# THE IMPACT OF THE ENVIRONMENTAL ATTRIBUTES ON THE VERBAL INTERACTION OF THE USERS IN THE LOUNGE SPACES IN THE CAMPUS BUILDINGS

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# CHAPTER ONE

## Introduction and Review of Literature

Osmond (1957) has defined **Sociopetality** as that spatial quality that encourages, fosters and even forces the development of stable interpersonal relationships and **Sociofugality** as that spatial quality that prevents or discourages the formation of stable human interaction. Several aspects of spatial quality including room proportions, seating arrangements and furniture density contribute to sociopetality and sociofugality.

Ortiz Gonzalez (1983) has measured the sociopetality of a space by developing a sociopetality score consisting of width to length proportion of the room, furniture arrangement within a seating cluster, and furniture density in the room. However, there is little research on additional factors such as other physical and social environmental characteristics which also might contribute to the sociopetality or sociofugality of a space.

### Purpose of the Study

The purposes of this study were (a) to refine the measurements of sociopetal and sociofugal characteristics of a space by exploring the role of additional qualities of the physical and social environments in determining sociopetality, and (b) to study the impact of the selected environmental attributes on the social behavior of the users of the lounge spaces used for study and social interaction in the campus buildings. The study sampled both study spaces designated for that purpose and spaces designated primarily for social interaction or non-study purposes. In other words, the study was conducted in spaces which have been designated to discourage social interaction disruptive to studying and in spaces which have not.

Background

As mentioned earlier, Osmond (1957) has defined **sociopetality** as that spatial quality that encourages, fosters and even forces the development of stable interpersonal relationships and **sociofugality** of spaces prevents or discourages the formation of stable human interaction. Previous research has identified some physical and social characteristics of an environment that influence the social behavior of the users of that environment. The following literature review suggests that in addition to room proportions, furniture arrangement and furniture density, there are other factors which might facilitate or discourage the social interaction of the users within an environment.

Room proportions

Several studies suggest that the room proportions are highly related to the social behavior of the users. Osmond (1957) has pointed out that when width to length ratio of an indoor environment (e.g. corridors) is about 1 to 5 (0.20), the space should be considered sociofugal in nature. Similarly, using observational techniques during a two week period in a mental hospital, Sommer and Gilliland (1962) found that over 40% of the friendless residents isolated themselves in corridors, which were sociofugal by Osmond's definition of width to length ratio.

Ortiz Gonzalez (1983) has found that a high sociopetality score comprised of space proportions, furniture arrangement and furniture density is strongly related to a high score in social behavior. However, he concludes that the correlation of space proportions (width to length ratio) with the social behavior was not significant. It should be noted that he did not consider the height of the space in the space proportions.

Furniture Arrangement

Research suggests that back-to-back and shoulder-to-shoulder seating arrangements discourage the formation of human interaction and thus are sociofugal, whereas arrangements of seating in small groupings tend to provide opportunity for comfortable interpersonal relationships and thus are sociopetal. Observing an airport lounge, Jacobson (1974) discovered that parallel seating so often found in public waiting spaces did not allow for either comfortable conversation or adequate levels of privacy. Similarly, Hall (1966) has argued that the back-to-back seating arrangement is an appropriate solution to minimize space because it is possible for two people to stay uninvolved if that is their desire. Sommer and Dewar (1963), using observational techniques in a psychiatric hospital, noted that visitors voluntarily re-arranged chairs, originally placed in straight rows (shoulder to shoulder) against the walls, into small groups of chairs that facilitated more comfortable conversation.

### Furniture Density

Ortiz Gonzalez (1983) found that among the three variables comprising his sociopetality score, the furniture density showed the strongest relationship to social behavior. He defined furniture density as a ratio relating the number of chairs per square foot for each grouping of seating.

### Proximity

Hall (1966) coined the term "proxemics" to define the human's use of distance in social interaction. This concept, derived from "proximity", identifies adequate interpersonal distances for social interaction. He has identified four types of distances, namely, **intimate distance** (0 -1.5 feet); **personal distance** (1.5 - 4 feet); **social distance** (4 - 12 feet) and **public distance** (>12 feet), which are suitable for specific behaviors. The type of social behaviors anticipated in the spaces studied were expected to take place primarily within personal distance, and social distance (between one and a half feet and twelve feet).

Sommer and Ross (1958) found an increase in social interaction among patients in a psychiatric ward by simply changing the placement of four chairs around small tables rather than around the perimeter of the room. This study suggests that distance between furniture, and possibly the provision of a prop such as a table, may be an important factor in the sociopetality or sociofugality of a space. It should be noted that the above arrangement also increased the furniture density of the cluster, which suggests that furniture density and proximity may be highly related in everyday settings, and may represent two measurements of one environmental dimension of sociopetality or sociofugality.

The above studies suggest that the room proportions, seating arrangement, proximity and the furniture density are among the spatial qualities which are strongly related to the sociopetality or sociofugality of a space, with furniture density having the strongest relationship (Ortiz Gonzalez, 1983) and thus may influence the social behavior of the users in that particular space. However, these studies have not included some other physical and social characteristics of the environment which might have influenced social behavior. The above studies also have not differentiated spatial qualities measured for the seating arrangement (hereafter called a cluster) as against the room. For example, three seating groups with different furniture arrangement, density and proximity might occur in the same room. Variables in the studies reviewed were measured at either one or the other of the levels. A review of additional research indicates that social density and ambient environment may be additional factors which might influence the social behavior of the users in that particular environment.

Social Density

Chalsa Loo (1970) has distinguished between **social density**, or the number of persons in a given area, and **spatial density**, or the available space in a particular setting. Researchers have investigated social density by increasing the number of persons, while keeping the area of the space constant, and spatial density by keeping the number of persons constant while reducing the area of the space.

Spatial density may be related to the factors of furniture density and room proportions identified previously. It was found that people's eye contact decreases as spatial density increases (McCauley, Coleman and DeFusco, 1978; Newman and McCauley, 1977). Worchel and Teddlie (1976) found that as spatial density increased, men tended to perceive other members of a short term group as more friendly. Epstein and Karlin found that spatial density was negatively related to interpersonal attraction in male groups, but that increased density led to greater liking in female groups. Thus gender may interact with spatial density in facilitating social interaction.

Studies conducted in both laboratory and field settings have consistently found that as social density increases, people are inclined to withdraw socially from one another. Studies also have shown that as density in an experimental play setting increases, children tend to withdraw socially and to interact less with one another.(Hutt and Vaizey, 1966; Loo, 1972; McGrew, 1970). It also has been demonstrated that students who live in more socially dense environments are less talkative, less sociable and less group-oriented than students who live in less dense settings. (Baum, Harpin and Valins, 1975; Baum and Valins, 1977; Valins and Baum, 1973).

Students living in the dormitories could be termed as those living in socially dense environments. Therefore significant differences might be expected in the social behaviors in the settings meant exclusively for dorm residents and in the settings which allow all students. Since the spaces to be studied in this research are expected to vary in both social and spatial density, one or both types of density of space could contribute to the sociopetal and sociofugal characteristics of the settings, and thus encourage or discourage socially interactive behavior among the college students.

### Ambient Environment

Ambient environment is defined by Holahan (1982) as the environment that surrounds us in any particular setting. Ambient environment consists of noise, temperature, light and air. Although previous studies suggest that change in the temperature above and below comfort levels does affect the social behavior of the people, the temperatures within the buildings studied were mechanically maintained at the comfort level. Thus, no significant differences in the temperatures within various spaces were expected. Similarly, all the buildings were mechanically ventilated and were not expected to have any significant difference in the air circulation within the spaces. Therefore light and noise were the only aspects of the ambient environment which were evaluated as potential factors contributing to the sociopetality or sociofugality of spaces.

Noise

Noise is a perceived quality of sound and cannot be measured directly by instruments. However, sound level, which can be measured in decibels and provides an approximation of a noise index most useful for future assessments, was used as the factor potentially contributing to the sociopetality or sociofugality of a space.

High levels of sound may discourage attention and thus have an impact on studying and/or social behavior. According to a study by Ward and Suedfeld (1973), taped traffic noise reduced students' classroom participation and attention, and more time was spent on group discussions. This could be interpreted as reduced performance in intended individual tasks and a tendency toward interactive behavior. Bronzaft (1981) found that the reading scores of children on the noisy side of the school were significantly lower than those on the quieter side of the school. In another study, Cohen, Evans, Krantz, Stokols and Kelly (1981) found that the reading scores of third grade students in sound-insulated classrooms were significantly higher than those in noisy classrooms. Although the impact of noise may be greater on vulnerable populations such as children, and the spaces to be studied are different from classrooms, similar findings could be anticipated for similar activities.

It should be noted that although it was not the aim of this study to measure performance, the variations in the reading scores of the subjects of the above studies could be attributed to the impact of noise on the study behavior and may be related to the likelihood of engaging in verbal interaction as against studying or reading. Brunetti (1972) found that students in general report they are more distracted by social conversations than by schoolwork-related conversations. He also found that noise is bothersome when classroom density is higher. This shows that although one does not participate in social interaction, interaction of others could affect the performance and it could affect more when the density is higher.

Noise also decreases attraction towards an anonymous stranger, but increases attraction towards another person who has been continually present in the aversive situation (Kenrick and Johnson, 1979). This finding indicates that noise in a lounge space for studying might discourage contacts soon after entering, but could encourage interaction among users who were in the space for some time.

Miller (1971) states that sound levels of the background noise must be below 50 decibels (dA) if speech communication is to be nearly normal. He also states that in one-to-one personal conversations the distance from talker to listener is usually of the order of 5 feet and nearly normal speech communication can proceed in noise levels as high as 66 decibels, whereas for group conversations for which the distances of 5-12 feet are common, the background noise should be less than 50-60 decibels. Noise, for the purpose of this study is defined as the sound level above 60 decibels.

Light

According to Flynn, Spencer, Martyniak and Hendrick (1973), the quality and quantity of light available in any setting has a strong effect on human emotions, communications and behavior. A study conducted by Butler and Biner (1987), suggests that the lighting preferences for a particular behavior are similar across different settings in which that behavior takes place. Therefore it could be said that the lighting preferences for learning related behaviors such as studying are similar across different settings. It also suggests that the lighting preferences for socially interactive behavior are similar across different settings, and difference in lighting levels could contribute to differences in the amount of social interaction. In another study by Butler and Biner (1987), there was significant differences in the amount of studying and reading behaviors judged at seven different settings which had different lighting levels. This finding also may be attributed to the different levels of lighting and can be applied to the intended study which also would deal with different settings.

<u>Focus of Research.</u>

In view of the issues identified through the review of background literature, this study addressed the following issues:

(1) Are there significant differences in the sociopetal or sociofugal design characteristics between the public spaces designated for socially interactive activities (e.g.; lounges, meeting areas, etc.) and public spaces designated for socially non-interactive activities (e.g.; study spaces).

(2) Are there significant differences in the amount of verbal interaction between spaces

(a) that are designated for socially interactive activities and that are not designated for socially interactive activities.

(b) that are sociopetal and sociofugal according to the criteria developed in this study.

(3) Which of the physical and social characteristics of the environment assessed in the study best predicts the amount of verbal interaction in a space?

(4) Are the selected physical characteristics of the environment more predictive of the amount of verbal interaction than the selected social characteristics of that environment?

In order to address these issues, the following physical characteristics of each space and their inter-relationships were documented.

(1) Furniture arrangement within the seating cluster and the room.

(2) Furniture density within the seating cluster and the room.

(3) Three-dimensional proportions of the room and two-dimensional proportions of the cluster.

(4) Quantity of light at each cluster.

(5) Level of sound within the cluster.

In addition, the following social characteristics were documented.

(1) Social density in the seating cluster and in the room.

(2) Gender distribution of people sitting in the

cluster.

# CHAPTER TWO

## Method

The following sections describe the settings that were selected for the study, the sample of users, variables that were measured and the procedures employed.

### Sample of Settings

Spaces in the non-academic campus buildings which are used by students predominantly for studying and social interaction were observed in this study. The spaces were categorized as (1) spaces designated as interactive and (2) spaces designated as non-interactive. Non-interactive spaces for the purpose of this study were the spaces that were designated study areas, and interactive spaces were the spaces which were not designated study areas and were intended for social activities such as informal conversations, entertainment or meetings, as well as studying. The sample of spaces was selected to include two categories: public spaces which were available for all the students in the campus (free access spaces) and semi-public spaces which were available only to the students who were residents of dormitories and their guests (limited access spaces).

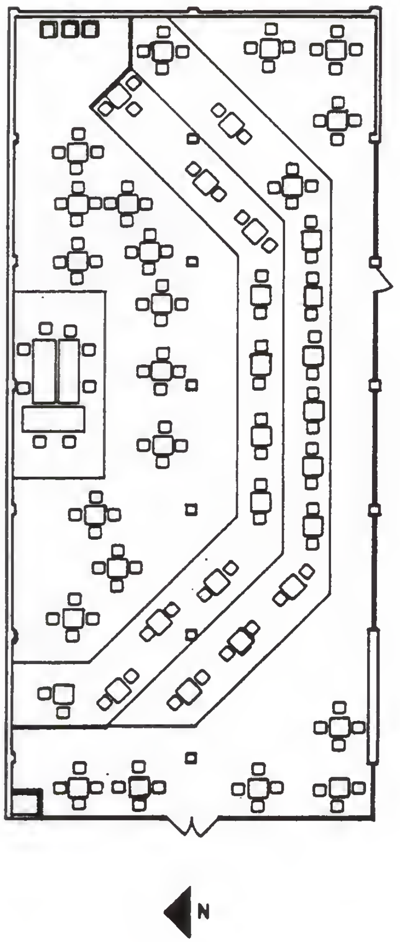
The spaces 'S1' (Figure 1) and 'S2' (Figure 2) in the

K-State Union were selected to meet the criteria for free access, interactive spaces. Beside being used for entertainment programs, space 'S1' is regularly used for studying by the students. It has a stepped floor, focusing to a platform, adjacent to the north wall, which is surrounded on three sides by a lower level floor, facilitating performance of entertainment programs. The north and east walls and part of the south wall are finished with timber panels. The platform and the stepped floor are carpeted with orange color. The floor around the platform has cream colored resilient tiles. The ceiling has the same color with exposed timber joists which are not painted. The columns are painted dark brown with paintings and photographs hanging on them. Most of the south wall is partitioned with canvas. The west wall is not plastered, and is painted yellow. Windows on the west wall are curtained with orange, brown, yellowish green stripes. Space 'S2' has an off-white vinyl tiled floor and the walls are papered with grey and white. The ceiling also is off-white in color.

Spaces 'S3' (Figure 3) and 'S4' (Figure 4), which are lobbies in the residence halls 'A' and 'B' respectively, were selected as limited access interactive spaces. Space 'S3' has its walls not plastered and painted off-white. The columns are plastered and have the same color. The seating cluster areas are carpeted with blue, brown and cream

Figure 1

Plan of Space 'S1'



Scale: 3" = 64'-0"

Figure 2

Plan of Space 'S2'

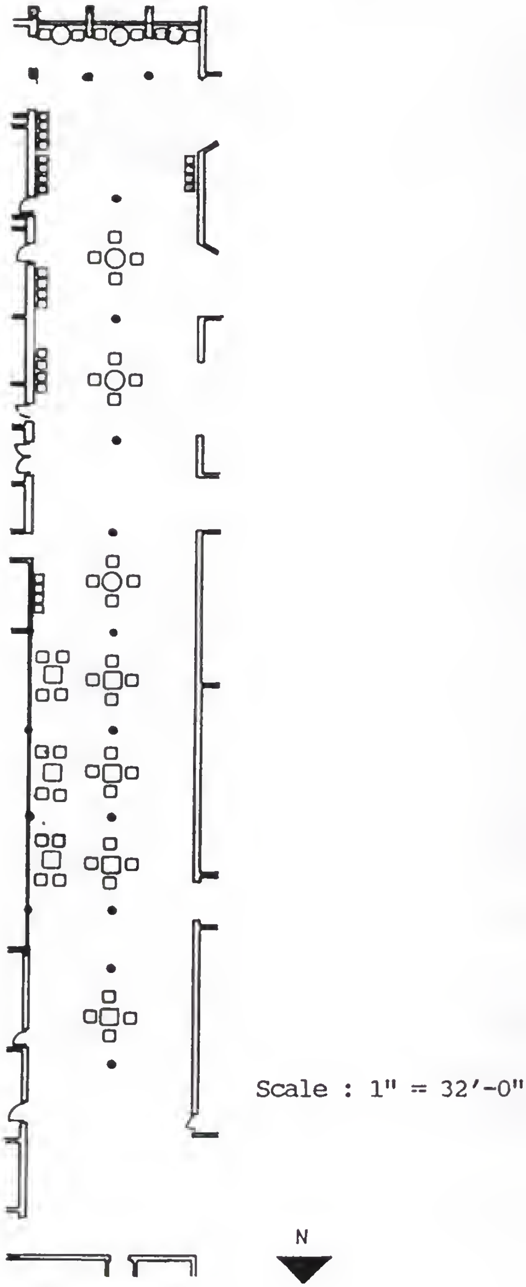
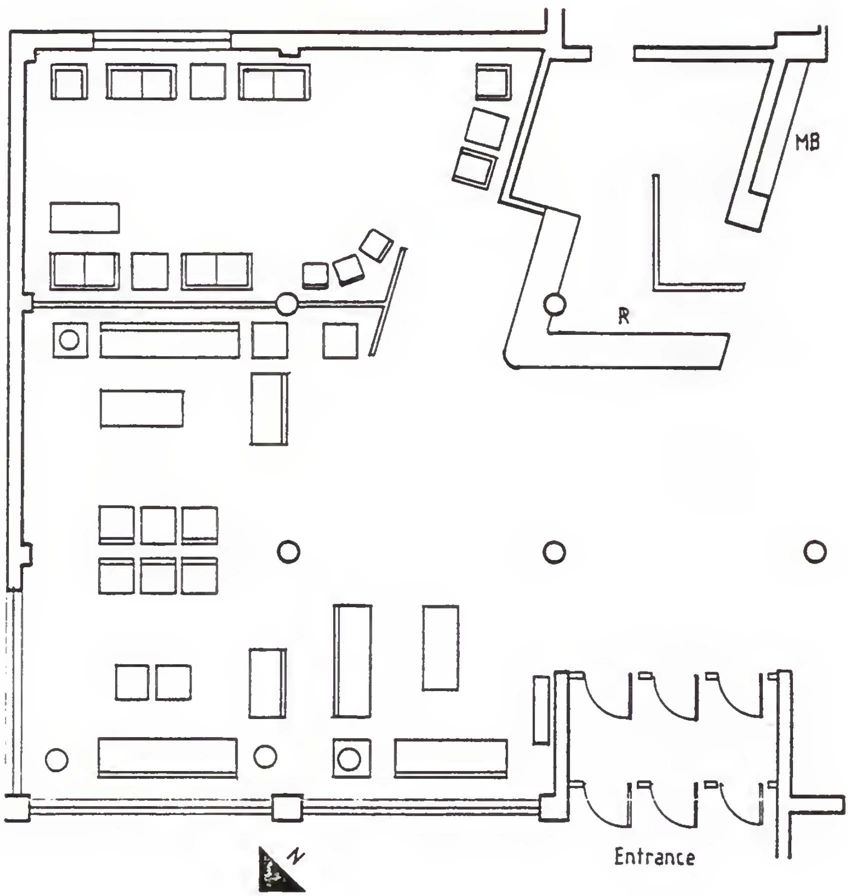


