of figures is smaller, but the accommodation time is higher, suggesting that the number of figures may have influenced the length of time that the crowding would be accommodated.



Short-term time categories (hours):
1=less than hour; 2=1-2; 3=2-4;
4=4-24; 5= + 24.

Figure 18. Mean crowding accommodation time compared to the number of figures placed until Nearcrowding in four scenarios.

Discussion

Although no significant differences in crowding accommodation time were observed among floor plan groups, the results are inconclusive because the number of figures

in the open plan was less than in the semi-open and closed plans when a goal-directed activity was presented (private conversation). The comparison among scenarios reveals that participants accommodated crowding longer in situations where no goal-directed activity was specified. However, when similar non-directed activities were compared, the length of accommodation time was less when more figures were placed in the model (ceremonial). The differences found in accommodation time among scenarios supports the notion that the number of people in a space as well as situational differences influence perceptions of crowding. It also supports the notion that perception of crowding is associated with adjustment and adaptation reactions such as the length of time that crowding is accommodated. In this hypothesis, the length of time that crowding would be accommodated was related to activity situations which influenced perception. Influence of the floor plan design was not determined.

Implications

The findings imply that family activities will influence perceptions of crowding in a dwelling. If the family has an unstructured life style and frequently participates in non-goal directed activities, a dwelling may accommodate people for longer periods of time without perceptions of crowding regardless of the floor plan design.

Recommendations for Further Research

While this study shows that crowding can be accommodated for longer periods of time when household activities are non-goal directed, it does not show this as a cause and effect relationship. There remains the question, "Does crowding reduce goal-directed activity performance?" If so, the open plan may have greater impact than anticipated on task performance of families with children. It is recommended that researchers hold the number of figures constant when assessing accommodation time. Also consideration should be given to the development of an open-ended, more linear, time measurement.

Hypothesis Three:

The level of adjustment and adaptation that is experienced in crowded household conditions will be no greater in the open plan model than in the semi-open or closed plan models in four typical family situations.

After participants placed figures in a model until they felt that one more figure would be one too many in each scenario, they were asked to add two more. It was assumed that the addition of two more figures would create a crowded situation. Participants were then given a questionnaire and asked to respond to three questions regarding crowding (See Appendix B).

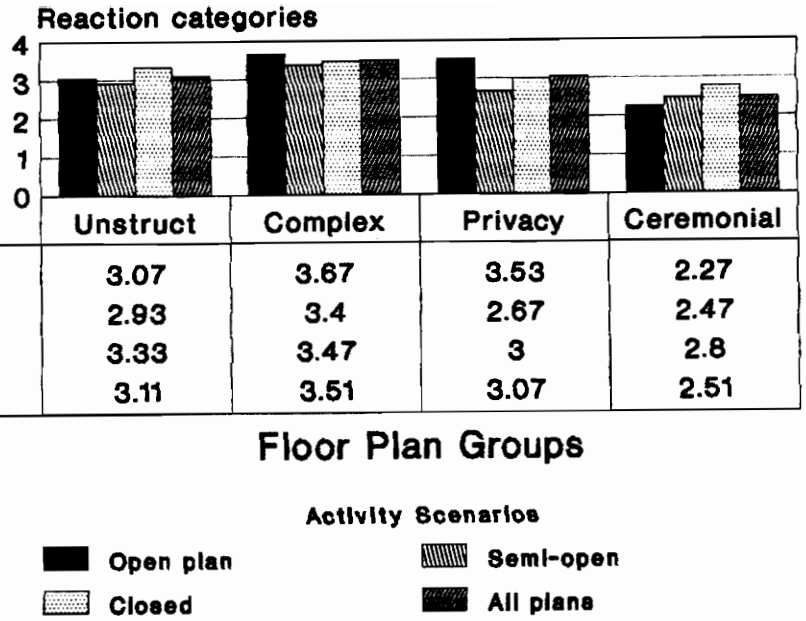
The first question is discussed in Hypothesis Two. The second question on the questionnaire asked them to indicate their reaction to the additional figures on a forced-choice response form. Six possible reactions which represented various levels of control, adjustment, adaptation, activity abandonment, and withdrawal were given. The levels are as follows: 1 = no crowding was perceived, (even with the additional two figures); 2 = control of crowding by asking others to leave; 3 = personal adjustment to facilitate continuing an on-going activity; 4 = additional expenditure of energy to continue the activity; 5 = abandonment of an activity; and 6 = withdrawal from the dwelling. It was hypothesized that, because the open plan did not have other

public rooms in which to perform an activity when crowding occurred, it would be associated with a higher level of adjustment, activity abandonment, and withdrawal than the semi-open and closed plans. Analysis of variance was used to determine differences in crowding reactions among the three floor plan groups. Means, standard error, F-ratio, and probability values are presented in Table 11, Appendix F. The null hypothesis, that the crowding reaction level among participants in the open-plan group would be higher, could not be rejected. Figure 19 illustrates mean reaction levels for each model. Figure 20 illustrates the levels of reaction among scenarios.

Means, standard srror, F-ratio, and probability values of combined floor plan groups and differences on crowding reactions among scenarios are presented in Table 12. A significantly higher level of reaction to crowding is observed in the complex task scenario when compared to the ceremonial scenario.

Discussion

The findings indicate that reactions to crowding are influenced by the activity or goal that an individual is attempting to accomplish as well as by individual personal attitudes. The findings are consistent within the overall theoretical framework which theorizes that situational

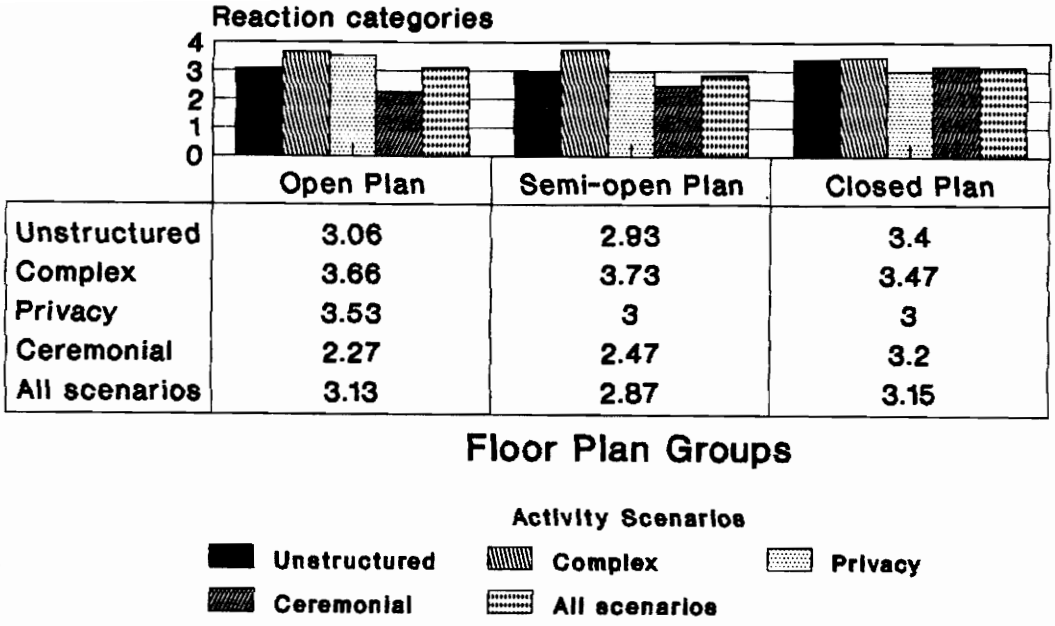


	Unstruct	Complex	Privacy	Ceremonial
Open plan	3.07	3.67	3.53	2.27
Semi-open	2.93	3.4	2.67	2.47
Closed	3.33	3.47	3	2.8
All plans	3.11	3.51	3.07	2.51

Reaction categories: 1=no crowding; 2=control; 3=adjustment; 4= + effort; 5=quit activity; 6=leave dwelling.

Figure 19. Reactions to crowding by floor plan group in four typical family activity scenarios.

differences (as well as housing conditions) will influence perception, and perception will influence adjustment and adaptation reactions. The higher level of reaction to crowding in the complex task scenario indicates that



Reaction categories: 1=no crowding; 2=control; 3=adjustment; 4= + effort; 5=quit activity; 6=leave dwelling.

Figure 20. Reactions to crowding by scenario: All floor plan groups.

situational differences were perceived and reactions were influenced by perceptions.

It should be noted that, although the reaction level in the privacy scenario was not significantly different from

that of the ceremonial scenario, fewer figures were initially placed and participants indicated shorter crowding accommodation times in the privacy scenario. It suggests that control of social interaction in the privacy scenario was already achieved through other means and less adjustment was necessary.

Implications

The results of this experiment indicate that, when residential crowding is experienced, tasks that are complex and goal-directed will be abandoned more frequently than social activities. The findings suggest that families with children living in crowded conditions may experience more difficulty completing tasks that require concentration (such as homework). The results imply that residential space designers need to incorporate some means for reducing social interaction among occupants to support the performance of goal-directed activities in housing designed for families with children.

While significant differences in reaction levels were not observed among floor plan groups, because of lower initial figure placement in the open plan group within the privacy scenario, it would be presumptuous to discard the influence of floor plan design on reactions to crowding.

Recommendations for Further Research

The relationship between dwelling unit crowding and completion of a complex task needs further study. More knowledge about the effectiveness of using scale-model dwellings, figures, and scenarios in studies that include children and men could increase research efforts in this area and improve understanding of crowding, housing behavior, and complex task performance among children. It is recommended that researchers hold the number of figures constant when assessing crowding reactions. While the forced-choice instrument used in this study provided opportunities for an open-ended response through an "other" category, validation of the instrument needs consideration.

Hypothesis Four

The number of nights that crowded conditions can be accommodated in an overnight emergency situation will be no less in the open-plan than in the semi-open or closed-plan models in four different typical family situations.

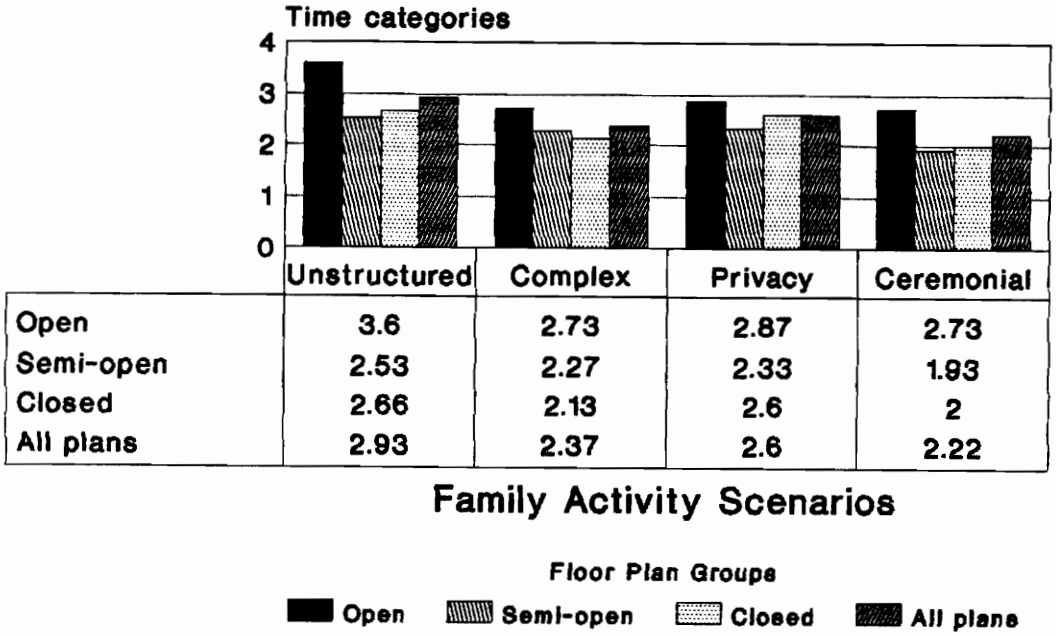
After participants placed figures in a model until they felt one more figure would be one too many in each situation, they were asked to add two more. It was assumed that the addition of two more figures would create a crowded situation. Participants were then given a questionnaire and asked to respond to three questions regarding crowding. The first two questions are addressed in Hypothesis Two and Hypothesis Three and a copy of the questionnaire is provided in Appendix B. The third question asked them to determine if they could accommodate the two additional people overnight. If so, they were asked to indicate the number of nights that the extra two people could be accommodated if their family frequently participated in the activity identified in the scenario. The forced-choice time increments were as follows: 0 = 0 nights; 1 = one night; 2 = more than one night but less than 5; 3 = more than 5 but less than one week; 4 = more than a week but less than two; 5 = more than two but less than a month; 6 = more than a month but less than two; 7 = more than two but less than a year; and 8 = more than a year.

It was theorized that, because the open plan did not provide sleeping privacy for two additional people, participants would not accommodate crowding in it for as long a time as in the semi-open and closed models. However, the null hypothesis, that overnight accommodation time would be no different in the open plan than in the semi-open and closed plans, could not be rejected. Means, standard error, F-ratio, and probability values are presented in Table 13, Appendix F. Figure 21 illustrates overnight crowding accommodation time by floor plan group in the four scenarios.

When analysis of variance was used to assess differences among scenarios, no significant differences were observed in overnight crowding accommodation time. An analysis of variance summary information is provided in Table 14, Appendix F. Figure 22 illustrates the accommodation times by scenario. Most participants would accommodate two extra people for approximately one week.

Discussion

The findings suggest that neither floor plan design nor activity situations influence overnight crowding accommodation time. However, it should be noted that, while there were no significant differences in overnight crowding accommodation time among floor plan groups, there were

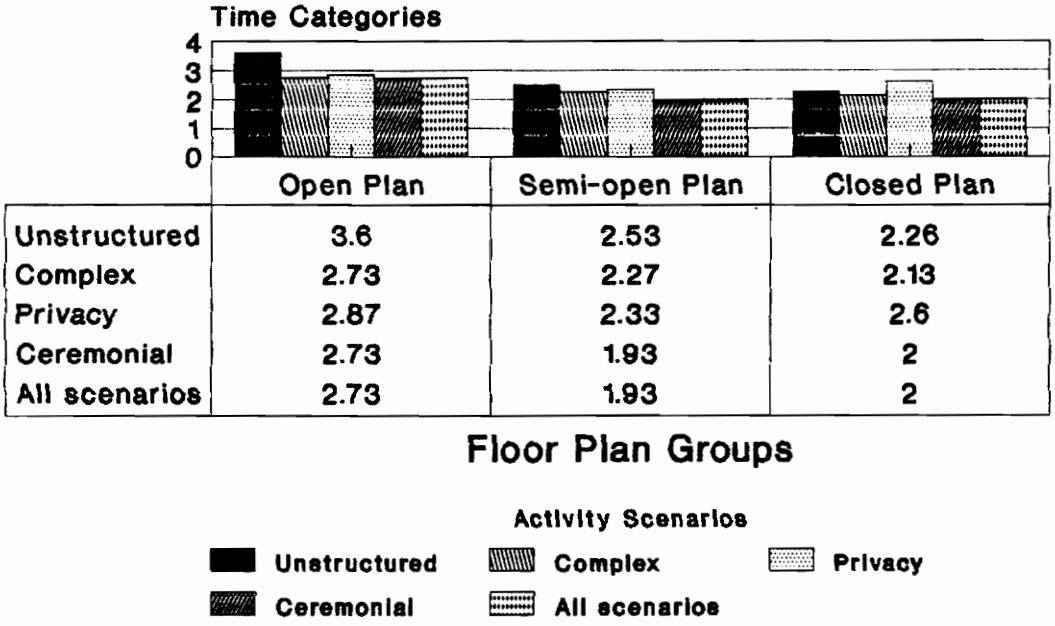


	Unstructured	Complex	Privacy	Ceremonial
Open	3.6	2.73	2.87	2.73
Semi-open	2.53	2.27	2.33	1.93
Closed	2.66	2.13	2.6	2
All plans	2.93	2.37	2.6	2.22

Time categories (nights):
1=1 night; 2=2-5; 3=6-7; 4=8-14;
5=15-30; 6=31-60; 7=61-360; 8=+360.

Figure 21. Overnight crowding accommodation time by floor plan group in four typical family activity situations.

significantly fewer figures placed in the open floor plan in the privacy scenario. Therefore, if only individual attitudes influence overnight accommodation time, one might anticipate that time would be greater in the open plan



Time categories (nights):
1=1 night; 2=2-5; 3=6-7; 4=8-14;
5=15-30; 6=31-60; 7=61-360; 8=+360.