Figure 3

Plan of Space 'S3'



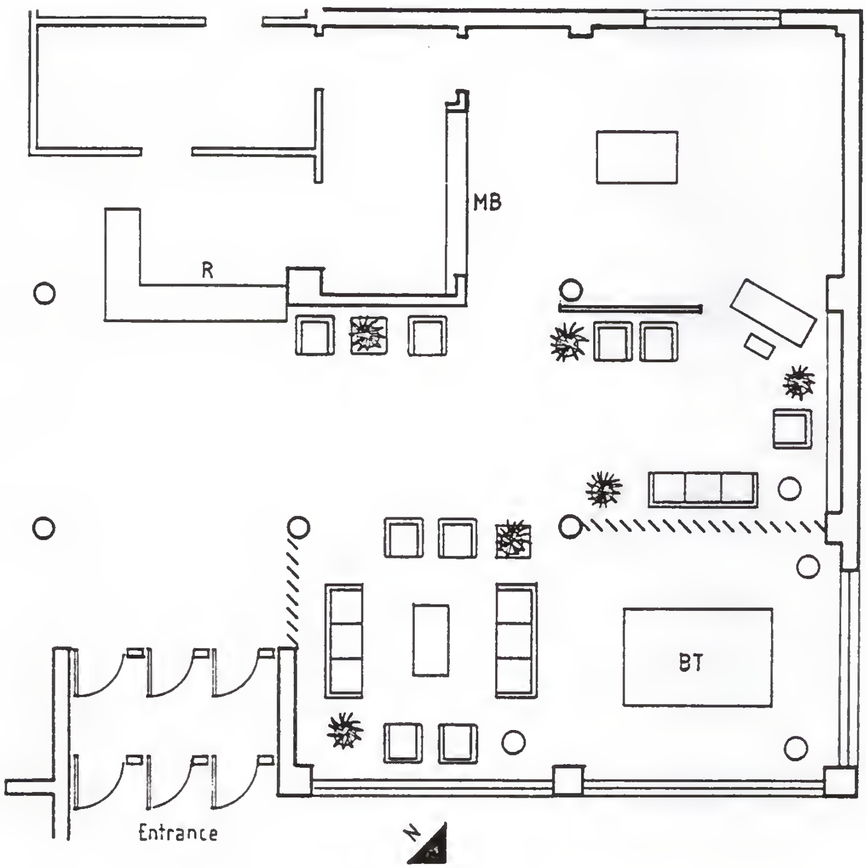

Scale: 1" = 12'-0"

R - Reception

MB - Mail boxes

Figure 4

Plan of Space 'S4'




Scale: 1" = 12'-0"

R - Reception

MB - Mail boxes

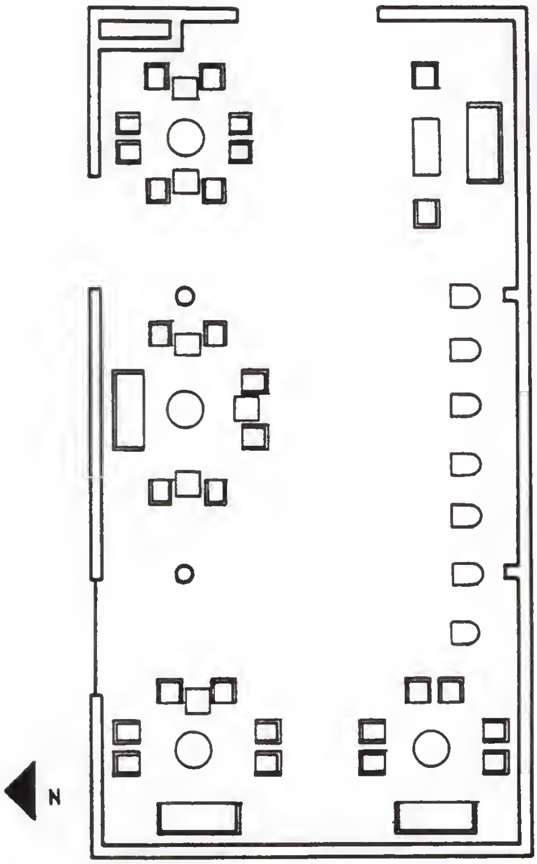
BT - Billiard table

colors, while the circulation areas have red tile flooring. The ceiling is painted white with brown spots. Space 'S4' has a limestone finished wall and timber louvered partition on the southeast side. On the southwest side it has a timber panelled wall and a marble panelled wall. The billiard table area and the cluster on the west corner are separated by a louvered timber partition. The seating cluster on the east corner is carpeted using a yellowish green color. The other walls are not plastered and are painted greenish yellow.

Space 'N1' (Figure 5) in the K-State Union was the sample of the spaces designated as non-interactive with free access. The space 'N1' has materials and colors similar to the space 'S2' with the exception of flooring. It has blackish grey carpet on the floor. Finally, the spaces designated as non-interactive with limited access were the space 'N2' (Figure 6), a study room in one food center, and spaces 'N3' (Figure 7) and 'N4' (Figure 8), which are study rooms in the residence halls 'A' and 'B' respectively. In space 'N2', except for the wall on southeast, the walls are not plastered. All the walls are painted greenish yellow and the floor has cream colored vinyl tiles. The seating cluster on the west corner is carpeted with dark and light brown squares. Paintings are hung on all the walls. Space 'N3' has a plastered wall on southeast, while the other walls are not plastered.All walls are painted light blue. The floor has

Figure 5

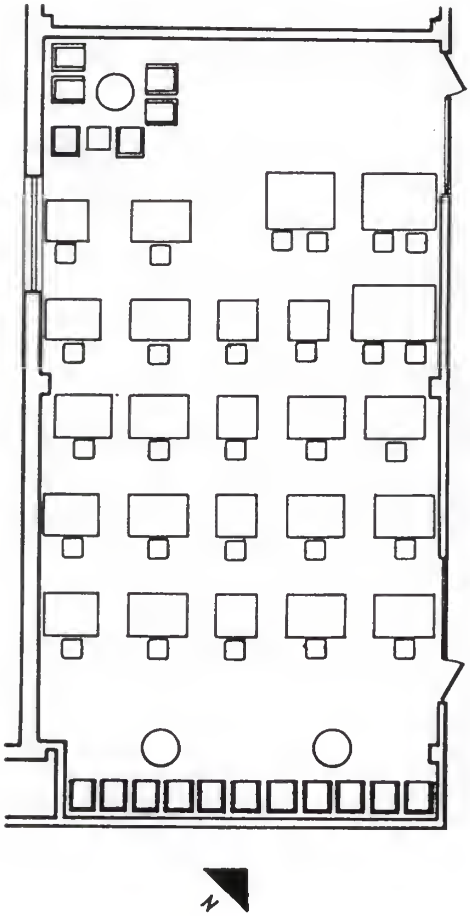
Plan of Space 'N1'




Scale: 1" = 12'-0"

Figure 6

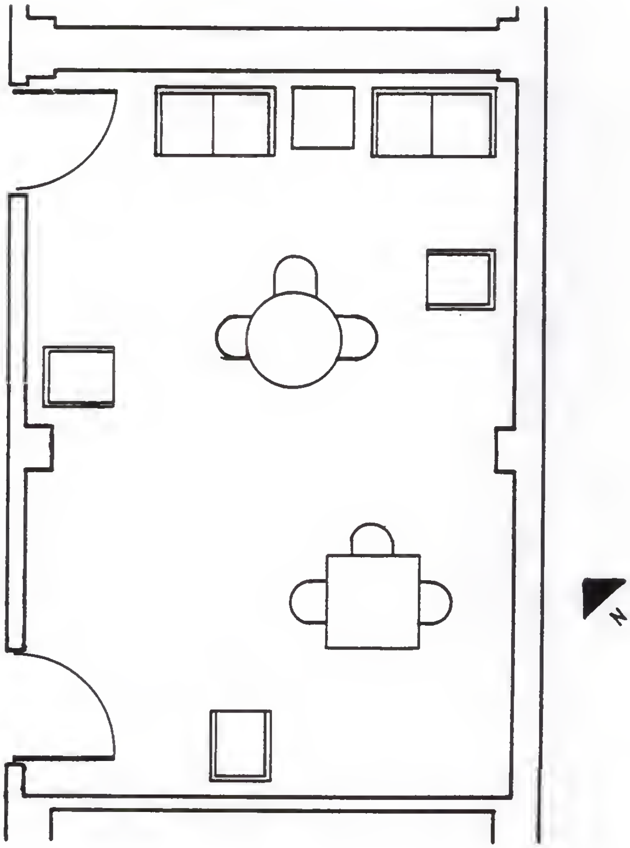
Plan of Space 'N2'




Scale: 1" = 12'-0"

Figure 7

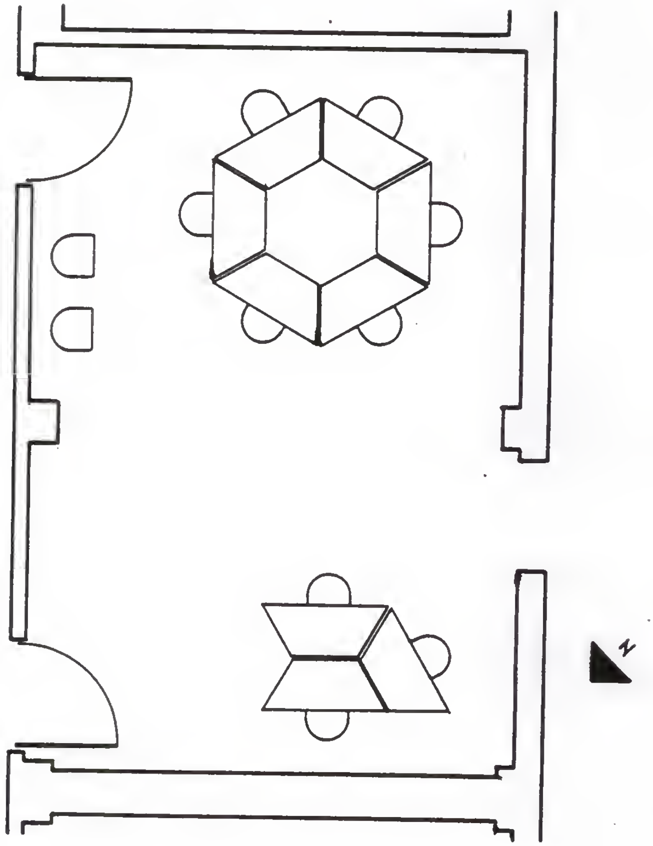
Plan of Space 'N3'




Scale: 3" = 16'-0"

Figure 8

Plan of Space 'N4'




Scale: 3" = 16'-0"

blackish blue carpeting and the ceiling is plastered and painted white. Space 'N4' had similar colors and materials with the plastered wall on its northeast side.

## Sample of Users

The sample of users selected for the study were the students who were found using the sample of settings during the observations.

## Measurement of Physical and Social Characteristics of Settings

The physical and social characteristics identified previously as established or hypothesized characteristics contributing to sociopetal space were selected as the independent variables in the study. The operational definitions and measurements of each physical and social characteristics to be used will be described in this section.

### Furniture Arrangement

Furniture arrangement is defined as the type of arrangement of seating within a cluster. A Furniture Arrangement Score (FAS) was developed and measured for each cluster as well as the room. In addition to the ranking of seating arrangements (R) developed by Ortiz Gonzalez (1983) shown in Figure 9, three other factors may influence the interaction of persons in an arrangement. These additional factors need to be considered in the furniture arrangement score. The total score for the furniture arrangement was calculated using scores on these four indicators which are described below with a worked example of furniture arrangement score calculations for the seating cluster shown in Figure 10.

Component 1 of FAS: Ranking of Seating Arrangement

These scores based on the study of Ortiz Gonzalez (1983) range from 1 to 7 as shown in Figure 9. A single chair which does not provide the opportunity for verbal interaction has been assigned a lowest rank point of 1. The seating arrangement closed on all four sides and provides the best opportunity for interaction of all those seated in the cluster has been assigned the highest rank point of 7. Based on Ortiz Gonzalez's ranking method, the cluster A (Figure 10) will have 6 rank points.

Component 2 of FAS: Barrier Factor (BF)

Physical barriers or props within a seating arrangement could encourage or discourage the interaction. Therefore it is necessary to develop a

## Figure 9

### Ranks for Furniture Arrangements varying in Suitability for Social Interaction

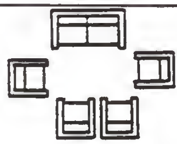
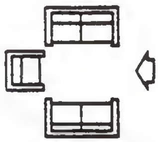
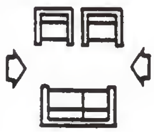
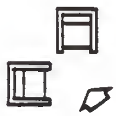
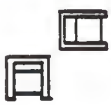
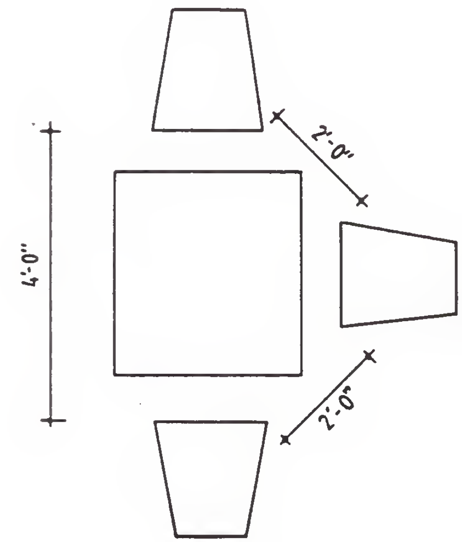
| Classification System | | Rank Points |
|---|---|---|
| 4 sides closed. |  | 7 |
| One side open. |  | 6 |
| Front. |  | 5 |
| L - shape. |  | 4 |
| Side-by-side. |  | 3 |
| Facing outside. |  | 2 |
| One chair. |  | 1 |

Figure 10

Seating Arrangement for the worked example




Seating cluster 'A'

factor which is added to or deducted from the ranking of the arrangement, based on whether the barrier, such as a study table or a planter could be a positive or negative influence on social interaction. The value of this index was either (+1) or (-1). For example, in seating arrangement A (Figure 10), barrier factor index would be +1, because the table might facilitate interaction.

Component 3 of FAS: Proximity Index (PI)

From the studies reviewed, it was noted that interpersonal distance or proximity influences the verbal interaction between people. As the distances between the seating will determine the interpersonal distance, it is appropriate to develop a proximity index to measure the proximity of individual seating. The proximity index is the ratio of the mean social distance to the mean of inter-chair distances within a cluster. Mean social distance is the average of the maximum (12 feet) and minimum (4 feet) of the social distance as defined by Hall (1966).

$$PI = \frac{\text{8 feet}}{\text{mean inter-chair distance}}$$

For example, Proximity Index for seating arrangement A (Figure 10) will be calculated as follows:

$$\text{Mean social distance} = \frac{4 \text{ feet} + 12 \text{ feet}}{2} = 8 \text{ feet.}$$

$$\text{Mean inter-chair distance} = \frac{2 + 2 + 4}{3} = 2.67 \text{ feet.}$$

$$\text{Proximity index (PI) for cluster A} = \frac{8}{2.67} = 3.$$

Component 4 of FAS: Social Index (SI)

An index of potential social interaction (social index) was developed for each cluster of arrangements, in order to assess opportunities for interaction. It was based on an additive index for each chair or seat within the social distance in a cluster. Thus the additive index for a chair (or seat) is the number of chairs (or seats) within social distance and the social index is the ratio of the total of the additive index in the cluster to the number of chairs (or seats) within that cluster.

$$\text{Social Index} = \frac{\text{Total of additive index in the cluster}}{\text{Number of chairs within the cluster}}$$

For example, in cluster A (Figure 10), additive index for each chair is 2 and the number of chairs within the cluster is 3.

The total of additive index in the cluster = 2 +2 +2

= 6

$$\text{Social Index (SI) of cluster A} = \frac{2 + 2 + 2}{3} = 2.$$

Final Computation of Furniture Arrangement Score (FAS)

The final furniture arrangement score of a seating cluster is the product of two factors consisting of the above mentioned components. As described in the component 2 of furniture arrangement score, the barrier factor index should be summed to the ranking score, thus forming one factor of the furniture arrangement score.

Factor 1 of FAS = Rank + Barrier Factor

As the proximity index (PI) and social index (SI) are based on the social distance of chairs or seats within a cluster, they are summed to form the second factor of the furniture arrangement score (FAS).

Factor 2 of FAS = Proximity Index + Social Index

Since the increase in the factor 2 of the furniture arrangement score would proportionately increase the opportunity for the amount of interaction, factor 1 should be multiplied by the factor 2 for the final computation of the furniture arrangement score (FAS).

Furniture Arrangement Score = Factor 1 x Factor 2

**FAS = (R + BF) x (PI + SI)**

For seating cluster A (Figure 10), the final computation of furniture arrangement score is described below. As shown earlier in the description of the components of furniture arrangement score, cluster A had the following component scores:

| | |
|---|---|
| Ranking (R) of arrangement | = 6 |
| Barrier Factor Index (BF) | = 1 |
| Proximity Index (PI) | = 2.67 |
| Social Index (SI) | = 2 |
| Furniture arrangement score (FAS) | = (R + BF)+ (PI + SI) |
| FAS | = (2.67 + 2)x (6 + 1) |
| | = 4.67 x 7 = 32.69 |

The FAS for the room was the mean of the furniture arrangement score of all clusters within that room.

Furniture Density (FD)

As furniture density influences the interaction, it is important to measure the furniture density of both the cluster and the room. Furniture density is the ratio relating to the number of chairs per square foot and was measured at both the cluster level as well as room level.

$$FD = \frac{\text{Number of chairs}}{\text{Area of space}}$$

Space Proportions

It was found that the space proportions also influence the social interaction. To measure the extent to which this factor influences the social interaction, space proportions of the cluster and the room were developed. It consisted of (1) width to length ratio and (2) height to length ratio.

Width to Length Ratio (WLR)

The ratio of the width of the space (cluster or room) to the length of the space.

$$WLR = \frac{\text{Width of the space}}{\text{Length of the space}}$$

Height to Length Ratio (HLR)

The ratio of the height of the room to the length of the room.

$$\text{HLR} = \frac{\text{Height of the room}}{\text{Length of the room}}$$

<u>Quantity of Light</u>

The review of literature suggests that the lighting levels contribute to the type of interactive behaviors in a setting. Lighting levels other than the recommended range, might affect the social interactive behavior. The quantity of light at each cluster will be measured in footcandles. Measurement above or below the recommended range of level were scored as 1 and measurement within the range were scored as 0. Lighting levels were recorded for each observation. Recommended lighting levels for lobby areas ranges from 20 to 40 footcandles (Traister, 1982).

Lighting levels at different locations within a space were found to vary. Lighting levels were measured by a lightmeter at different locations within each space and the mean of the readings within the space was considered as the lighting level of that particular space.

<u>Noise Level</u>

Studies have found that the noise does influence the amount of social interaction in a setting. Noise level is the level of sound heard within the cluster. Noise was measured with a soundmeter in decibels and measurement above 60 decibels level was scored as 1 and below that level was recorded a score of 0. Noise level was recorded for each observation. Noise level in a space and in the clusters within that space were considered to be the same.

Social Density (SD)

Social density is the number of persons per square feet of space and was measured both at the cluster level and the room level for each observation.

Gender Distribution

Gender distribution is a ratio of the number of males or females to the total number of persons and was measured both at the cluster level and room level and recorded for each observation.

$$M = \frac{\text{\# of males}}{\text{\# of persons}} \quad (1)$$

$$F = \frac{\text{\# of females}}{\text{\# of persons}} \quad (2)$$

Type of Behaviors

Behaviors were recorded by using the behavioral mapping technique. Random observations of ten minutes' duration were made during every two-hour time periods, beginning from 8:00 A.M. to 10:00 P.M. on Tuesday, Wednesday, Thursday during the week as more students were expected to use the spaces during the mid of the week. Week-end observations were made on Saturdays. Data collection lasted for six weeks beginning in early fall through mid-fall. By making observations on both working days and week-ends, behaviors at the most crowded situation as well as the sparse situation were recorded.

All the behaviors observed in each of the spaces were categorized into four types. Interaction for the purpose of this study was defined as any activity which involves two or more persons with verbal communication.

The four types of behaviors were:

(1) Interactive behavior by male users.

(2) Interactive behavior by female users.

(3) Non-interactive behavior by male users.

(4) Non-interactive behavior by female users.

For each observations, the number of people involved in each type of behavior were recorded and considered as the frequency of behaviors. A Verbal Behavior Score (VBS) was developed, which was the proportion of the frequency of verbal interactive behavior to the frequency of all behaviors and was considered as the dependent variable.

$$VBS = \frac{\text{No. of verbal interactive behaviors}}{\text{Total No. of behaviors}}$$

The verbal behavior score was recorded for both men and women and also for all the users.

## CHAPTER THREE

## Results and Discussion

This chapter provides a summary of the data, a description of the settings and the observations and the results of the analyses addressing the issues raised earlier. First, the design characteristics of the spaces designated for interaction were compared with those of the spaces not designated for interaction. Second, the amount of verbal interaction taking place in these different type of spaces also was compared. Third, multiple regression analyses were conducted to determine the factors in the physical and social environment which predicted the amount of verbal interaction and which characteristics were most predictive.

### Type of Behaviors.

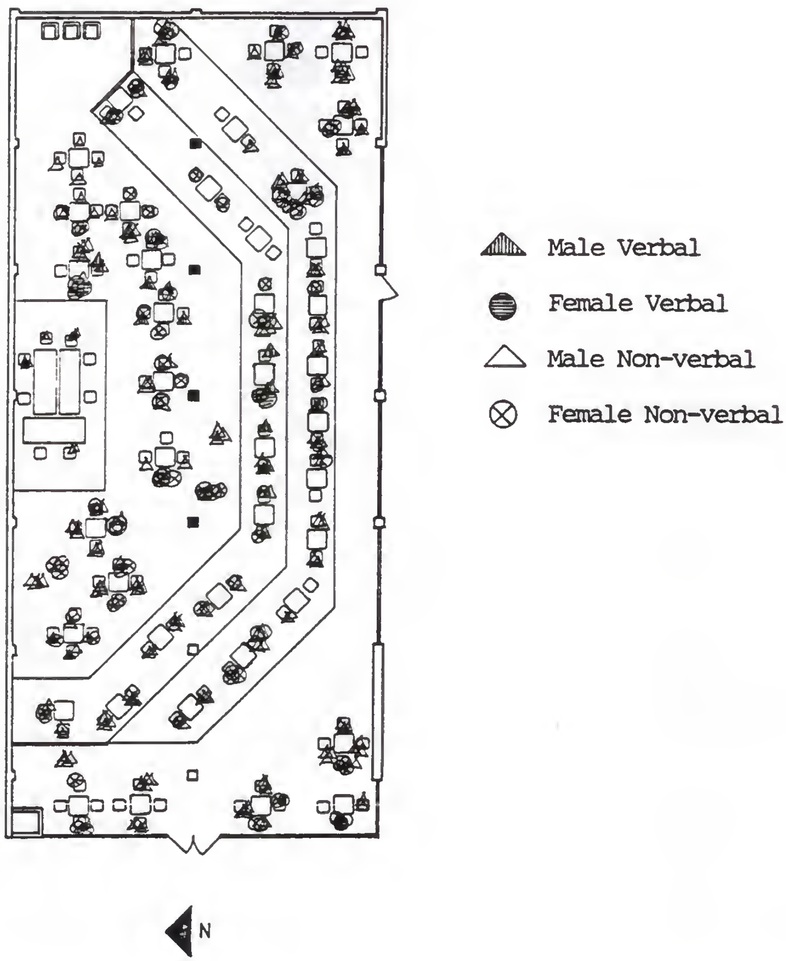
This section provides a brief description of the behaviors observed in the spaces. Figures 11 through 18 display the cumulative behavioral maps of the spaces observed, summarizing all the ten-minute observations in each space. As mentioned earlier, verbal and non-verbal behaviors of male and female users were coded.

It can be noted that in space 'S1'(Figure 11), most of the times the users were not sitting in groups for

Figure 11

Typical Furniture Layout and Cumulative Behavioral Map of

20 ten-minute Observations in Space 'S1'




Scale: 3" = 64'-0"

Figure 12

Typical Furniture Layout and Cumulative Behavioral Map of

20 ten-minute Observations in Space 'S2'

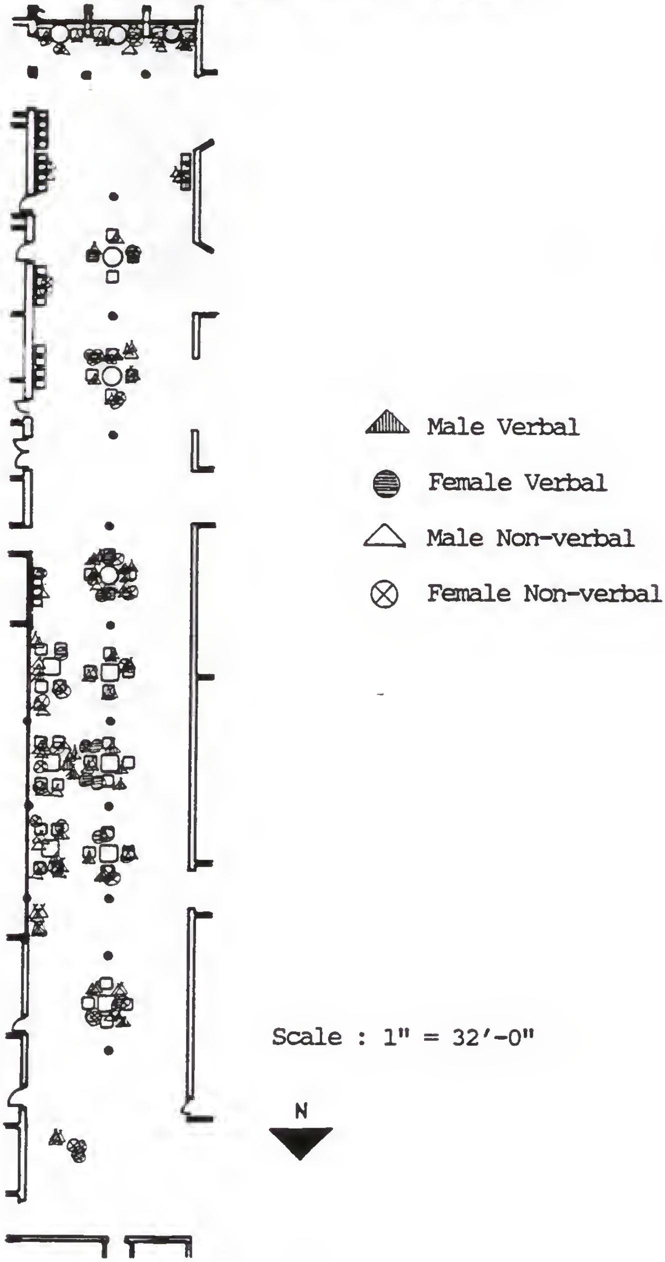
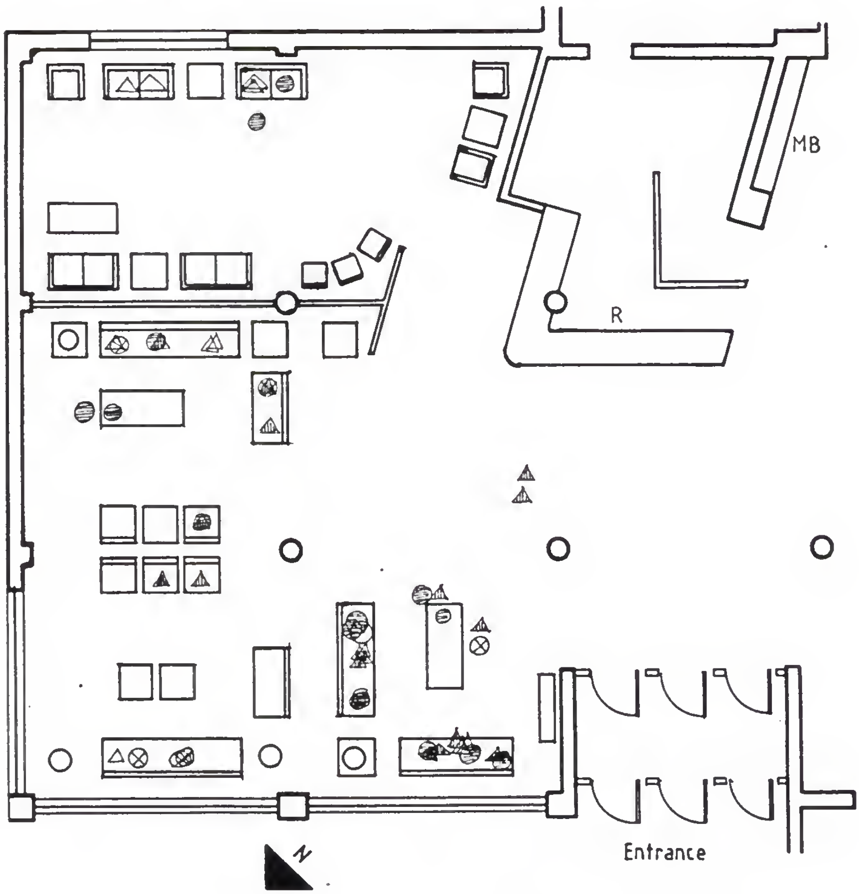


Figure 13

Typical Furniture Layout and Cumulative Behavioral Map of

20 ten-minute Observations in Space 'S3'




Scale: 1" = 12'-0"

R - Reception

MB - Mail boxes

Male Verbal

Female Verbal

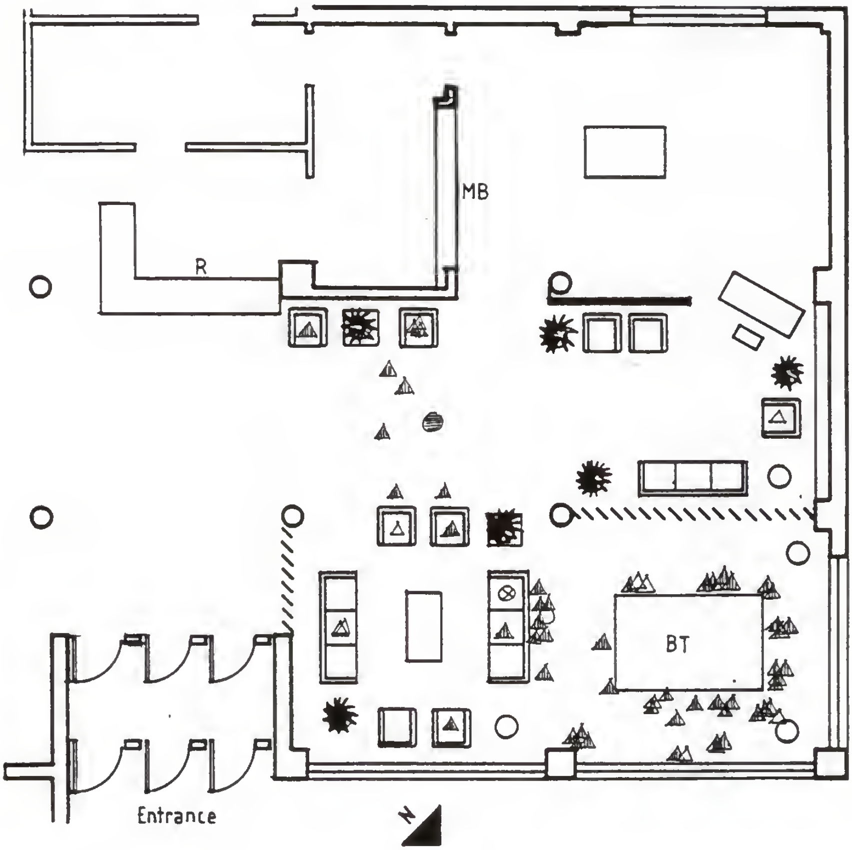
Male Non-verbal

Female Non-verbal

Figure 14

Typical Furniture Layout and Cumulative Behavioral Map of

21 ten-minute Observations in Space 'S4'




Scale: 1" = 12'-0"

R - Reception

MB - Mail boxes

BT - Billiard table

Male Verbal

Female Verbal

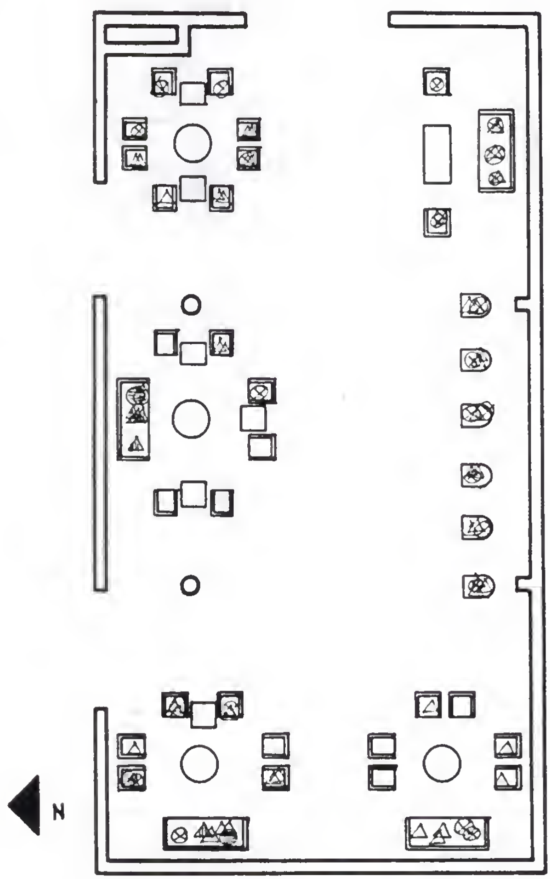
Male Non-verbal

Female Non-verbal

Figure 15

Typical Furniture Layout and Cumulative Behavioral Map of

20 ten-minute Observations in Space 'N1'