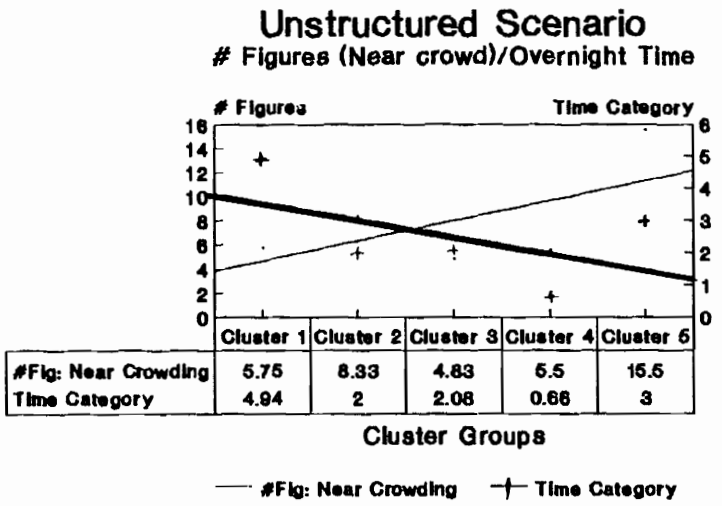
Figure 22. Mean overnight crowding accommodation times by scenario in three floor plan groups.

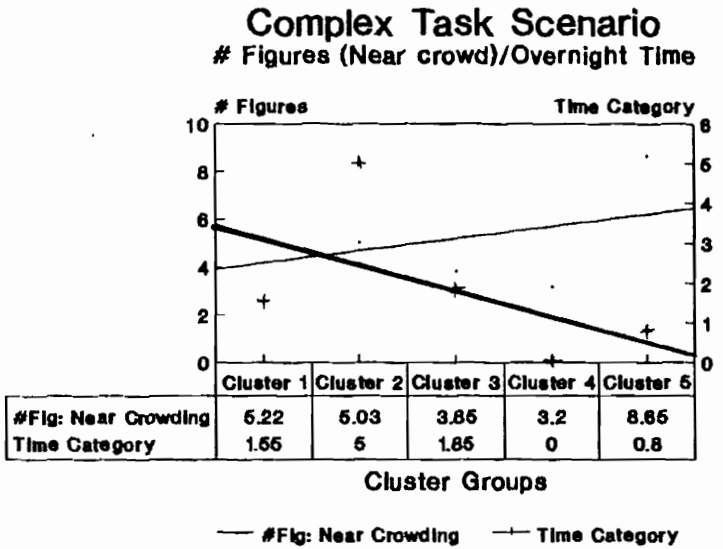
privacy scenario because there are fewer figures. Pearson's *r* correlation coefficient was calculated to determine if the number of figures in a scenario influenced overnight crowding accommodation time. No relationship was

observed until the number of figures and accommodation time were grouped into five clusters. Figure 23 illustrates negative relationships between the number of figures and overnight accommodation time in the unstructured (r = -.72), complex task (r = -.45), and privacy (r = -.13) scenarios. In the ceremonial scenario, a high level of social interaction is desirable and no negative relationship is observed (r = .70). The strength, as well as the direction of the relationships, indicates that both the situation and the number of figures placed in a model has some influence on the overnight crowding accommodation time. Further study is needed to substantiate the relationships.

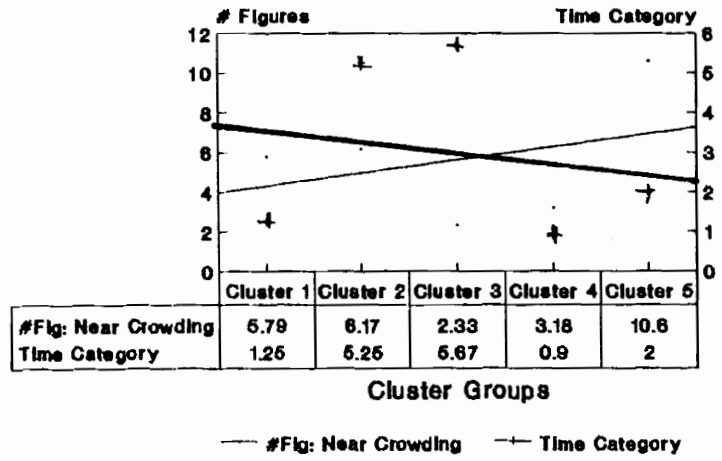
Implications

The ability of a household to accommodate extra people for an extended period of time may reduce the necessity for reliance on public assistance or the potential for homelessness. When occupants perceive crowding at lower densities during some typical family activity, such as in the open plan when privacy is desired, the ability to accommodate crowding over an extended period of time is likely to be affected. The results of this study suggest a relationship, but more evidence is needed to substantiate it. Aging of "baby boomers" and their parents may place a greater burden on younger families to accommodate additional family members. Housing which supports extended-family





Time categories (nights):
1=1 night; 2=2-5; 3=6-7; 4=8-14;
5=15-30; 6=31-60; 7=61-360; 8=>360



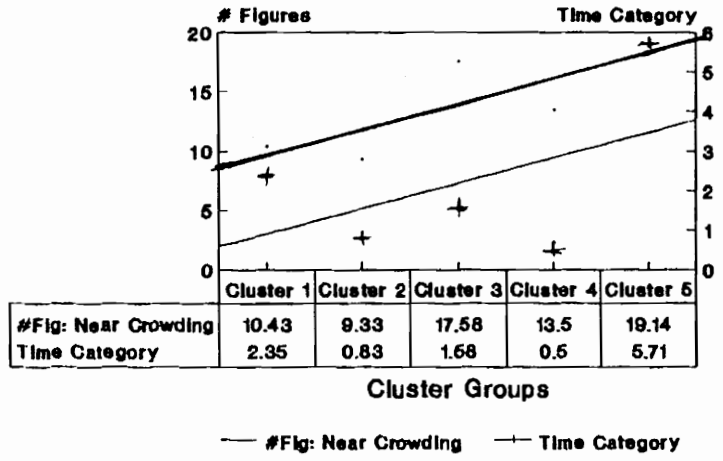


Figure 23. Cluster trends: Overnight crowding accommodation time in four scenarios.

living behaviors will be needed.

Recommendations for further research

To further assess overnight crowding accommodation time, both the physical environment and the number of persons in the household, need to be controlled in various situations. It is recommended that the number of figures be held constant in each environment (model) when assessing the length of overnight accommodation time. Also, an open-ended linear time scale needs to be developed. A listing of increments along with blank spaces for participants to fill in the amount of hours, days, weeks, months or years may be a more accurate measure.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

This chapter summarizes the research project purposes, methodology, findings, conclusions, and implications. Recommendations for further research are presented. The purposes of the study were (a) to compare perceptions of crowding in relationship to housing floor plan design and (b) to formulate a theoretical basis for explaining the relationship of housing and human behavior.

Summary

A review of literature indicates that physical environments influence an occupant's perception of his or her ability to control space (territoriality); social interaction (privacy); and events (predictability). Characteristics of the environment, as well as individual, family, and situational differences, influence the occupant's perception of control. It is one's perception which produces satisfaction or dissatisfaction. If dissatisfaction occurs, adjustments or adaptations occur. If the adjustments or adaptations are not successful, performance deficits, learned helplessness, and mental illness may occur.

The literature also suggests that physical housing characteristics associated with housing norms (adequate space, single-family structures, single-family

neighborhoods, ownership, and quality) are associated with greater ability to perceive control. One housing norm, space, was chosen to be tested in this study. It was chosen because considerable information applicable to housing was available from previous crowding research. Also, the influence of housing space has important implications for the design of small housing for families with children.

It was hypothesized that undivided housing space (open-plan design) would reduce occupant ability to control social interaction when compared to divided space (semi-open and closed designs). To determine if the division of space influenced perception of control in housing environments, an assumption was made that subjective crowding is perceived as uncontrollable social interaction. Evidence of reduced control that was used in this study included (a) perceived crowding at a lower occupancy rate; (b) willingness to accommodate a social situation for a shorter period of time; (c) greater incidence of abandonment of a goal-directed activity or withdrawal from the home; and (d) willingness to accommodate overnight "guests" for a shorter period of time.

A randomized three-group post test only research design with repeated measures was used to test the hypothesis. A scale model room and three scale model houses with three different degrees of openness in the floor plans were used to siumulate housing situations. The open plan model had no

walls between the living room, dining room, and kitchen. The semi-open plan provided two separate rooms--living room and kitchen--which could provide visual separation. The third plan (closed) provided three separate rooms where occupants could be visually separated from household circulation. The models included only the three public areas listed above (bedrooms were not included) and all models were identical except for the space divisions.