Scale: 1" = 12'-0"

Male Verbal

Female Verbal

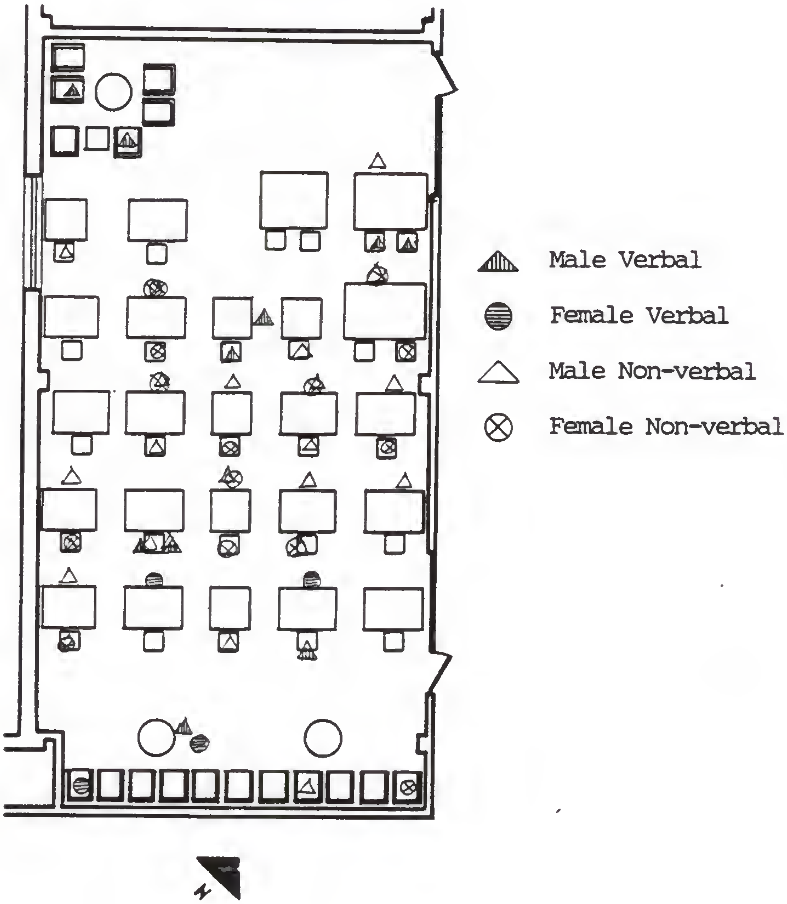
Male Non-verbal

Female Non-verbal

Figure 16

Typical Furniture Layout and Cumulative Behavioral Map of

20 ten-minute Observations in Space 'N2'

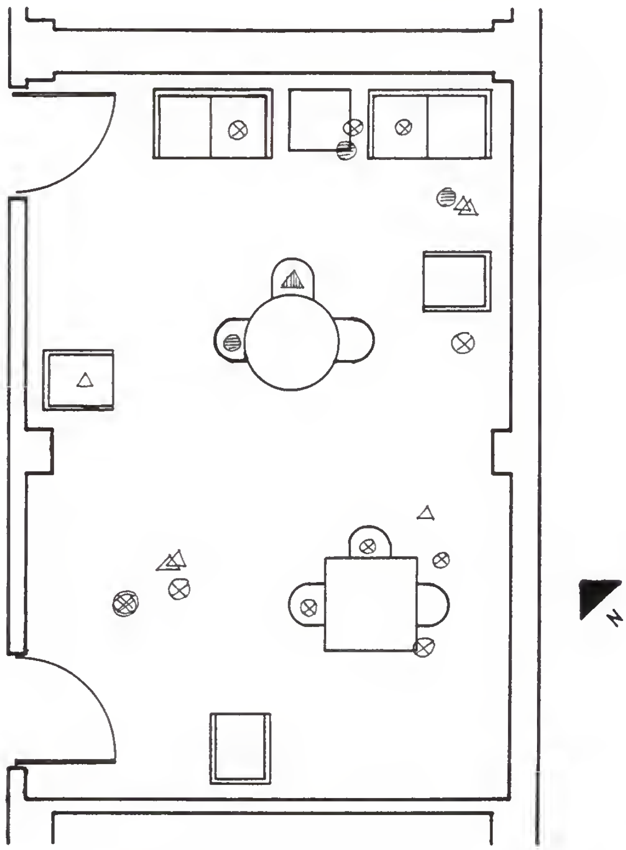



Scale: 1" = 12'-0"

Figure 17

Typical Furniture Layout and Cumulative Behavioral Map of

16 ten-minute Observations in Space 'N3'




Scale: 3" = 16'-0"

Male Verbal

Female Verbal

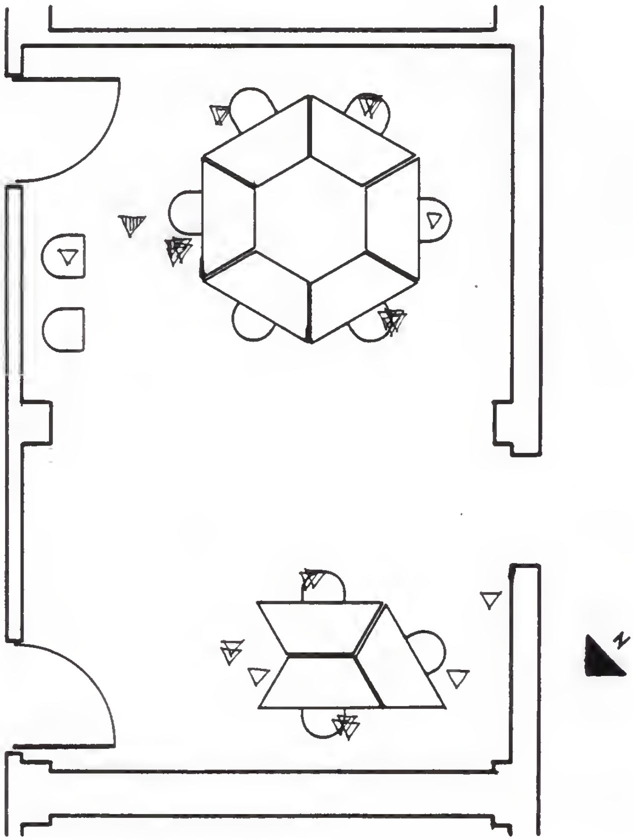
Male Non-verbal

Male Non-verbal

Figure 18

Typical Furniture Layout and Cumulative Behavioral Map of

17 ten-minute Observations in Space 'N4'



Scale: 3" = 16'-0"

Male Verbal

Female Verbal

Male Non-verbal

Female Non-verbal

interaction, although the seating clusters were arranged to accommodate four persons and facilitates interaction. The fact that this space is being used as a study space despite its designation as an interactive space may be attributed to this finding. The brochure of the K-State Union states that this space is used for entertainment purposes.

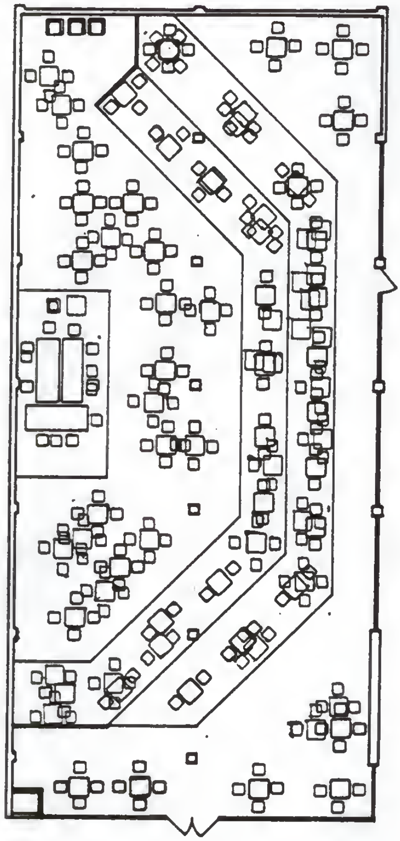
It can be noted in Figure 14 that most of the people in space 'S4' tend to use the cluster without seating arrangement and most of the verbal interactions observed also took place in that cluster. It is the area where the billiards table has been placed and it seems that rather than sitting in the lounge, the residents prefer to play. This activity attracts the others also to watch the game although they were not participating and as a result, the seating areas were not used much. The other six spaces did not have any significantly dominant behaviors in any particular cluster.

Furniture Arrangement

Figures 19 through 26 display the summarized layout of furniture arrangements observed in each space. The furniture arrangements were unchanged for the observations in the lounges of residence hall 'A' and residence hall 'B'(spaces 'N3' and 'N4' respectively) as can be seen Figures 25 and 26 respectively. Figure 24 shows that the furniture arrangement

Figure 19

Summarized Furniture Layout of Space 'S1'

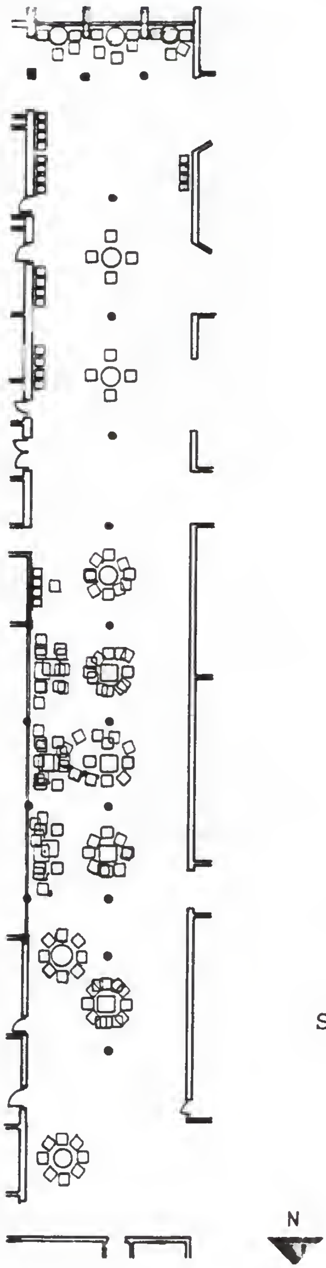


N

Scale: 3" = 64'-0"

Figure 20

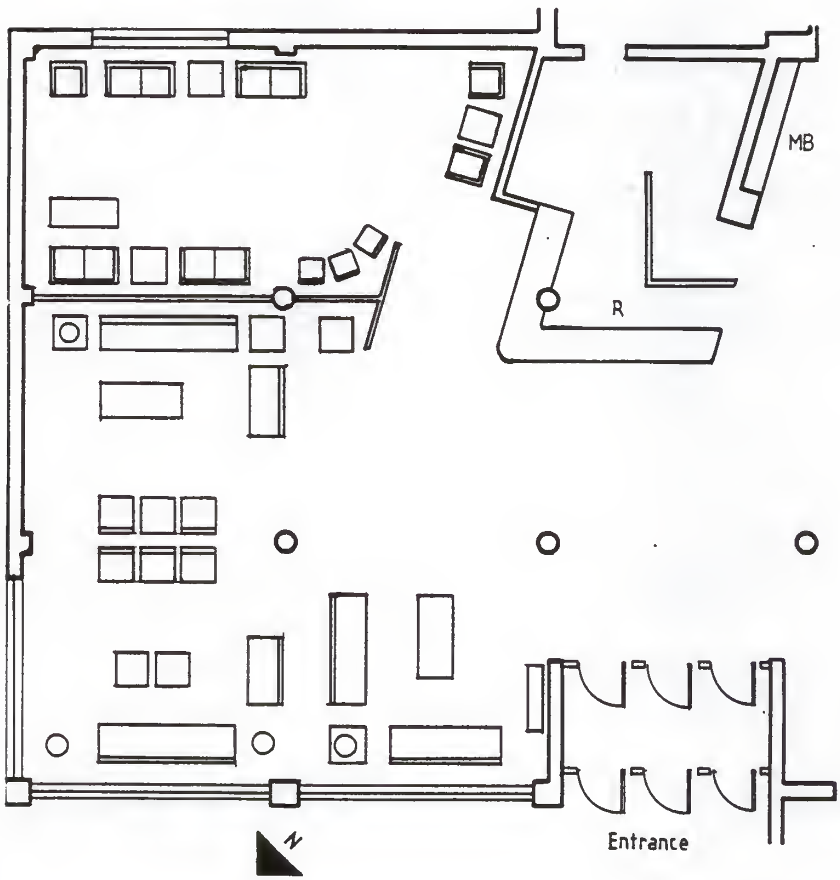
Summarized Furniture Layout of Space 'S2'




Scale : 1" = 32'-0"

Figure 21

Summarized Furniture Layout of Space 'S3'



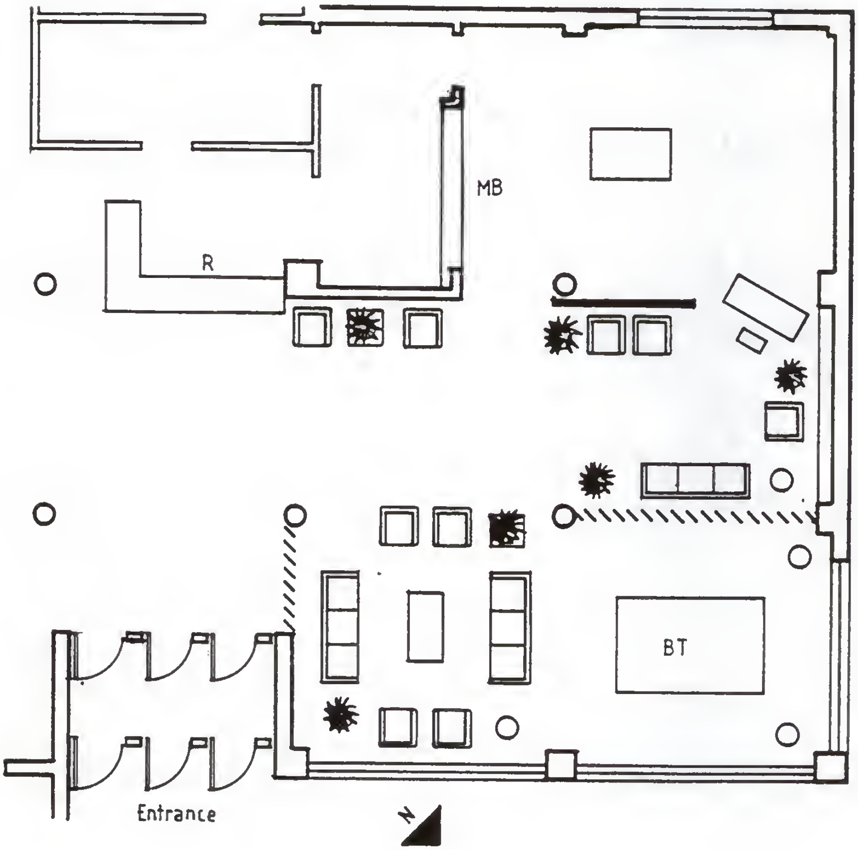

Scale: 1" = 12'-0"

R - Reception

MB - Mail boxes

Figure 22

Summarized Furniture Layout of Space 'S4'




Scale: 1" = 12'-0"

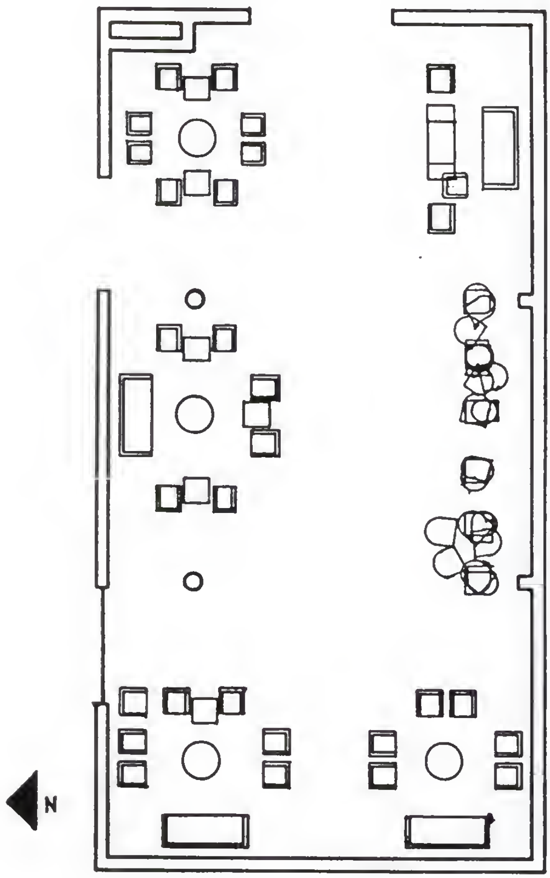
R - Reception

MB - Mail boxes

BT - Billiard table

Figure 23

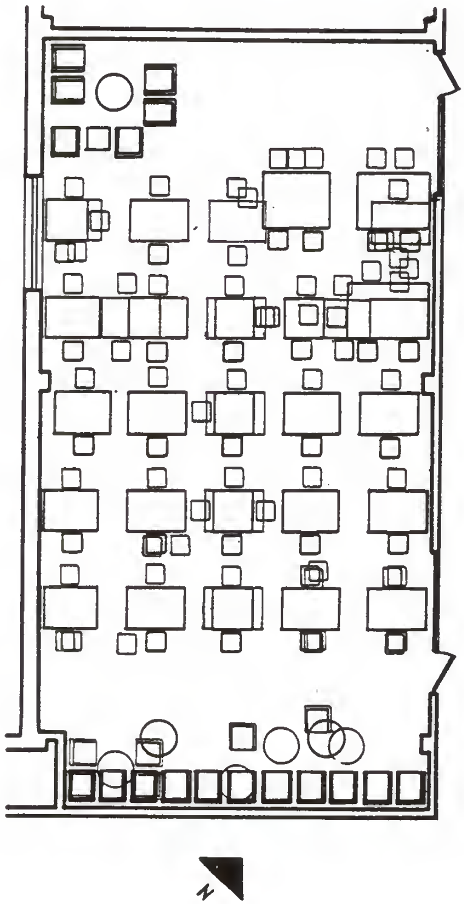
Summarized Furniture Layout of Space 'N1'