Forty-five female volunteers from households of four or more people with at least two children under the age of 18 years or younger were randomly assigned to one of the three floor plan groups. The subjects were given four typical family activity scenarios. Two of the scenarios represented unstructured, high social interaction activities and two represented goal-directed, low-interaction activities. The subjects were also given a supply of scale-sized figures which were painted a non-associational blue- gray color. The subjects were asked to place figures in a model, one-by-one in each scenario, until one more figure would be one too many. This number was determined to be uncrowded--a condition of perceived control. The researcher then added two more figures to produce a condition of crowding and asked the subjects to indicate their reactions and accommodation times. Analysis of Variance statistical procedures were used to analyze the difference of means

among the three floor plan groups.

The number of figures placed in the open plan model in the privacy (low-social interaction) scenario was significantly less than the number placed in the semi-open and closed models. No significant differences were observed among models in the other three scenarios. However, results in the goal-directed (complex-task performance) scenario were in the hypothesized direction. Analysis of the Standard Error term in the ceremonial scenario suggests that, with a larger sample size, a significant difference would have been obtained in the closed plan.

Significantly more figures were placed in all models in the high interaction (ceremonial) scenario than in the goal-directed (complex task) and low interaction (privacy) scenarios. This was expected and supports the reliability of the methodology. No significant differences were observed among floor plan models on reactions and accommodation times, which may be due to the design of the study.

Conclusions

It was concluded from this study that:

1. Perceived crowding occurs at lower density levels in open plan housing than in semi-open or closed plan design in situations where low social interaction is

desired.

2. The length of time that crowding will be accommodated is influenced by both the type of activity occurring in the household and the number of people in the household. When a family is engaged in *non-goal directed* activities, short-term crowding accommodation time was greater, even when the density of the household was greater during the performance of those activities. Also, more abandonment of an activity occurs when a complex task needs to be accomplished than when family members are participating in a high density social activity such as a party.
3. Assuming that the number of figures placed in a model until one more is one too many represents a desirable and controllable level of social interaction, the study supports the theory that housing design and situational differences influence perceptions of control which result in adjustments and adaptations.

Implications for Public Policy

The results of this study have implications for Federal and state government supported housing. First: the definition of household density needs to be more precisely defined to account for the different effects of open and closed plan housing design.

Second: the ability to control social interaction among family members within a dwelling unit needs to be given greater consideration by those who work with families and children. Do children who have more control of interaction and who can achieve low levels of interaction when desired have longer attention spans and greater ability to complete goal-directed activities?

Third: Housing officials need to consider the impact of Federal and state government supported housing built according to HUD minimum standards on perceptions of crowding among occupants. Does housing encourage or discourage desired interaction among family members? Is there a relationship between the size and design of government supported housing to density and withdrawal of males from the household?

Implications for Educators

The ability of participants to visualize themselves in various family activity scenarios and to illustrate their reactions within the confines of a scale model has implications for educators. It is likely that high school home economics students could become more aware of the impact of physical surroundings through this method. The very positive responses of the participants suggests that scale models and role playing would be well received by

students.

At the college level, the use of scale models and figures can be used to increase awareness of environment and behavior concepts, housing design, and interior design. The models provide a concrete way to discuss abstract concepts such as the division of space, extension of space, territoriality, and privacy.

Implications for Housing Designers

This study suggests that designers of small housing for low and moderate income families with children need to pay close attention to features of the design that enable occupants to control social interaction. While this may not be important in a small house with one or two occupants, it increases in importance as the number of occupants increases. Although no differences were observed between the number of figures placed in the semi-open and closed plans, the semi-open plan provides greater flexibility than the closed plan in that it can simulate the spaciousness of an open plan when doors and dividers are open. The doors and dividers can be closed to provide visual and auditory privacy when low-levels of interaction are needed. While design preferences were not addressed in this study, a preference for open plan spaciousness over closed plan designs may be met with a semi-open plan.

The link between housing norms and perceived control identified in the review of literature generates numerous additional questions for housing designers. It suggests that perceived control needs to be addressed in the study of housing norms such as structure type, neighborhood, quality, and tenure.

Implications for Further Research

While some questions have been answered by this study, it has generated many more. The study directs housing research into an area that has not received very much attention in the past--the effects of housing on occupant behavior. Implications for further study have been divided into three categories: (a) methodology, (b) housing design, and (c) housing norms.

Methodology

Sample size. The methodology produced significant results with a small sample size (15 persons per group) when comparisons were made among groups and among scenarios. However, sample size was insufficient to observe effects within a group on any scenario.

Reaction to crowding measurement. An assumption was made that the reaction to crowding measurement addressed all possible reactions by including an open-ended "other" category. When this category was used by participants, the

responses were assessed by the researcher to be within the categories listed. For example; the response, "I'd go to the mall," was interpreted as a withdrawal from the home response. Further clarification may be needed on occupant attitudes toward the reactions listed? How do respondents feel about moving to another location to avoid crowding? Is this a stress inducing or stress reducing reaction? In this study, reactions were treated as progressive (from low to high); however, categorizing them did not result in any significant differences.

Accommodation time. Refinement is needed on the accommodation time measurement. The forced-choice increments used in this study reflect quick and easy response increments. More linearity and precision could be achieved with an open-ended instrument.

Procedures. Each participant saw only one model and used that model throughout the experiment with various scenarios. As a result, floor plan preference was not an issue. Future researchers may wish to introduce preference by having each participant repeat the process in one scenario using all three models.

No significant differences were observed among floor plan models on reactions and accommodation times. This may be due to the design of the study and future researchers should consider holding the number of figures in the models

constant when assessing crowding reactions and accommodation times. It is also suggested that the instrument for assessing time be refined by providing an opportunity for open-ended responses which can then be grouped into linear categories.

Scale models, full-size models or reality. Scale models are an inexpensive and transportable method of assessing human behavior within an environment. Previous research indicates that visual interpretation of space in a 1" = 12" scale is very close to reality. However, there appears to be little evidence to refute or substantiate that scale models influence behavior reactions to the same degree as full-size models or actual houses. For example; does the behavior exhibited in role playing with models correspond to behavior exhibited in a real housing situation? It should be noted that, while differences between models were observed in this study, the study does not address the reliability of comparing scale models to full-size models or actual dwellings.

Furthermore, no evidence was found to assess the influence of time in scale models. When using scale models, is time, as well as space, compacted? Do people imagine the activities which occur in a day to occur much more rapidly than in a full-size model or actual dwelling? If so, how does this affect the behaviors exhibited?

Computer and video simulation are other methods that need consideration in housing research for evaluating the effects of space on human behavior.

Sample characteristics. The sample in this study was representative of women who work outside the home, have households of four or more people, and who have at least two children under 18 years of age. While it was conducted in East Tennessee, many of the women moved to the area from other parts of the United States. The sample does not address race, ethnic, or nationality differences in housing attitudes and behavior. Furthermore, the sample represents people who are least likely to perceive crowding (females). Previous research indicates that men would perceive crowding more readily and the implications of this for housing designs needs to be investigated.

Housing Design

This study has numerous implications for further research on housing design and human behavior. One important implication is the difference in perception and reactions between the APHA optimum standard housing and HUD minimum standard housing size. How does the size of a room affect occupant perceptions? How would alcoves, privacy nooks, high ceilings, lofts, and other interior design features influence perceptions of crowding in small housing for families with children? Do balconies, patios, or other

outside accessibility features affect occupant attitudes and behaviors? Do the size and location of windows have an effect on perception of space and control? Do colors, patterns, textures, sizes, and shapes of furniture, finishes, and accessories influence occupant perceptions of crowding or control?

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Appendix A
Family Activity Situations

SITUATION A

Imagine a rainy/stormy weekend when everyone is in the house trying to find something to do. Think about all the different things that might be happening simultaneously by different people throughout the house. Place figures representing family members (including yourself) one-by one into the model.

Imagine the sounds that you would hear in a house of this size as people are doing whatever they are doing. Keep in mind that the situation is continuing for more than a day. Place figures into the model one-by-one until you <u>feel</u> that one more person in this house for a long rainy/stormy weekend or more would be one too many.

1. You can open and/or close doors or dividers if they are available.
2. You can move, remove, or add furniture.
3. Imagine the first figure is yourself, however the rest of the family members do <u>not</u> need to represent your real family.

When you finish I will photograph the model and ask you too tell me briefly what you imagine people doing in this situation.

SITUATION B:

Imagine yourself taking care of the family's financial records, involved in a community/church project, and working full time outside the home. You are required to do many things that take a great deal of concentration and you must do them in the evening when everyone else is home, too.

Now imagine yourself in this house reading an important report, then having to balance the checkbook, then having to make several important telephone calls for an organization meeting.

Place figures representing hypothetical family members (including yourself), one by one into the model until one more "person" would be too many and YOU would FEEL uncomfortable, crowded or a lack of privacy as you tried to accomplish these tasks.

1. You can open and/or close doors or dividers if they are available.
2. You can move, remove, or add furniture.
3. Imagine the first figure is yourself, however the rest of the family members do not need to represent your real family.

SITUATION C

Imagine that a dear neighborhood friend comes to your house crying and wants to quietly and confidentially discuss a recent and awful event in her life. She doesn't want anyone else to know what happened or to even know that she is upset.

Place figures one-by-one into the model until, if one more "person" is in the house, it would seem difficult to talk with your friend without others hearing or interrupting.

1. You can open and/or close doors or dividers if they are available.
2. You can move, remove, or add furniture.
3. Imagine the first figure is yourself, however the rest of the family members do <u>not</u> need to represent your real family.

SITUATION D

Imagine that you are having a celebration such as a family/friend birthday party, a reception, etc. at your house. Everyone is talking, laughing and having a good time. You are getting ready to serve food and refreshments. Place figures representing this situation in the model. Place them in one-by-one until one more "person" would seem to be too many for a house of this size.

1. You can open and/or close doors or dividers if they are available.
2. You can move, remove, or add furniture.
3. Imagine the first figure is yourself, however the rest of the family members do <u>not</u> need to represent your real family.

Appendix B

Questionnaire

SITUATION	#	GROUP	SEQUENCE

QUESTION #1: (Circle only one answer).

How long could you accommodate this number of people in this situation....

(1) less than an hour?

(2) more than a hour but less than 2 hours?

(3) more than 2 hours but less 4 hours?

(4) more than 4 hours but less than a day?

(5) more than a day?

QUESTION #2: (Circle one answer. Provide explanations if appropriate).

What would be your reaction to this number of people in this size house in this situation? Would you....

(1) Do nothing different. Two more people wouldn't bother me too much in this situation.

(2) Gently ask the two relatives (friends) to leave (and perhaps ask them to come back another time)?

(3) Continue to *(whatever you are doing)* but change my location from the _____ (room) to the _____(room). (Or ask other people to move to someplace else in the model (not bedrooms). Explain_____).

(4) Continue to *(whatever you are doing)*, but I'd have to concentrate more and I might feel crowded.

(5) Give up on trying to *(whatever you are doing)* until there are less people in the house (room).

(6) Stop *(whatever you are doing)* and go for a walk (or visit a neighbor; or attend an evening meeting; or go shopping, etc.) or do something that would give me a reason to leave the house for a while.

(7) Other (Explain) _____

Imagine that your two friends or relatives, who are very responsible people, are temporarily without a home.

Think about this ACTIVITY as well as the SIZE and DESIGN of this house. Could you temporarily accommodate the two friends if your family and house were of the sizes indicated with the model?. (There is extra sleeping space on the sofa-bed in the living room).

QUESTION #3: **(Circle one answer).**

No (1), I could not accommodate the extra people if my family and house were of the sizes represented.

(If you circled "No" tell the researcher you are finished).

Yes (2), I could accommodate the extra people temporarily.

(If you circle "Yes", please answer the following question).

If you answered "Yes", you could temporarily accommodate the extra two people in this situation, how long could you accommodate them with the size family and house represented? (Circle one answer).

(1) One night.

(2) More than 1 night but less than 5 nights.

(3) More than 5 nights but less than a week.

(4) More than a week but less than two weeks.

(5) More than two weeks but less than a month.

(6) More than a month but less than two months.

(7) More than two months but less than a year.

(8) More than a year.

Appendix C

Volunteer Recruitment Letter/Reply Form

EAST TENNESSEE STATE UNIVERSITY
JOHNSON CITY, TENNESSEE
Box 70671 Ext. 4403

INTERDEPARTMENTAL COMMUNICATION

TO: * Female ETSU Staff

FROM: * Nancy L. Gruel, Dept. of Applied Human Sciences

SUBJECT: * Research on Housing

DATE: * November 9, 1992

Would you help me find out how people feel about houses with different floor plan designs? Scale model houses and scale size figures have been constructed for this study. You will simply place figures in a model house in four different, but typical family situations, then answer some questions. There are no right or wrong answers--only your feelings and opinions are being sought. You would need to come to Hutcheson Hall one time in the next month for about 45 minutes.

I am asking female staff to participate if they live in households of four or more people and have at least two children in the household under 18 years of age. My reasons for asking female staff are:

1. Women spend more time in the home and are more likely than men to be affected by a home's design.
2. The scale model houses are difficult to move from place to place so it is a practical advantage to have both the participants and the study on campus.

Fifty participants are needed for the study. Because of the limitations on household size, I'll probably need all of you who can answer "yes" to the two questions on the return form. As encouragement, one participant among the first fifty forms received will be randomly selected to receive her choice from the following:

a. Lunch for two at Galloway's
b. A $25.00 Cashier's check.

Everyone will receive a report on the final results. The study has been approved and people who participated in the past thought it was fun.

If you can volunteer about 45 minutes of your time, return the response card immediately. If you need a supervisor's permission, indicate the name and telephone number of your supervisor. I will try to secure permission for you to be away from your job for the required 45 minutes. Then I will call you to set up a convenient time.

HOUSING RESEARCH RETURN CARD

1. Are there at least four people currently living in your household?

____Yes
____No, there are fewer than four people in my household.

2. Are there at least two children age 18 or younger currently living in your household?

____Yes
____No, there are fewer than two children age 18 or younger in my household.

If you answered "No" to either question, please fold, staple, and return this form.

If you answered "Yes" to both questions, please continue.

Your Name_____
Your Telephone No._____

Do you have a supervisor that you would like me to contact to secure permission for you to be away from your job one time for approximately 45 minutes?

____Yes ____No

Supervisor's Name_____
Supervisor's Telephone No._____

Fold, staple and deposit in campus mail. Thank you.

EAST TENNESSEE STATE UNIVERSITY
JOHNSON CITY, TENNESSEE
Box 70671 Phone No. 4403

INTERDEPARTMENTAL COMMUNICATION

TO: * Dr.
Box

FROM: * Nancy L. Gruel, Applied Human Sciences

SUBJECT: * Request for employee permission to be away from the workplace.

DATE: * December 9, 1992

Attached is a copy of the request for research participants that went out to all female ETSU faculty and staff. One of the people in your department, Sally Thomas-Lee is eligible to participant. To do so, she would need to be away from her workplace one time before Christmas for approximately 45 minutes. Is that acceptable with you. I will call you within the next three days.

Thank you.

East Tennessee State University
Institutional Review Board
INFORMED CONSENT FORM

TITLE OF PROJECT:

Effects of floor plan design on perceived household crowding among families with children.

PURPOSE OF THIS STUDY:

I understand that the purpose of this experiment is to investigate the attitudes of families with children toward various floor plan designs and the effect that the designs might have on family activities. The results will be used to aid housing designers develop plans that support family activities.

I understand that arrangements will be made for me to go to the first floor of Hutcheson Hall once at an agreed upon time during the workday for approximately 30-45 minutes. A variety of family daily-activity situations that might occur from the time children return from school until they go to bed at night will be presented. I will place scaled figures into a 3-dimensional scale-model house to represent the number of people that could comfortably live in this size and style house. The number of scale figures placed in the model will be recorded and the model (not the participant) will be photographed. Opinions regarding how people might respond to noisy, crowded situations (but no embarrassing personal questions) will be asked.

I understand that my individual responses will be kept strictly confidential and only group data will be distributed.

I understand that I have the right to choose to participate and to receive a copy of this form. While no risks or discomfort to participants is expected, if I feel uncomfortable I may quit at any time before or during the 30-45 minute process.

I understand that I will receive a copy of the results of this study and if I am among the first 50 eligible participants to return the response form, my name will be placed in a pool from which one name will be drawn to receive an incentive worth $25.00.

I understand that if I have further questions about this study I can contact Nancy L. Gruel, Dept. of Applied Human Sciences (formerly Home Economics) 929-4403.

Date	Signature of Volunteer
Date	Signature of Investigator

(Fifty participants chosen for this study were randomly selected from among ETSU staff that met the following three criteria: (a) female, (b) live in households of four or more people, and (c) have two or more children under the age of 18 living at home.)

Appendix D

Scripted Guide Sheet

RESEARCHER GUIDE SHEET

NOTE TO RESEARCHER: CHECK TO INSURE THAT ALL FURNITURE IS POSITIONED ACCURATELY AND THAT (A) THE APPROPRIATE MODEL MATCHES THE ANSWER SHEETS; (B) SITUATIONS AND ID SHEETS ARE IN SAME SEQUENCE AS INDICATED ON ANSWER SHEETS.

"With this project, we are attempting to learn more about how people began to feel crowded in a small house in typical family situations."