Scale: 1" = 12'-0"

Figure 24

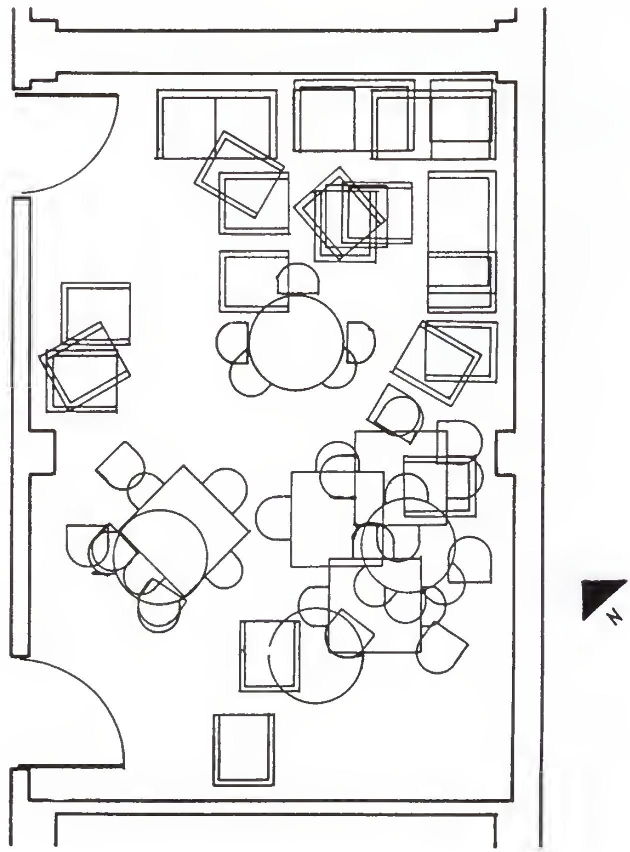
Summarized Furniture Layout of Space 'N2'



Scale: 1" = 12'-0"

Figure 25

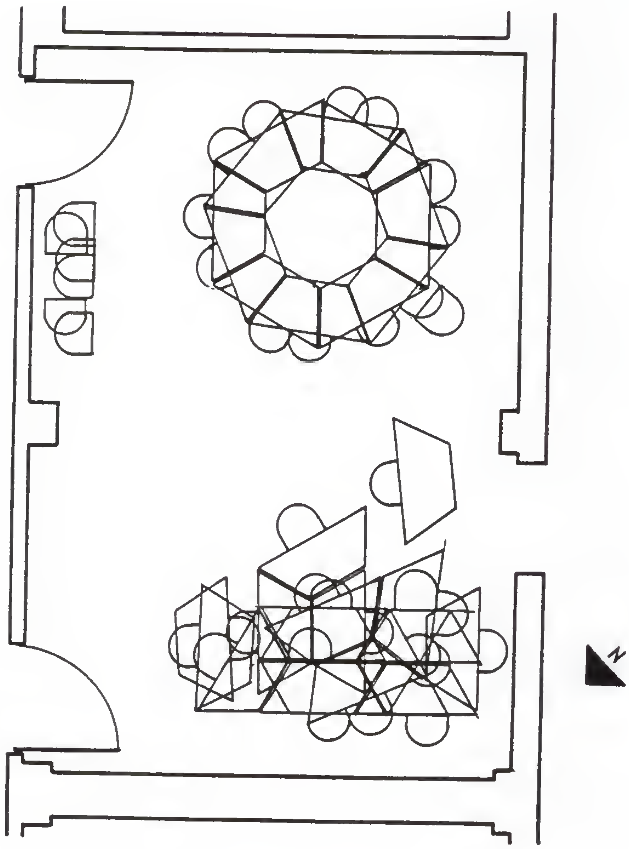
Summarized Furniture Layout of Space 'N3'




Scale: 3" = 16'-0"

Figure 26

Summarized Furniture Layout of Space 'N4'




Scale: 3" = 16'-0"

of one seating cluster in space 'N1' was consistently rearranged while the arrangement of other seating clusters remained unchanged except for one observation. In the remaining five spaces almost every observation had different arrangements of furniture.

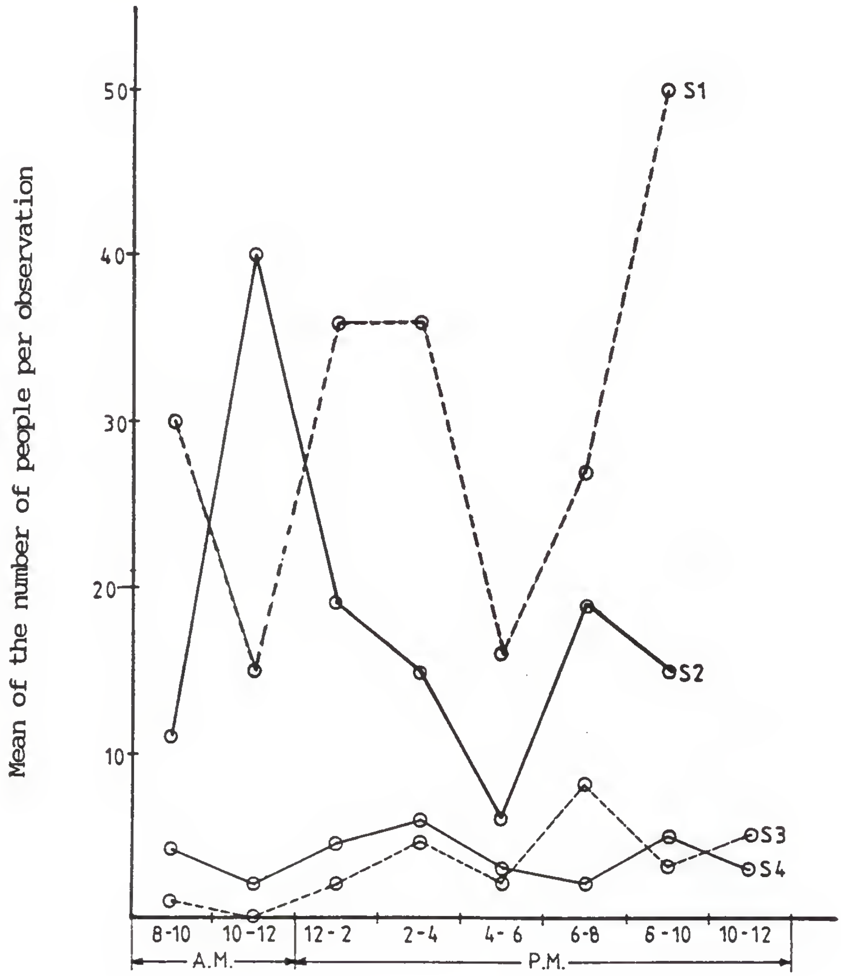
Time of day

Data collection took place during randomly selected two-hour time intervals from 8.00 a.m. until 10.00 p.m. on Tuesdays, Wednesdays, Thursdays and Saturdays over a period of six weeks beginning from early part of the fall semester through mid-fall. Figures 27 and 28 displays the distribution of the mean number of people in the spaces per observation during each two-hour time interval. It was found that the use of study rooms in Residence Hall A' and Residence Hall 'B' were very limited during this time-frame. However, it was observed that the furniture in these rooms were rearranged on different days, implying that the rooms were used between 10.00 p.m. and 8.00 a.m. In order to increase the number of observations during the use of these spaces, the observation period was extended until midnight for the spaces in the residence halls. It also was notable that more people were using the spaces during evening hours.

Although the study rooms in the residence hall 'A' (space 'N3') and residence hall 'B' (space 'N4') were in

Figure 27

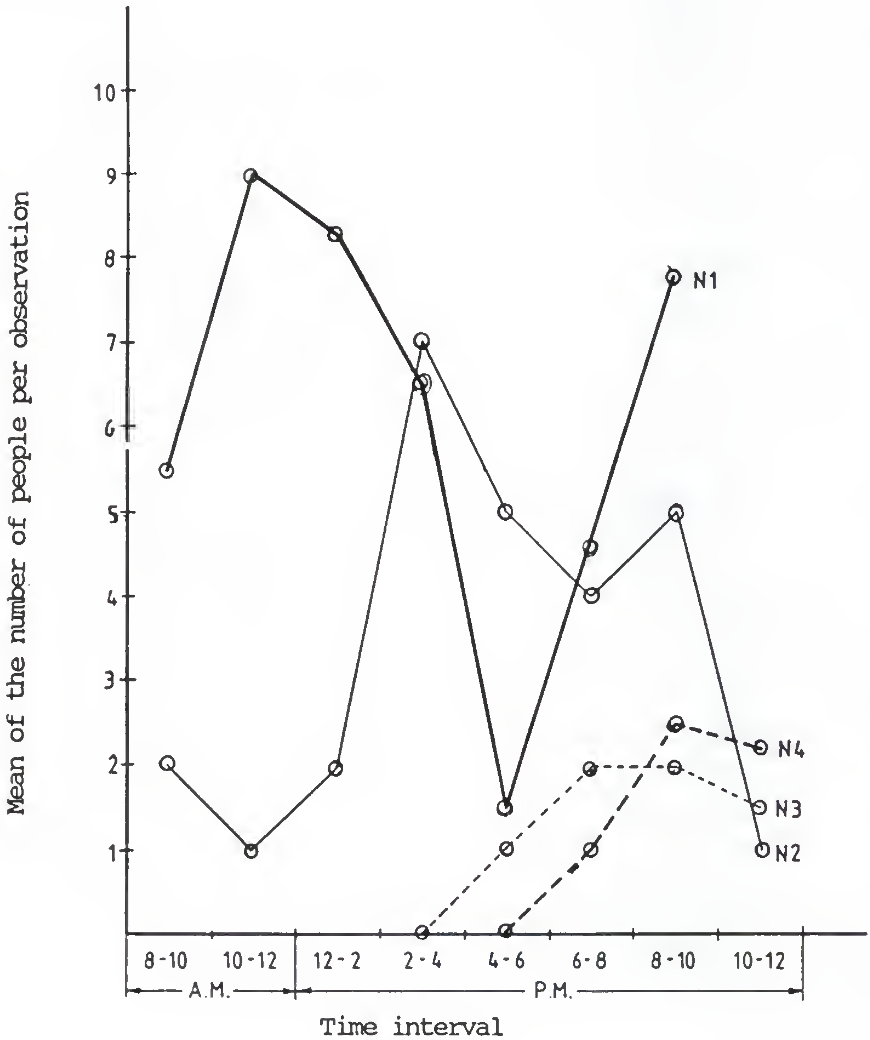
Distribution of Mean of the Number of People per Observation over the Time Interval in Interactive Spaces




Time interval

Figure 28

Distribution of Mean of the Number of People per Observation over the Time Interval in Non-interactive Spaces



use during 16 observations and 17 observations respectively, verbal interactions were observed only on two occasions in each space. A total of 30 observations were made in these two spaces. 25 observations were made in space 'N2', 23 observations each were made in spaces 'S3' and 'S4' and 20 observations each were made in spaces 'S1', 'S2' and 'N1' which were in the K-State Union. Only observations completed when the space was in use by at least one person were considered for the purpose of analyses.

Day of week

Figures 29 and 30 display the distribution of the mean of the number of people per observation over the days of week in the interactive spaces and non-interactive spaces respectively. The number of people observed on Saturdays was much less than other days in all the spaces. The increase shown in Figure 29 for the space 'S2' on Saturdays was due to one particular observation on which extraordinarily higher number of people were found in the space.

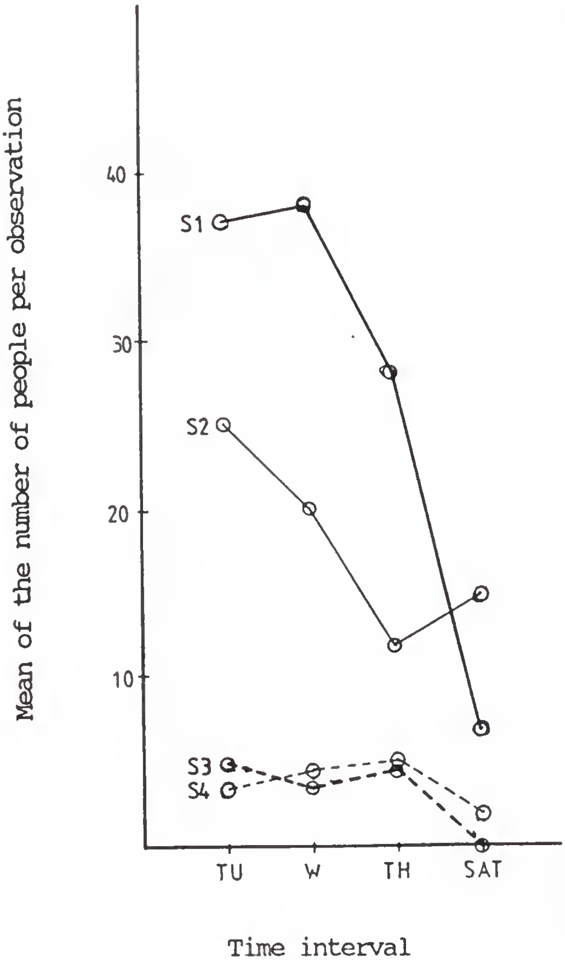
Gender Distribution

Figures 31 through 38 display the gender distribution in each space during each observation. As Hall 'B' is a residence hall for males, not a single female user was found in its study room (space 'N4') during any observation which

Figure 29

Distribution of Mean of the Number of People

per Observation over the Days of Week in Interactive Spaces




TU - Tuesday

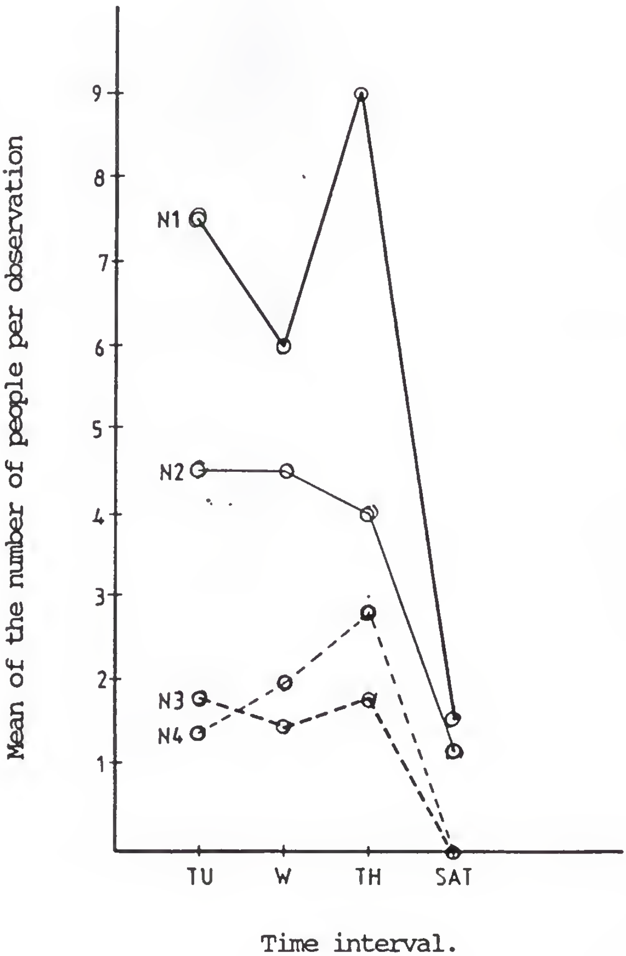
W - Wednesday

TH - Thursday

SAT - Saturday

Figure 30

Distribution of Mean of the Number of People per Observation over the Days of Week in Non-interactive Spaces




TU - Tuesday

W - Wednesday

TH - Thursday

SAT - Saturday

Figure 31

Gender Distribution in Space 'S1'