"First, I'll have you fill out a short survey asking about the size of your current dwelling and the number of people who live there."

"The second part will be to go through a practice situation using the model living room in front of you."

"In the practice session, you'll place these scale size figures in the room. The figures are divided into four groups (a) standing adults and teenagers; (b) seated adults and teenagers; (c) standing children; and (d) seated children. When you BEGIN to place figures in each situation, imagine that the first figure is yourself and that you will live in this house for a long time--10 years or more. Then continue placing figures one-by-one until you feel that if you placed one more figure, it would be one too many."

"When you finish I'll photograph the model with a Polaroid and video camera and ask you to briefly explain what this imaginary household is doing. Then I'll have you add more figures to create a situation that is crowded and ask you to answer 3 questions."

"When you finish the questions, I'll give you an opportunity to look at the photograph and tell me the number of people that would be IDEAL for this size room and situation."

"The third part of the study will be to repeat the practice session using the house models and four different family situations; a rainy weekend, a family get-together, a private conversation, and a situation that requires a lot of concentration."

"The process will take approximately 30-45 minutes and you may decide to quit anytime before or during the process."

"Would you like to continue?"

GIVE PARTICIPANT A SURVEY AND A PENCIL.

"This is the survey. Place numbers in the blanks or circle what you feel is the best answer. If you have any questions, feel free to ask. Let me know when you are finished."

(finished)

"Now we'll begin the practice session."

"Imagine:

"This is only the living room in a small house. Imagine yourself coming home from work each evening and spending most of the evening in this room doing whatever you like to do in the evening."

"Place figures in the room one-by-one until one more figure each evening in a room this size would be one too many. Imagine that the first figure is yourself. While the first figure is yourself, all other figures can be imaginary. Think about living in a house with this size living room for a long time--ten years or more.

1. You can open and/or close doors or dividers if they are available.

2. You can move, remove, or add furniture. (There are extra chairs in the box next to the figures.)

3. Think of your feelings as more figures are added. There are not right or wrong answers.

4. Feel free to ask questions at any time.

5. Tell me when you are finished."

(Finished)

6. TELL PARTICIPANT: "There is a satisfaction chart displayed in front of you. If your household was this size and you lived for a long time in a house of this size, when a situation like this occurred, how satisfied would you be with this amount of space?

   WRITE ANSWER ON VIDEO CUE CARD.

1. INSTRUCT PARTICIPANT. "Now I'll photograph the model." PHOTOGRAPH MODEL WITH POLAROID.

   IDENTIFY PHOTO WITH SUBJECT #, GROUP, SITUATION, AND NUMBER OF FIGURES. USE ID SHEET AS A REFERENCE.

2. PUT ID SHEET OVER MODEL. TURN ON VIDEO. REMOVE ID SHEET AFTER 10 SECONDS. ASK PARTICIPANT:

"Would you explain a little about what you imagine people doing in this situation?"

3. INSTRUCT PARTICIPANT: "Add two more figures to the model. Imagine that they are very close friends or relatives."

"Is there anything that you would change to make this house more comfortably for this number of people?"

4. TURN OFF VIDEO. GIVE PARTICIPANT ANSWER SHEET WITH SITUATION "P". ASK PARTICIPANT,.

"Would you answer these three questions by putting a circle around the number most appropriate for you."

"TELL ME WHEN YOU ARE FINISHED."

PREPARE PHOTO FOR PARTICIPANT TO OBSERVE. INSTRUCT:

"When you placed figures in the model, you placed them in one-by-one until one more would have been too crowded. Now I'd like you to look at the photograph and tell me the number of people that would be IDEAL for this size room in this situation. Would the ideal number of people for a living room of this size be more, less, or the same as you have shown?"

(IF MORE OR LESS, ASK FOR A NUMBER. RECORD ANSWER).
"I'll remove the model room and show you the house.

REMOVE ROOM. LIFT COVER OFF MODEL. REPLACE FIGURES IN APPROPRIATE TRAYS.

"This is the model house you will be working with. It has a kitchen with some seating space, dining space and a living room area. There are enough bedrooms to accommodate what ever size family you put in this model, but the bedrooms are small and would not have space for recreation, desks, etc."

"Some models have doors and dividers that open and close. You may operate the doors or dividers anytime you feel the model would accommodate more people or be more comfortable with a change."

GIVE PARTICIPANT THE FIRST SITUATION OF SEQUENCE.

"This is the first of the four situations. I'll let you read each situation and place figures one-by-one until one more is too many. Tell me when you are finished."

(Finished)

A. TELL PARTICIPANT: "There is a satisfaction chart displayed in front of you. If your household was this size and you lived for a long time in a house of this size, if a situation like this occurred frequently, how satisfied would you be?

WRITE ANSWER ON VIDEO CUE CARD.

1. "Now I'll photograph the model. PHOTOGRAPH MODEL WITH POLAROID. IDENTIFY WITH SUBJECT #, GROUP, SITUATION, & NUMBER OF FIGURES.

2. PLACE ID SHEET. TURN ON VIDEO. ASK,

"Would you explain a little about what you imagine people doing in this situation?" (LISTEN TO EXPLANATION. IT WILL BE RECORDED ON VIDEO).

3. INSTRUCT PARTICIPANT: "Add two more figures to the model. Imagine that they are very close friends or relatives."

ASK OPEN-ENDED QUESTION BELOW:

"With this number of people, is there anything that you would change to make this house more comfortable?"

4. TURN OFF VIDEO (after recording placement). ASK,

GIVE PARTICIPANT ANSWER SHEET IDENTIFIED WITH THE SITUATION. "Would you answer these three questions?"

REMOVE FIGURES FROM MODEL AND REPLACE IN TRAY. ARRANGE FURNITURE IN ORIGINAL POSITION. OPEN ALL DOORS AND DIVIDER.

"Tell me when you are finished."

GIVE PARTICIPANT THE SECOND SITUATION OF SEQUENCE.

"This is the second of the four situations. Place figures one-by-one just as you did the others. Tell me when you are finished."

(Finished)

A. TELL PARTICIPANT: "There is a satisfaction chart displayed in front of you. If your household was this size and you lived for a long time in a house of this size, if a situation like this occurred frequently, how satisfied, how satisfied would you be?

WRITE ANSWER ON VIDEO CUE CARD.

1. "Now I'll photograph the model.
PHOTOGRAPH MODEL WITH POLAROID. IDENTIFY WITH SUBJECT #, GROUP, SITUATION, & NUMBER OF FIGURES.

2. PLACE ID SHEET. TURN ON VIDEO. ASK,
"Would you explain a little about what you imagine people doing in this situation?" (LISTEN TO EXPLANATION. IT WILL BE RECORDED ON VIDEO).

3. INSTRUCT PARTICIPANT: "Add two more figures to the model. Imagine that they are very close friends or relatives."

ASK OPEN-ENDED QUESTION BELOW:

"With this number of people, is there anything that you Would change to make this house more comfortable?"

4. TURN OFF VIDEO (after recording placement). ASK,

GIVE PARTICIPANT ANSWER SHEET IDENTIFIED WITH THE SITUATION.
"Would you answer these questions?"

REMOVE FIGURES FROM MODEL AND REPLACE IN TRAY. ARRANGE FURNITURE. OPEN ALL DOORS AND DIVIDER.

GIVE PARTICIPANT THE THIRD SITUATION OF SEQUENCE.

"This is the third of the four situations. Imagine that the first figure is yourself. Tell me when you are finished."

(Finished)

A. TELL PARTICIPANT: "There is a satisfaction chart displayed in front of you. If your household was this size and you lived for a long time in a house of this size, if a situation like this occurred, frequently how satisfied would you be?

WRITE ANSWER ON VIDEO CUE CARD.

1. "Now I'll photograph the model. PHOTOGRAPH MODEL WITH POLAROID. IDENTIFY WITH SUBJECT #, GROUP, SITUATION, & NUMBER OF FIGURES.

2. PLACE ID SHEET. TURN ON VIDEO. ASK PARTICIPANT:

"Would you explain a little about what you imagine people doing in this situation?" (LISTEN TO EXPLANATION. IT WILL BE RECORDED ON VIDEO).

3. INSTRUCT PARTICIPANT: "Add two more figures to the model. Imagine that they are very close friends or relatives."

ASK OPEN-ENDED QUESTION BELOW:

"With this number of people, is there anything that you would change to make this house more comfortable?"

4. TURN OFF VIDEO (after recording placement). ASK,

GIVE PARTICIPANT ANSWER SHEET IDENTIFIED WITH THE SITUATION. "Would you answer these questions?