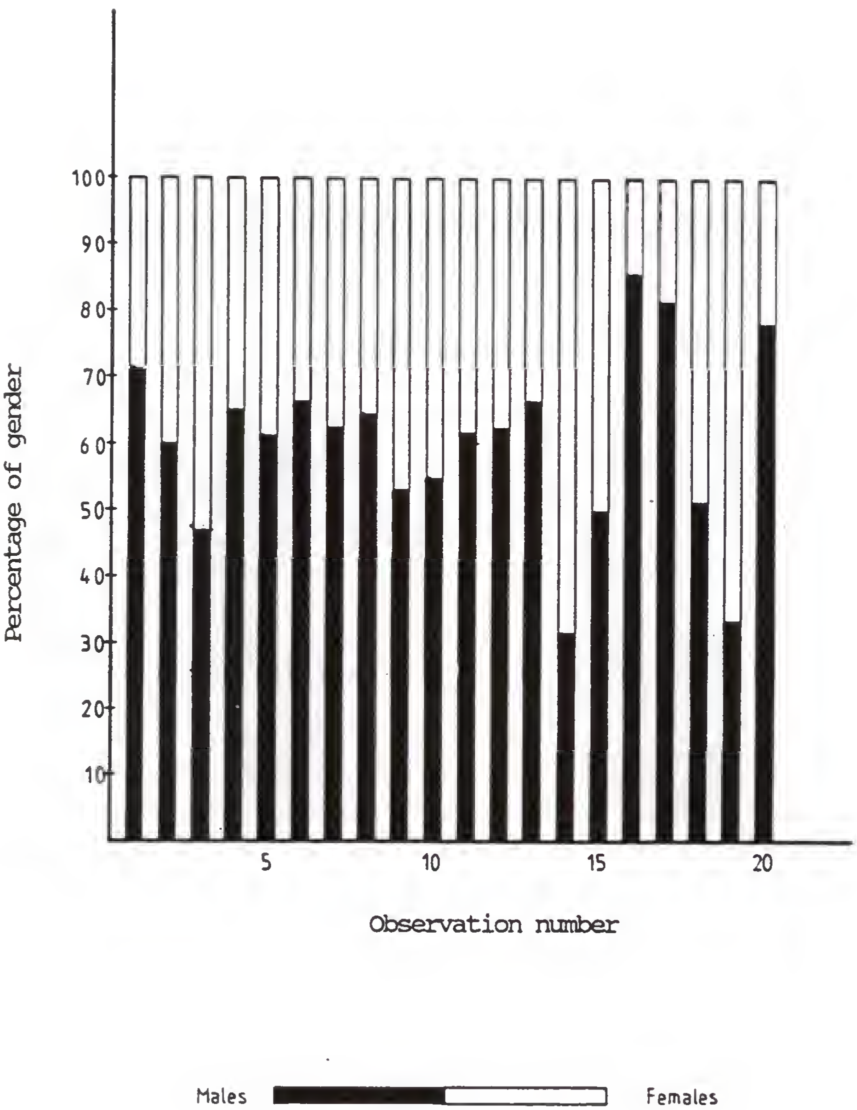


Figure 32

Gender Distribution in Space 'S2'

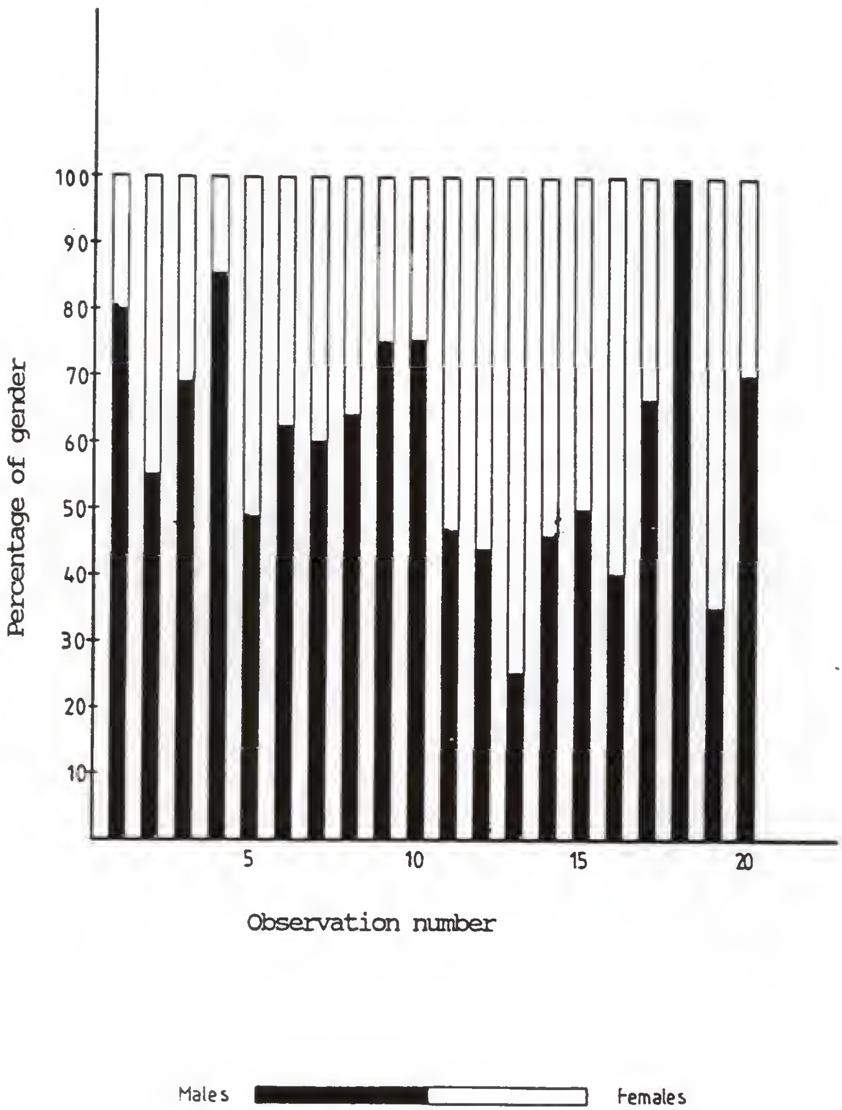


Figure 33

Gender Distribution in Space 'S3'

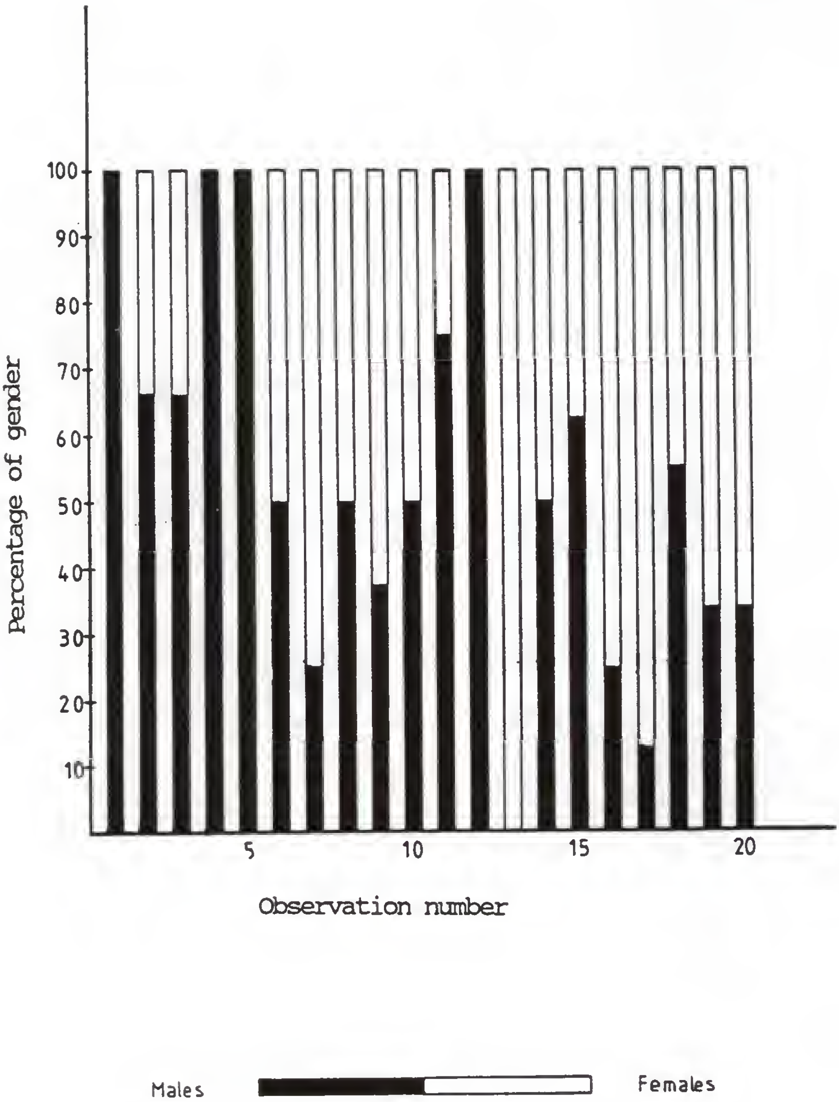


Figure 34

Gender Distribution in Space 'S4'

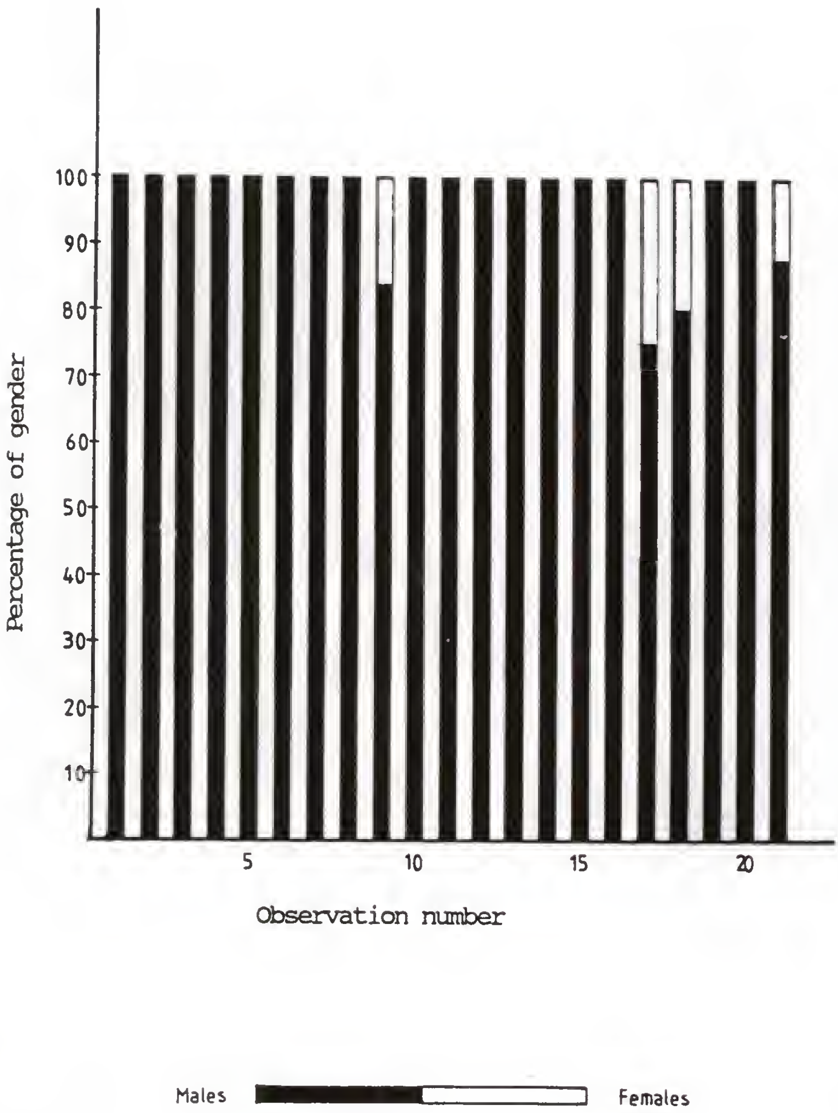


Figure 35

Gender Distribution in Space 'N1'

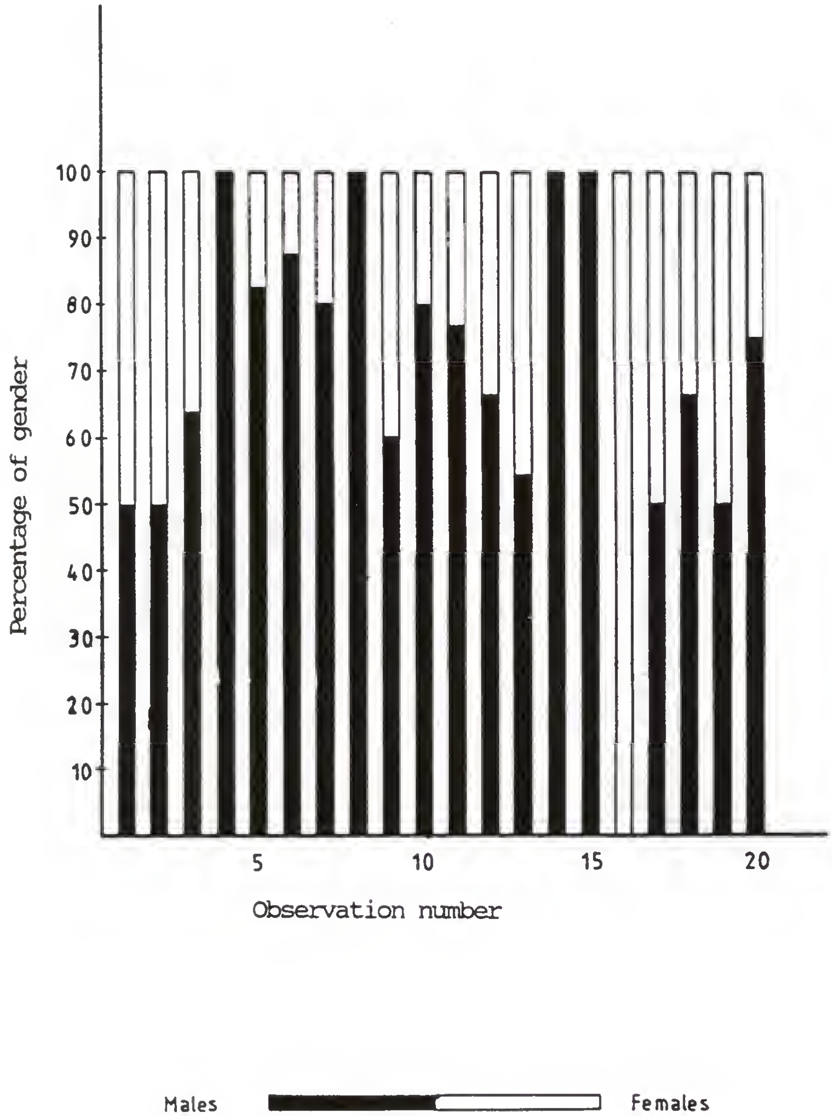


Figure 36

Gender Distribution in Space 'N2'

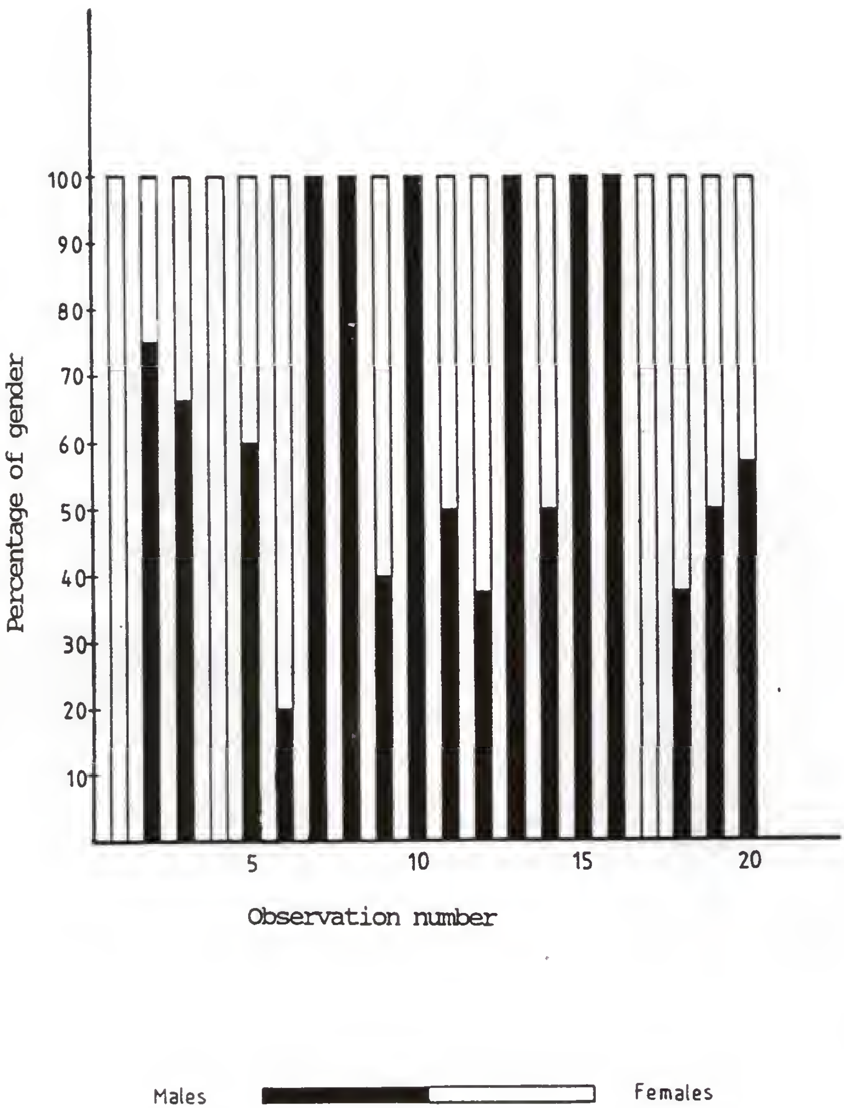


Figure 37

Gender Distribution in Space 'N3'

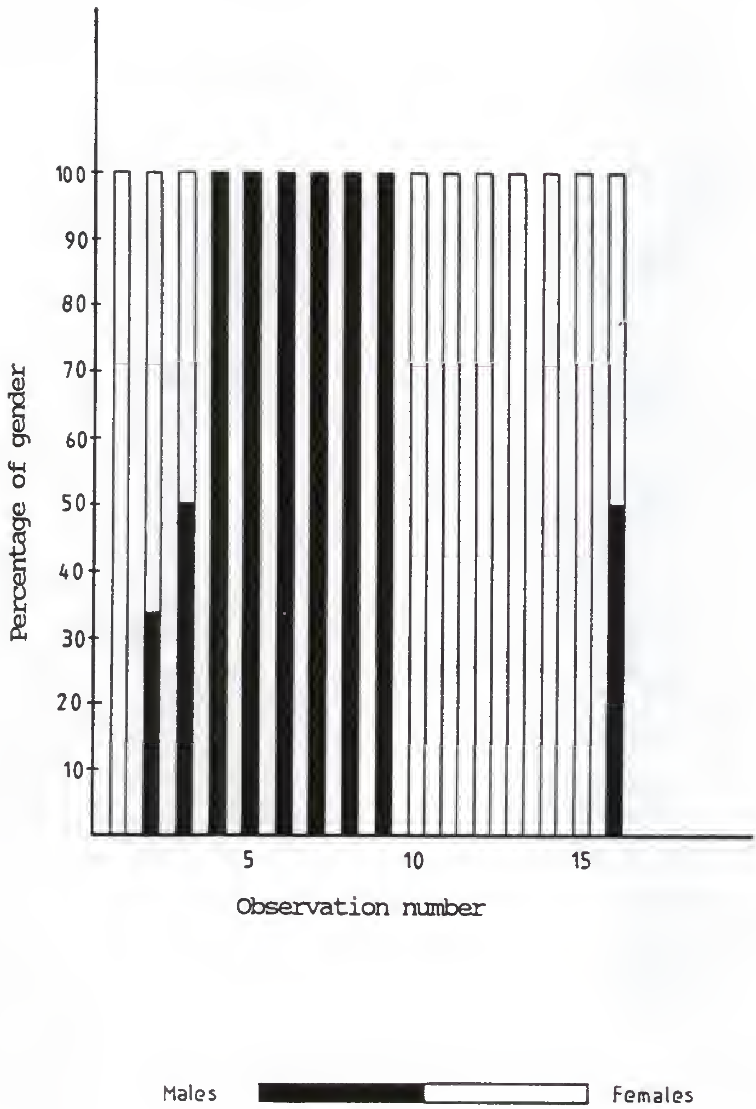
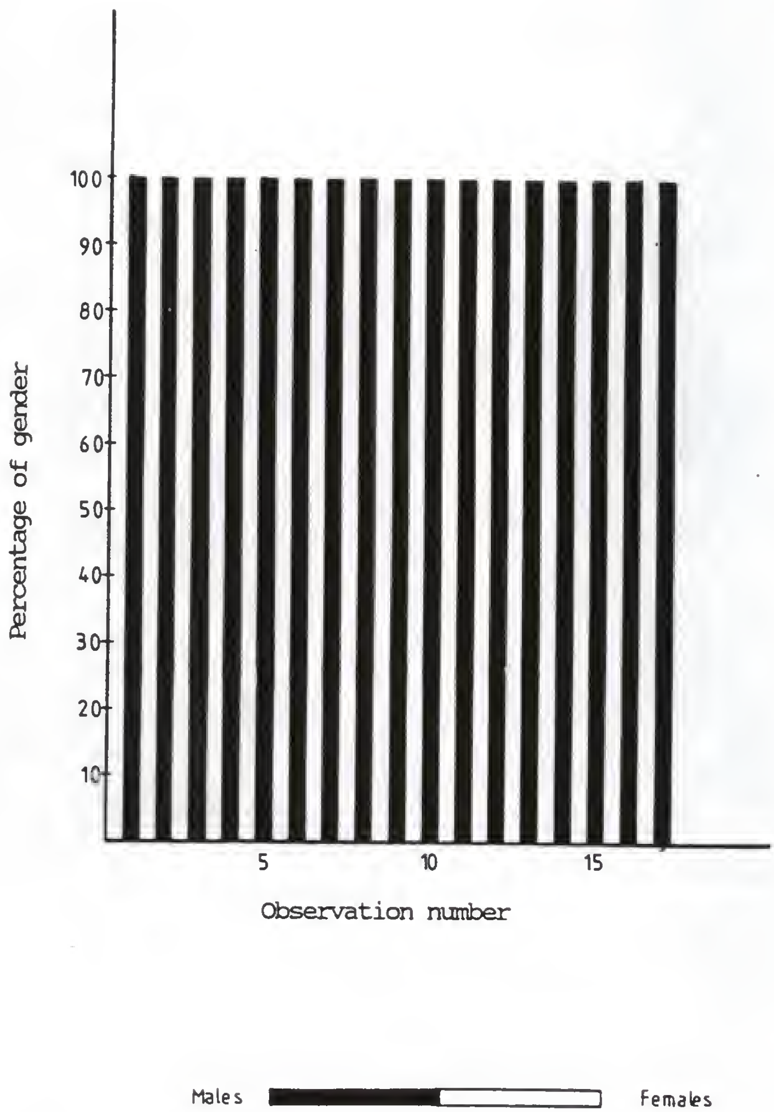


Figure 38

Gender Distribution in Space 'N4'



can be noted in Figure 38. Of the 21 observations made in the lounge of this hall, female users were observed only on four occasions. There was no significant dominant use by any one gender group in the other spaces.

Noise

As mentioned in the previous chapter, noise level was considered to be the same for the space and the clusters within that space during an observation. In both study rooms ('N3' and 'N4') in the residence halls, the noise generated by the lights and the pipelines running at ceiling level, were found to be at constant level and continuous. Noise levels at other spaces were not so consistent. Table 1 displays the number of observations in which noise level exceeded 50 decibels in each space. Spaces 'S1' and 'N1' have recorded a very low percentage of noise, while spaces 'S3', 'S4', 'N3' and 'N4' have recorded a very high percentage of noise.

Lighting

Table 2 displays the number of observations in which lighting levels were above or below the recommended range of levels with the percentage of observations in parentheses. Spaces 'S2', 'N2' and'N3' have recorded a very high percentage of excess lighting levels with 'N2' and 'N3'

Table 1

Number of Observations with Noise Level above 50 Decibels

| Space | Number of Observations N | Number of Observations Noise Level above 50 Decibels | Percentage of Observations Noise Level above 50 Decibels |
|---|---|---|---|
| S1 | 20 | 2 | 10 |
| S2 | 20 | 14 | 70 |
| S3 | 20 | 19 | 95 |
| S4 | 21 | 19 | 90.5 |
| N1 | 20 | 4 | 20 |
| N2 | 20 | 10 | 50 |
| N3 | 16 | 16 | 100 |
| N4 | 17 | 17 | 100 |

Table 2

Percentage of Observations with

Lighting Levels above 40 Footcandles and

below 20 Footcandles

| Space | Number of Observations N | Percentage of Observations above 40 Footcandles | Percentage of Observations below 20 Footcandles |
|---|---|---|---|
| S1 | 20 | 0% | 0 |
| S2 | 20 | 85% | 0 |
| S3 | 20 | 0% | 85% |
| S4 | 20 | 10% | 25% |
| N1 | 20 | 0% | 75% |
| N2 | 20 | 100% | 0% |
| N3 | 16 | 100% | 0% |
| N4 | 17 | 47% | 0% |

always being above the recommended range of lighting levels. Spaces 'S3' and 'N1' have recorded a high percentage of lower lighting levels than recommended.

## Comparison of Design Characteristics between Interactive Spaces and Non-interactive Spaces

The first question addressed by this study was possible significant differences in the sociopetal design characteristics between interactive and non-interactive spaces. The spaces 'S1' and 'S2' in the K-State Union and spaces 'S3' and 'S4' in the residence halls were designated as interactive spaces and space 'N1' in the K-State Union and spaces 'N2', 'N3' and 'N4' in the residence halls were designated as non-interactive spaces. A series of t-tests were used to test the statistical significance of differences in four spatial qualities between the two types of spaces: two indicators of spatial proportions, furniture arrangement and furniture density.

While spatial proportions consisting of width to length ratio (WLR) and height to length ratio (HLR) remained fixed for each space, furniture arrangement score (FAS) and furniture density (FD) varied for each observation in most of the spaces with the exception of the spaces ('S3', 'S4' and 'N1'). These changes were attributed to the rearrangement of the furniture by the users to facilitate interaction. In view of this variation, mean scores of Furniture Arrangement and Furniture Density from the total number of observations for each space were considered for this analysis.

Table 3 displays the number of observations (N), mean Furniture Arrangement Score (FAS), mean Furniture Density (FD), Width to Length Ratio (WLR) and Height to Length Ratio (HLR) for each space. Standard deviations for the mean scores are given in parentheses.

Comparison of Furniture Arrangement Score (FAS)

The mean Furniture Arrangement Score of the spaces designated for interaction was anticipated to be greater than that of spaces not designated for interaction. However, the t-test shows that there is no significant evidence to support the hypothesis that the mean Furniture Arrangement Score of spaces designated for interaction is greater than the mean Furniture Arrangement Score of spaces not designated for interaction. ($t=0.061$, the rejection region was $t>1.943$ at $p=0.05$ with 6 degrees of freedom). The rejection region assures that the probability of rejecting the null hypothesis while it is true (type I error) is less than 5%. However, the t-test does not provide any evidence to reject the null hypothesis.

Thus the t-test indicates the spaces designated as

Table 3

Design Characteristics of

Interactive and Non-interactive Spaces

| Interactive Space | N | FAS | FD | WLR | HLR |
|---|---|---|---|---|---|
| S1 | 20 | 30.68 (1.48) | 2.62 (0.165) | 0.45 | 0.08 |
| S2 | 20 | 26.17 (3.03) | 0.99 (0.03) | 0.13 | 0.04 |
| S3 | 20 | 29.99 (0) | 1.816 (0.043) | 0.71 | 0.16 |
| S4 | 21 | 28.62 (0) | 1.697 (0.109) | 0.86 | 0.22 |
| Non-Interactive Space | | FAS | FD | WLR | HLR |
| N1 | 20 | 57.02 (1.56) | 2.635 (0.015) | 0.51 | 0.16 |
| N2 | 20 | 11.28 (3.45) | 2.98 (0.193) | 0.51 | 0.16 |
| N3 | 16 | 20.97 (8.13) | 3.567 (0.068) | 0.68 | 0.39 |
| N4 | 17 | 23.78 (5.75) | 2.89 (0.137) | 0.68 | 0.38 |

interactive were not significantly different in the sociopetal arrangement of furniture from non-interactive spaces. However, it should be noted that this analysis employed mean Furniture Arrangement Scores of the spaces and the unusually high (more sociopetal) furniture arrangement score of space 'N1', which was designated as non-interactive space, may have largely contributed to this result. Before concluding that there was no significant difference in the arrangement of furniture for sociopetality, an additional t-test was performed for the furniture arrangement scores of seating clusters.

Table 4 displays the number of seating clusters observed, mean Furniture Arrangement Score (FAS), mean Furniture Density (FD), mean Width to Length Ratio (WLR) with the respective standard deviations in parentheses. The maximum and minimum scores of these design characteristics are also displayed on the table.

As the sample of clusters observed was large, a z-test was performed to test the statistical significance of the difference between the Furniture Arrangement Scores of the clusters in interactive and non-interactive spaces. The mean Furniture Arrangement Score of the seating clusters in the spaces designated for interaction was anticipated to be greater than that of the clusters in the spaces not designated for interaction. However, the z-test shows that

Table 4

Design Characteristics of

Seating Clusters in Interactive

and Non-interactive Spaces

| | N | FAS | FD | WLR |
|---|---|---|---|---|
| Mean Score for Interactive Spaces | 687 | 30.10 (13.56) | 7.29 (2.19) | 0.83 (0.15) |
| Maximum Score for Interactive Spaces | | 78.24 | 12.5 | 1.0 |
| Minimum Score for Interactive Spaces | | 0 | 0 | 0.5 |
| Mean Score for Non-interactive Spaces | 196 | 33.05 (25.47) | 5.85 (2.64) | 0.80 (0.22) |
| Maximum Score for Non-interactive Spaces | | 77.6 | 13.33 | 1.000 |
| Minimum Score for Non-interactive Spaces | | 0 | 1.79 | 0.15 |

there is no significant evidence to support the hypothesis that the mean Furniture Arrangement Score of the clusters in spaces designated for interaction is greater than the mean Furniture Arrangement Score of the clusters in spaces not designated for interaction. ($z=-1.563$ and the rejection region was $z>1.645$ at $p=0.05$).

Thus the z-test performed on the Furniture Arrangement Score of the clusters support the earlier finding that the spaces designated as interactive were not significantly different in the arrangement of furniture to be sociopetal from non-interactive spaces. However, it is interesting to note that the mean Furniture Arrangement Score of interactive spaces were found to be less than that of non-interactive spaces, which is totally opposite of the expectations. This finding could be attributed to the large furniture arrangement scores of the space 'N'1, which is designated as a non-interactive space and the seating clusters in that space. It also should be mentioned that the seating clusters in non-interactive spaces 'N3' and 'N4' were rearranged by the users, perhaps to facilitate social interaction. The increase in Furniture Arrangement Scores in these spaces resulted in the mean Furniture Arrangement Score of non-interactive spaces being found to be greater than that of interactive spaces.

Comparison of Furniture Density (FD)

It was anticipated that the mean furniture density of spaces designated for interaction would be greater than that of spaces not designated for interaction. The t-test shows that there is no significant evidence to conclude that the mean FD of spaces designated for interaction is greater than the mean FD of spaces not designated for interaction. ($t=-3.206$ and the rejection region was $t>1.943$ at $p=0.05$ and 6 degrees of freedom). Thus the spaces designated as interactive, which should reflect a sociopetal level of furniture density are not significantly different from non-interactive spaces, which should have had a lower level of furniture density.

As in the case of Furniture Arrangement Score, the difference in furniture density was tested at seating cluster level before concluding that there is no significant difference. A z-test was performed to test the significance of difference between the mean Furniture Density of clusters in spaces designated for interaction and the mean Furniture Density of clusters in spaces not designated for interaction. It was anticipated that the mean Furniture Density of clusters in interactive spaces will be greater than the mean Furniture Density of non-interactive spaces. The z-test shows that there is significant evidence to conclude that the mean Furniture Density of the clusters in interactive spaces is greater than the mean Furniture Density of non-interactive spaces. ($z=7.007$ and the rejection region was $z>1.645$ at $p=0.05$).

Thus it can be concluded that the furniture density of seating clusters in spaces designated as interactive is significantly different and more sociopetal than clusters in non-interactive spaces. It also can be concluded that this difference is significant only at the level of seating clusters.

### Comparison of Width to Length Ratio (WLR)

It was anticipated that the mean width to length ratio of interactive spaces would be greater than that of non-interactive spaces. The t-test in this case shows that there is no significant evidence to conclude that the mean Width to Length Ratio of spaces designated for interaction is greater than the mean Width to Length Ratio of spaces not designated for interaction. ($t=-0.328$ and the rejection region was $t>1.943$ at $p=0.05$ and 6 degrees of freedom). Thus the Width to Length Ratio in spaces designated as interactive were not significantly different from non-interactive spaces.

As in the previous cases, significance of difference was tested for the Width to Length Ratios of seating clusters. Since the sample was large, a z-test was performed to test the significance of difference between the Width to Length Ratios of the seating clusters in interactive spaces and non-interactive spaces. It was anticipated that the mean Width to Length Ratio of seating clusters in interactive spaces would be greater than the mean Width to Length Ratio of clusters in non-interactive spaces. The z-test shows that there is no significant evidence to conclude that the mean Width to Length Ratio of clusters in spaces designated for interaction is greater than the mean Width to Length Ratio of clusters in spaces not designated for interaction. ($z=1.476$ and the rejection region was $z>1.645$ at $p=0.05$). Thus the Width to Length Ratio of seating clusters in spaces designated as interactive were not significantly different from seating clusters in non-interactive spaces in terms of sociopetality.

<u>Comparison of Height to Length Ratio (HLR)</u>

It also was anticipated that the mean Height to Length Ratio of interactive spaces would be greater than that of non-interactive spaces. The t-test shows that there is no significant evidence to conclude that the mean Height to Length Ratio of spaces designated for interaction is greater than the mean Height to Length Ratio of spaces not designated for interaction. ($t=-1.899$ and the rejection region was $t>1.943$ at $p=0.05$ and 6 degrees of freedom). Thus spaces designated for interaction were not significantly different in the Height to Length Ratio to be sociopetal from non-interactive spaces. Since there was no difference in the height at the larger space level and the seating cluster level, it was decided not necessary to test the significance of difference in height to length ratio between interactive and non-interactive spaces at cluster level.

Summary of Comparisons of Physical Design Characteristics

Ortiz Gonzalez (1983) found that furniture arrangement score, furniture density and width to length ratio predict the social interaction in spaces. He concluded that this finding was more evident in small observational areas than in larger settings. He also found that furniture density had the strongest relationship with social interaction. Based on his finding it was anticipated that the furniture arrangement score, furniture density and width to length ratio should be greater in spaces designated for interaction than in spaces not designated for interaction both at larger space level and seating cluster level. Although the furniture density of interactive spaces at cluster level was greater than the furniture density of non-interactive spaces, none of the other variables were significantly more indicative of sociopetal design in the interactive spaces. This suggests that these factors were not considered when designating the spaces for their activities. It also could be suggested that the findings for the Furniture Arrangement Score and Furniture Density do not support the hypotheses because of the rearrangement of furniture by the users, perhaps to facilitate social interaction in non-interactive spaces.