REMOVE FIGURES FROM MODEL AND REPLACE IN TRAY. ARRANGE FURNITURE. OPEN ALL DOORS AND DIVIDER.

GIVE PARTICIPANT THE FOURTH SITUATION OF SEQUENCE.

"This is the last of the four situations. Place figures until you feel one more is one too many."

(Finished)

A. TELL PARTICIPANT: "There is a satisfaction chart displayed in front of you. If your household was this size and you lived for a long time in a house of this size, if a situation like this occurred, frequently how satisfied would you be?

WRITE ANSWER ON VIDEO CUE CARD.

1. "Now I'll photograph the model. PHOTOGRAPH MODEL WITH POLAROID. IDENTIFY WITH SUBJECT #, GROUP, SITUATION, & NUMBER OF FIGURES.

2. PLACE ID SHEET. TURN ON VIDEO. ASK,

"Would you explain a little about what you imagine people doing in this situation? (LISTEN TO THE EXPLANATION. IT WILL BE RECORDED ON VIDEO).

INSTRUCT PARTICIPANT: "Add two more figures to the model. Imagine that they are very close friends or relatives."

ASK OPEN-ENDED QUESTION BELOW:

"With this number of people, is there anything that you would change to make this house more comfortable?"

4. TURN OFF VIDEO (after recording placement). ASK,

GIVE PARTICIPANT ANSWER SHEET IDENTIFIED WITH THE SITUATION.

"Would you answer these questions?"

PUT SITUATION PHOTOS IN ORDER FOR PARTICIPANT TO VIEW ONE BY ONE. TELL PARTICIPANT:

"When you placed figures in the model, you placed them in one-by-one until one more would have been too crowded. Now I'd like you to look at the photographs and tell me the number of people that would be IDEAL for this size house in this situation."

1. "Would the IDEAL number of people for this first situation (SHOW PHOTOGRAPH AND IDENTIFY SITUATION) Be more, less, or the same as you have shown?"

   (IF MORE OR LESS, ASK FOR A NUMBER). RECORD ANSWER ON PHOTO.)

2. "Would the IDEAL number of people for the second situation (SHOW PHOTOGRAPH AND IDENTIFY SITUATION) Be more, less, or the same as you have shown?"

   (IF MORE OR LESS, ASK FOR A NUMBER). RECORD ANSWER ON PHOTO).

3. "Would the IDEAL number of people for the third situation (SHOW PHOTOGRAPH AND IDENTIFY SITUATION) Be more, less, or the same as you have shown?"

   (IF MORE OR LESS, ASK FOR A NUMBER). RECORD ANSWER ON PHOTO).

4. "Would the IDEAL number of people for the fourth situation (SHOW PHOTOGRAPH AND IDENTIFY SITUATION) Be more, less, or the same as you have shown?"

   (IF MORE OR LESS, ASK FOR A NUMBER). RECORD ANSWER ON PHOTO).

"Thank you very much for your help. All participants will be sent a report on the final results. It is anticipated that the report will be completed before the end of the spring semester. Thank you again."

Appendix E

Demographic Survey

Information about Current Dwelling

The first three questions are about the dwelling in which you currently live. If you live in an apartment or condominium, answer only for your unit.

1. How many rooms (not including bathrooms) are in the dwelling where you are currently living?

2. How many bathrooms and "half-baths" are in your dwelling?

3. How many rooms of each of the following types are in the dwelling where you are currently living?

Type of Room	Number of each type
Living rooms	_____
Dining rooms	_____
Combination living/dining room	_____
Kitchen without eating space	_____
Kitchen with small eating space	_____
Combination kitchen/dining room	_____
Combination kitchen/living/dining room	_____
Family/recreation room or den	_____
Home office	_____
Separate laundry room	_____
Bedrooms	_____
Others that are not listed	
_____	_____
_____	_____
_____	_____

4. What is the structure type of your current dwelling (Check only one answer).

Single-family detached home	_____
Side-by-side duplex	_____
House converted to _____(#) apartments.	_____
Townhouse	_____
Multi-family apartment - 1 floor	_____
Multi-family apartment - 2 or 3 floors.	_____
Multi-family apartment - 3+ floors	_____
Mobile home	_____
Other (Explain)_____	_____

Information About Current Household

5. How many people (including yourself) live in your dwelling?

_____

6. Please indicate the number of persons in your household of each age and sex, including yourself.

Number of person younger than 5 years.
_____girls_____boys

Number of persons at least 5 years old, but younger than 12 years.
_____girls_____boys

Number of persons at least 12 years old, but younger than 18 years.
_____girls_____boys

Number of persons at least 18 years old, but younger than 30 years.
_____women_____men

Number of persons at least thirty years old, but younger than 55 years.
_____women_____men

Number of persons over 55 years.
_____women_____men

7. Please check the blank which best represents your age.

___ Under 25
___ 25 - 35
___ 36 - 55
___ 56 or over

Appendix F

Tables

Table 1. Mean number of rooms and number of bathrooms in participant homes by control and treatment groups.

Group	n	Number of Rooms		Number of Bathrooms	
		Mean	SE	Mean	SE
Open plan (Control)		8.33	.803	2.25	.214
Semi-open plan		6.73	.396	2.00	.207
Closed plan		7.80	.470	2.17	.193
Total	N=45	7.62	MEAN	2.14	MEAN
		.3442	SE	.1167	SE
		1.95	F-ratio	0.39	F-ratio
		0.1552	Prob.	0.682	Prob.

n = 15 in each group.
Analysis of Variance revealed no significant differences in number of rooms and number of bathrooms in particiapnt homes among control and treatment groups.

Table 2. Frequency of structure type by control and treatment groups.

Group	n	Structure Type				
				Apartments		
		Single Family	Duplex	Converted House	Mid-rise	Total
Open plan (Control)		14	1			15
Semi-open plan		13		1	1	15
Closed plan		15				15
Total	N =45	42	1	1	1	45

n = 15 in each group.
Analysis of Variance revealed no significant differences in housing structure types among participants in the control and treatment groups.

Table 3. Frequency of participant age group by control and treatment groups.

Group	n	(- 25)	(25-35)	(36-55)	Total
Open plan (Control)		0	3	12	15
Semi-open plan		0	5	10	15
Closed plan		0	9	6	15
		0	17	28	45

n = 15 in each group.
No significant difference in age groups was observed among floor plan groups.
Chi-square = 5.29 DF = 2 P > .05

Table 4. Mean values of figure placement, satisfaction, and ideal number of figures in a scale-model room by control and treatment groups.

Group	n	# Figures Near crowding		Level of Satisfaction		# Figures Ideal	SE
		Mean	SE	Mean	SE	Mean	SE
Open plan (Control)		5.13	.584	3.6	.456	3.66*	.232
Semi-open plan		4.93	.345	3.7	.431	3.66*	.347
Closed plan		5.20	.518	3.9	.408	4.00*	.436
Total	N = 45	5.08	Mean	3.7	Mean	3.77*	Mean
		.2786	SE	.2444	SE	.1982	SE
		0.08	F-ratio	0.15	F-ratio	.30	F-ratio
		0.924	Prob.	0.86	Prob.	0.739	Prob.

n = 15 in each group.
Analysis of Variance revealed no significant differences in number of figures placed, number for satisfaction, and number considered ideal among control and treatment groups in the practice model room.
*The number of figures considered ideal is less at the .05 level of significance than the number placed to near crowding in each participant group.

Table 5. Cluster means of near crowding, satisfaction, and ideal number of figures with a scale-model room.

Clusters			Variables					
Near Crowding	Ideal	n	# of Figures Near crowding		Level of Satisfaction		# of Figures Ideal	
			Mean	SE	Mean	SE	Mean	SE
(1) MOD	MOD LOW	14	$5.2^{3,4,5}$	.334	$2.0^{2,3,4}$	.210	$3.4^{2,3,4,5}$	.173
(2) MOD	MOD	13	$4.6^{3,4,5}$	.180	$5.2^{1,5}$	.231	$4.2^{1,4,5}$	.122
(3) HIGH	MOD HIGH	5	$8.6^{1,2,4,5}$	.678	$4.2^{1,5}$	.583	$4.8^{1,4,5}$	.200
(4) LOW	LOW	10	$3.2^{1,2,3,5}$	.249	$4.6^{1,5}$	.221	$2.2^{1,2,3,5}$	.133
(5) HIGH	HIGH	3	$7.0^{1,2,3,4}$	.577	$2.0^{2,3,4}$	.577	$7.0^{1,2,3,4}$	.577
Total		N = 45	5.08 Mean		3.75 Mean		3.78 Mean	
			26.38 F-ratio		30.10 F-ratio		54.09 F-ratio	
			0.000 Prob.		0.000 Prob.		0.000 Prob.	

[1] denotes significantly different than 1.
[2] denotes significantly different than 2.
[3] denotes significantly different than 3.
[4] denotes significantly different than 4.
[5] denotes significantly different than 5.

Table 6. Mean number of figures placed, satisfaction level, and ideal number of figures in model houses by control and treatment groups in four typical family scenarios.

Group	n[1]	# of Figures Near crowding		Level of Satisfaction		# of Figures Ideal	
Open plan		Mean	SE	Mean	SE	Mean	SE
Unstructured		6.33	.741	4.5	.542	5.00*	.704
Complex task		4.53	.477	4.7	.374	3.13*	.559
Privacy		3.73	.419	5.3	.494	2.80*	.341
Ceremonial		14.67	1.626	5.0	.414	13.40*	.174
Semi-open plan							
Unstructured		6.00	.569	5.2	.460	4.33*	.333
Complex task		5.20	.380	5.3	.303	3.33*	.319
Privacy		6.00	.516	5.2	.355	4.20*	.428
Ceremonial		14.87	.985	3.7	.494	13.20	1.493
Closed plan							
Unstructured		6.93	.913	4.8	.449	5.33*	.347
Complex task		5.00	.478	5.4	.400	3.87*	.559
Privacy		6.93	.700	5.1	.435	5.00*	.609
Ceremonial		12.33	.773	4.1	.441	11.60	.722

n = 15 in each group.
* Analysis of Variance revealed that at the .05 level of significance the ideal number of figures is less than the number of figures placed to near crowding.

Table 7. Number of figures placed by floor plan groups in four typical family-activity scenarios.

		SCENARIO							
		Unstructured		Complex		Privacy		Ceremonial	
Group	n	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Open (Control	15	6.33	.74	4.53	.48	3.73[1]	.42	14.67	1.63
Semi-open	15	6.00	.57	5.20	.38	6.00	.52	14.87	.98
Closed	15	6.93	.91	5.00	.34	6.93	.70	12.33	.77
All Groups	45	6.42	.43	4.91	.26	5.55	.37	13.96	.69
F-ratio		0.39		0.58		8.71		1.41	
Prob		0.6772		0.5618		0.0007		0.2547	

[1]Analysis of Variance revealed significantly fewer figures placed in the open plan model in the privacy scenario.

Table 8. Number of figures placed by typical family-activity scenario in scale model houses of three floor plans.

		FLOOR PLAN GROUP					
		Open plan (Control)		Semi-open plan		Closed plan	
Scenario	n	Mean	SE	Mean	SE	Mean	SE
Unstructured	60	6.33	.741	6.00	.569	6.93	.913
Complex task	60	4.53	.477	5.20	.380	5.00	.478
Privacy	60	3.73	.419	6.00	.516	6.93	.700
Ceremonial	60	14.67[1]	1.626	14.87[1]	.985	12.33[1]	.773
All Groups	180	29.27	2.540	32.07	1.940	31.20	2.240
F-ratio		28.02		49.25		18.55	
Prob.		0.000		0.000		0.000	

n = Total number of observations (4 per subject).
Analysis of Variance reveals that significantly more figures were placed in the ceremonial scenario in all floor plan groups.

Table 9. Mean crowding accommodation time by floor plan groups in four typical family activity scenarios.

		SCENARIOS							
		Unstruct		Complex		Privacy		Ceremonial	
Group	n	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Open (Control)	15	4.60	.25	3.00	.42	2.40	.46	3.73	.21
Semi-open	15	4.13	.27	3.2	.34	2.67	.36	3.07	.25
Closed	15	4.00	.30	2.67	.41	2.40	.31	3.07	.25
All floor plans	45	4.24	.16	2.96	.22	2.49	.21	3.29	.14
F-ratio		1.27		0.47		0.16		2.68	
Prob.		0.2921		0.6295		0.8485		0.0801	

Analysis of Variance revealed no significant differences in crowding accommodation time among floor plan groups in any of the four scenarios.

Table 10. Mean crowding accommodation time by typical family-activity scenario in scale model houses in three floor plans.

		FLOOR PLAN GROUPS					
		Open plan		Semi-open		Closed	
Scenario	n	Mean	SE	Mean	SE	Mean	SE
Unstructured[1]	60	4.60[4]	.25	4.13[6]	.27	4.00[6]	.30
Complex task[2]	60	3.00[5]	.42	3.20	.34	2.67	.41
Privacy[5]	60	2.40[5]	.46	2.67	.36	2.40	.31
Ceremonial	60	3.73[6]	.21	3.07	.25	3.07	.25
All scenarios	180	3.43	.26	3.27	.21	3.03	.23
F-ratio		7.28		4.02		4.69	
Prob.		0.0003		0.0116		0.0054	

n = number of observations in each floor plan group).

Analysis of Variance revealed significant differences in crowding accommodation time among family activity scenarios.

[1]Denotes significantly different than complex, privacy, and ceremonial (combined floor plan groups).

[2]Denotes significantly different than unstructured (combined floor plan groups).

[3]Denotes significantly different privacy and unstructured.

[4]Denotes significantly different than complex and privacy.

[5]Denotes significantly different than unstructured and ceremonial.

[6] Denotes significantly different than privacy.

Table 11. Level of reaction to crowding by floor plan group in four typical family activity scenarios.

		SCENARIOS							
		Unstruct		Complex		Privacy		Ceremonial	
Group	n	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Open (Control)	15	3.07	.55	3.67	.33	3.53	.45	2.27	.42
Semi-open	15	2.93	.46	3.40	.39	2.67	.30	2.47	.45
Closed	15	3.33	.46	3.47	.45	3.00	.45	2.80	.46
All floor plans	45	3.11	.28	3.51	.22	3.07	.23	2.51	.25
F-ratio		0.17		0.12		1.17		0.37	
Prob.		0.8438		0.8846		0.3208		0.6919	

Analysis of Variance revealed no significant difference in the level of reaction to crowding among floor plan groups in any of the four scenarios.

Table 12. Level of reaction to crowding by family activity scenario in three floor plan groups.

		FLOOR PLAN GROUPS					
		Open plan		Semi-open		Closed	
Scenario	n	Mean	SE	Mean	SE	Mean	SE
Unstructured	60	3.07	.55	2.93	.46	3.33	.46
Complex task[1]	60	3.67	.33	3.40	.39	3.47	.45
Privacy	60	3.53	.45	2.67	.30	3.00	.45
Ceremonial	60	2.27	.42	2.47	.45	2.80	.46
All scenarios	180	3.13	.24	2.87	.27	3.15	.30
F-ratio		2.04		0.99		0.45	
Prob.		0.1191		0.4020		0.7218	

n = number of observations in each floor plan group (4 per subject).

Analysis of variance revealed no significant differences in the level of reaction to crowding among scenarios in any floor plan group.

[1]Denotes significantly different than Ceremonial when all floor plan groups are combined (F-ratio = 2.74. Prob. = 0.0446)

Table 13. Overnight crowding accommodation time by floor plan groups in four typical family activitiy scenarios.

		SCENARIOS							
		Unstruct		Complex		Privacy		Ceremonial	
Groups	n	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Open (Control)	15	3.60	.47	2.73	.60	2.87	.68	2.73	.59
Semi-open	15	2.53	.48	2.27	.42	2.33	.46	1.93	.47
Closed	15	2.67	.40	2.13	.47	2.60	.54	2.00	.26
All floor plans	45	2.93	.26	2.37	.28	2.60	.32	2.22	.27
F-ratio		1.17		0.50		0.30		0.60	
Prob.		0.3212		0.6822		0.8285		0.6168	

Analysis of Variance revealed no significant difference in the overnight accommodation time among floor plan groups in any of the four activity scenarios.

Table 14. Overnight crowding accommodation time by scenario in three floor plan groups.

		FLOOR PLAN GROUPS					
		Open		Semi-open		Closed	
Scenarios	n	Mean	SE	Mean	SE	Mean	SE
Unstructured	60	3.6	.47	2.53	.48	2.27	.40
Complex task	60	2.73	.60	2.27	.42	2.13	.47
Privacy	60	2.87	.68	2.33	.46	2.60	.54
Ceremonial	60	2.73	.59	1.93	.47	2.00	.26
All scenarios	180	2.73	.59	1.93	.47	2.00	.26
F-ratio		0.50		0.30		0.60	
Prob.		0.6822		0.8285		0.6168	

n = number of observations in each floor plan group (4 per subject).

Analysis of Variance revealed no significant differences in overnight crowding accommodation time by scenario in any of the three floor plan groups.

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