<u>Comparison of the Amount of Verbal Interaction in the 'Interactive' Spaces and 'Non-interactive' Spaces</u>

The second question addressed by the study was possible significant differences in the amount of verbal interaction between spaces designated for interaction and spaces not designated for interaction. Due to variations in the amount of verbal interactions during each observation, the mean Total Verbal Behavior Score of each space was considered for the analysis .

$$\text{Mean TVBS} = \frac{\text{Sum of TVBS for all the observations}}{\text{\# of observations}}$$

Table 5 displays the mean Total Verbal Behavior Scores (mean TVBS) of both interactive spaces and non-interactive spaces with the standard deviations indicated in parenthesis.

Verbal interactions in the spaces not designated for

Table 5

Mean Total Verbal Behavior Scores (TVBS) of

'Interactive' and 'Non-interactive' Spaces

| Interactive Space | Mean Total Verbal Behavior Score |
|---|---|
| 'S1' | 0.125 (0.12) |
| 'S2' | 0.454 (0.282) |
| 'S3' | 0.61 (0.377) |
| 'S4' | 0.712 (0.243) |

| Non-interactive Space | Mean Total Verbal Behavior Score |
|---|---|
| 'N1' | 0.129 (0.252) |
| 'N2' | 0.158 (0.317) |
| 'N3' | 0.083 (0.228) |
| 'N4' | 0.063 (0.183) |

interaction were observed only on few occasions, which resulted in the high standard deviations of these scores, as shown in parentheses in the table. From Table 5 it can be noted that the mean Total Verbal Behavior Score of space 'S1' is more similar to those of non-interactive spaces. This finding might be attributed to the space being used for studying, which is a non-interactive use.

It was anticipated that the amount of verbal interaction in the spaces designated for interaction would be greater than the amount of verbal interaction in spaces not designated for interaction. The t-test shows that there is significant evidence to conclude that the amount of verbal interactions in spaces designated for interaction is greater than the amount of verbal interactions in spaces not designated for interaction. ($t=2.82$ and the rejection region was $t>2.47$ at $p=0.025$ and 6 degrees of freedom). To support this finding, since so few cases were available for analysis, a non-parametric statistical test (Mann-Whitney 'U' test) also was performed. This test rejected the hypothesis that both populations are identical ($z=-1.88$ and the rejection region was $z>0.01$ or $z<-0.01$ at $p=0.05$), indicating a significant difference between the two groups of spaces.

The above test shows that more verbal interaction takes place in spaces designated for interaction than in spaces not designated for interactions, although the design characteristics of these spaces do not fall into the category of sociopetal spaces based on previous research. These findings suggest that in the case of campus buildings, official designation of spaces for activity types may exert a greater influence on the activities taking place than the design characteristics of the spaces. However, this has been demonstrated only at the larger space level. Before making any conclusions the amount of verbal interactions also was examined at the seating cluster level.

A z-test was performed to test the statistical significance of difference in the amount of verbal interaction between seating clusters in interactive spaces and clusters in non-interactive spaces. Table 6 displays the mean Total Verbal Behavior Scores (mean TVBS) of seating clusters in both interactive and non-interactive spaces with the standard deviations indicated in parenthesis.

It was anticipated that the amount of verbal interaction in the spaces designated for interaction would be greater than the amount of verbal interaction in spaces not designated for interaction. The z-test shows that there is significant evidence to conclude that the amount of verbal interactions in the seating clusters in spaces designated for interaction is greater than the amount of verbal interactions in the clusters in spaces not designated

Table 6

Mean Total Verbal Behavior Scores (TVBS) of

Clusters in 'Interactive' and 'Non-interactive' Spaces

| Space | N | Mean TVBS | Max.TVBS | Min.TVBS |
|---|---|---|---|---|
| Interactive Space | 687 | 0.17<br>(0.369) | 1 | 0 |
| Non-interactive Space | 196 | 0.083<br>(0.268) | 1 | 0 |

for interaction. ($z=3.618$ and the rejection region was $z>1.645$ at $p=0.05$), indicating a significant difference between the two groups of spaces.

## Physical and Social Characteristics of Spaces Predicting the Amount of Verbal Interaction

A stepwise regression analysis was conducted to explore the physical and social characteristics which predict the amount of verbal interaction taking place in all the spaces under study. The regression procedure was conducted for three dependent variables the total amount of verbal interaction, amount of verbal interaction by female users and verbal interaction by male users. A total of 154 observations were taken and analysis were conducted using the following physical and social environmental independent variables, measured for each space (as against cluster); Furniture Arrangement Score (FAS), Furniture Density (FD), Width to Length Ratio (WLR), Height to Length Ratio (HLR), Gender Distribution (Proportion) of Males (GDM), Social Density (SD), Noise and Lighting Level. Gender distribution was not included in the regression for interaction by female users and interaction by male users.

The results of the first regression analysis using total verbal interaction, are displayed in Table 7. The following four characteristics predicted the total amount of

Table 7

Stepwise Regression of Total Verbal Behavior Scores (Space)

| Variable | Correlation Coefficient (r) | Beta | Partial R-Square | Model R-Sq. | Prob > F |
|---|---|---|---|---|---|
| Step 1 | | | | | |
| FD | -0.55 | -0.30 | 0.298 | 0.298 | 0.0001 |
| Step 2 | | | | | |
| WLR | 0.17 | 0.63 | 0.13 | 0.43 | 0.0001 |
| Step 3 | | | | | |
| GDM | 0.01 | -0.17 | 0.023 | 0.45 | 0.0142 |
| Step 4 | | | | | |
| Noise | 0.3 | 0.09 | 0.013 | 0.46 | 0.0617 |

Note:

Adjusted R-Square = 0.45

Total F value = 32.02, p = 0.0001

Total degrees of freedom = 153

verbal interaction taking place in space: Furniture Density (p=0.0001), Width to Length Ratio (p=0.0001), Gender Distribution of Males (p=0.0142) and Noise (p=0.0617). The variance accounted for by the model (R-square) was 0.4637 with an adjusted R-square of 0.4493.

The second regression analysis focused on the amount of verbal interaction by female users. In this case only 14% of the variance could be accounted for by the environmental variables. The female interactions were predicted by Furniture Density (p= 0.0001), Noise (p=0.0172) and Light (p=0.1237). The results of this analysis are displayed in Table 8.

In the third analysis, the amount of verbal interaction by male users were examined. An amount of variance similar to the analysis for all users was predicted (45.5%) but in this case by Furniture Density (p=0.0001), Width to Length Ratio (p=0.0001) and Light (p=0.0313). Table 9 displays the results of the regression analysis of male verbal behavior score (MVBS).

In all the three analyses above, Furniture Density found to be the first variable entered in the regression model. Although Ortiz Gonzalez (1983) found that Furniture Density has the strongest relationship with the social interaction, this study contradicts his findings. In contrast to the positive relationship found by Ortiz

Table 8

Stepwise Regression of Female Verbal Behavior Scores (Space)

| Variable | Correlation Coefficient (r) | Beta | Partial R-Square | Model R-Sq. | Prob > F |
|---|---|---|---|---|---|
| **Step 1** | | | | | |
| FD | -0.304 | -0.063 | 0.093 | 0.093 | 0.0001 |
| **Step 2** | | | | | |
| Noise | 0.209 | 0.080 | 0.04 | 0.13 | 0.0172 |
| **Step 3** | | | | | |
| Light | -0.153 | -0.03 | 0.01 | 0.14 | 0.1237 |

Note:

Adjusted R-Square = 0.12

Total F value = 8.14, p = 0.0001

Total degrees of freedom = 153

Table 9

Stepwise Regression of Male Verbal Behavior Scores (Space)

| Variable | Correlation Coefficient (r) | Beta | Partial R-Square | Model R-Sq. | Prob > F |
|---|---|---|---|---|---|
| Step 1 | | | | | |
| FD | -0.49 | -0.25 | 0.24 | 0.24 | 0.0001 |
| Step 2 | | | | | |
| WLR | 0.275 | 0.71 | 0.20 | 0.44 | 0.0001 |
| Step 3 | | | | | |
| Light | -0.172 | 0.05 | 0.02 | 0.46 | 0.0313 |

Note:

Adjusted R-Square = 0.44

Total F value = 41.84, p = 0.0001

Total degrees of freedom = 153

Gonzalez, this study shows a negative correlation between the furniture density and the amount of verbal interactions, despite the earlier findings that the furniture density and the amount of verbal interactions are higher in interactive spaces. Several reasons may be attributed to this contradiction. First, the designation of spaces with higher furniture density as non-interactive spaces could have restricted the amount of verbal interactions taking place. It should be noted that the regression analyses considered the scores of furniture density and verbal interactions of both interactive and non-interactive spaces in the model. Second, according to earlier analyses, although there was significant difference in the amount of verbal interactions between interactive and non-interactive spaces, there was no significant difference in the furniture density between both type of spaces. In fact, at larger space level, the furniture density of interactive spaces was found to be less than that of non-interactive spaces. In order to consider the implications of these contrasting data, similar regression analyses were conducted for the scores of seating clusters, which is discussed later in this chapter. In addition, width to length ratio, a factor which Ortiz Gonzalez did not find as a predictor of verbal interaction, was found in this study to be a predictor of verbal interaction by the male users and by all users. This finding, and perhaps the contrasting directions of influence for furniture density, may be attributed to the fact that this study examined a broader range of spaces as against the study of Ortiz Gonzalez, which examined only the lounges in dormitories.

More similarities can be found in the analyses of total verbal interactions and male verbal interactions than in the analyses of male verbal interaction and female interactions. Both have an R-square value of nearly 46% and the first two variables entered in both the models are the same, Furniture Density and Width to Length Ratio. The regression of verbal interaction by female users has an R-square value of only 14%. These analyses also suggest that the verbal interaction of female users are not predicted to the same extent or by exactly the same physical characteristics as in the case of total verbal interaction and verbal interactions of male users. Although both are predicted by furniture density and light, the second strongest predictor variable is different. It can be found that noise predicts verbal interaction of females, but not the verbal interaction of males. Similarly, width to length ratio predicts verbal interaction of males, but does not predict for females.

Physical and Social Characteristics of seating clusters predicting the amount of verbal interaction

The next step in the analyses was to examine the same regression model using predictors based on the clusters, rather than spaces. Tables 10, 11 and 12 display the regression analyses at the seating cluster levels of the verbal interactions of all the users, verbal interactions of females and verbal interactions of males respectively.

It is interesting to find that the same environmental variables, Social Density, Furniture Density, Furniture Arrangement Score and Noise predict the total amount of verbal interactions, male verbal interactions and female verbal interactions. The stepwise entry into the model also was the same for the three types of verbal interaction scores suggesting that these variables do predict the amount of verbal interactions to some extent regardless of the gender. Previous research also have found these variables to predict the verbal interaction. However, it should be noted that the verbal interactions at the cluster levels are not predicted by exactly the same variables as in the spaces. Furniture arrangement score and social density, which did not predict the amount of verbal interactions in the larger spaces were found to be predicting the amount of verbal interactions in the seating clusters. This is in accordance with the finding of Ortiz Gonzalez, that furniture density,

Table 10

Stepwise Regression of the Amount of Verbal Interactions of all the Users (TVBS) in the Seating Clusters

| Variable | Correlation Coefficient (r) | Beta | Partial R-Square | Model R-Sq. | Prob > F |
|---|---|---|---|---|---|
| Step 1 | | | | | |
| SD | 0.32 | 0.099 | 0.1 | 0.1 | 0.0001 |
| Step 2 | | | | | |
| FD | -0.12 | -0.054 | 0.05 | 0.15 | 0.0001 |
| Step 3 | | | | | |
| FAS | 0.09 | 0.01 | 0.09 | 0.24 | 0.0001 |
| Step 4 | | | | | |
| Noise | 0.21 | 0.15 | 0.04 | 0.28 | 0.0001 |

Note:

Adjusted R-Square = 0.28

Total F value = 83.69, p = 0.0001

Total degrees of freedom = 882

Table 11

Stepwise Regression of the Amount of Verbal Interactions of Female Users (FVBS) in the Seating Clusters

| Variable | Correlation Coefficient (r) | Beta | Partial R-Square | Model R-Sq. | Prob > F |
|---|---|---|---|---|---|
| Step 1 | | | | | |
| SD | 0.25 | 0.04 | 0.06 | 0.06 | 0.0001 |
| Step 2 | | | | | |
| FAS | 0.126 | 0.003 | 0.03 | 0.09 | 0.0001 |
| Step 3 | | | | | |
| FD | -0.015 | -0.02 | 0.05 | 0.14 | 0.0001 |
| Step 4 | | | | | |
| Noise | 0.143 | 0.07 | 0.02 | 0.16 | 0.0001 |

Note:

Adjusted R-Square = 0.15

Total F value = 42.07, p = 0.0001

Total degrees of freedom = 882

Table 12

Stepwise Regression of the Amount of Verbal Interactions by Males (MVBS) in the Seating Clusters

| Variable | Correlation Coefficient (r) | Beta | Partial R-Square | Model R-Sq. | Prob > F |
|---|---|---|---|---|---|
| Step 1 | | | | | |
| SD | 0.199 | 0.055 | 0.04 | 0.04 | 0.0001 |
| Step 2 | | | | | |
| FD | -0.178 | -0.04 | 0.07 | 0.11 | 0.0001 |
| Step 3 | | | | | |
| FAS | 0.017 | 0.004 | 0.04 | 0.15 | 0.0001 |
| Step 4 | | | | | |
| Noise | 0.148 | 0.07 | 0.01 | 0.16 | 0.0002 |

<u>Note:</u>

Adjusted R-Square = 0.15

Total F value = 41.98, p = 0.0001

Total degrees of freedom = 882

social density and furniture arrangement score predict the social behavior more at small observational level than at larger space level, although direction of furniture density is still reversed.

But the variance accounted for by these models is much less than the analyses for the larger space and contradicts the findings of Ortiz Gonzalez that environmental variables predict the amount of social interaction more at small observational levels. This is particularly evident in the case of total verbal interaction and male verbal interaction, which have R-square values of 27.6% and 16% respectively as against the 46% at the larger space level. It also should be noted that furniture density in this study consistently has a negative relationship with the amount of verbal interactions, whereas in the study by Ortiz Gonzalez, it had a strong positive relationship with the social behavior. This contradiction may be due to the fact that the types of spaces examined in this study and Ortiz Gonzalez's study were different. The fact that some spaces examined in this study had been designated as non-interactive, thus restricting the possibility of more verbal interactions also might have attributed towards this contradictory finding. Another fact is that the study by Ortiz Gonzalez included all the social behaviors in the study and the social behavior score consisted of rankings of behavior developed in that study. In this study only the amount of verbal interactions were examined.

Finally, forward stepwise regression analyses were conducted to explore the relationships of the strongest predictors of verbal interactions at both space level and cluster levels to the amount of verbal interactions at the seating cluster level for all the users, males, and females. Results of these analyses are displayed in Tables 13, 14 and 15.

Table 13, displaying the analysis for all users, indicates that social, room and cluster characteristics all are important predictors of social interaction. After social density, which will vary during use, the most important predictors were at the level of the room, and are readily manipulated by designers. The cluster variables reflecting furniture arrangement and density followed next, while the environmental stressors of light and noise were the last to enter the analysis. The analyses also showed that the amount of verbal interactions by the males and all users are predicted by the same characteristics. Clearly, furniture density and width to length ratio of the larger space are strong predictors of the amount of verbal interactions at cluster level, especially for males. The variance accounted for in these models is much greater for all users and for males than the earlier models at the cluster level. This

Table 13

Stepwise Regression of the Amount of Verbal Interactions of all the Users (TVBS) in the Seating Clusters predicted by Variables at both Levels

| Variable | Correlation Coefficient (r) | Beta | Partial R-Square | Model R-Sq. | Prob > F |
|---|---|---|---|---|---|
| Step 1<br>SD (cluster) | 0.32 | 0.06 | 0.104 | 0.104 | 0.0001 |
| Step 2<br>FD (space) | -0.27 | -0.23 | 0.056 | 0.16 | 0.0001 |
| Step 3<br>WLR (space) | -0.04 | 0.88 | 0.12 | 0.28 | 0.0001 |
| Step 4<br>FAS (cluster) | 0.09 | 0.006 | 0.04 | 0.32 | 0.0001 |
| Step 5<br>FD (cluster) | -0.11 | -0.03 | 0.02 | 0.34 | 0.0001 |
| Step 6<br>Light | 0.07 | 0.03 | 0.01 | 0.35 | 0.0038 |
| Step 7<br>Noise | 0.21 | 0.04 | 0.002 | 0.352 | 0.1004 |

<u>Note:</u>

Adjusted R-Square = 0.34

Total F value = 66.23, p = 0.0001

Total degrees of freedom = 881

Table 14

Stepwise Regression of the Amount of Verbal Interactions of Female Users (FVBS) in the Seating Clusters predicted by Variables at both Levels

| Variable | Correlation Coefficient (r) | Beta | Partial R-Square | Model R-Sq. | Prob > F |
|---|---|---|---|---|---|
| Step 1<br>SD (cluster) | 0.25 | 0.04 | 0.06 | 0.06 | 0.0001 |
| Step 2<br>FAS (cluster) | 0.13 | 0.003 | 0.03 | 0.09 | 0.0001 |
| Step 3<br>FD (cluster) | -0.02 | -0.02 | 0.05 | 0.14 | 0.0001 |
| Step 4<br>Noise | 0.14 | 0.07 | 0.02 | 0.16 | 0.0001 |

Note:

Adjusted R-Square = 0.157

Total F value = 42.07, p = 0.0001

Total degrees of freedom = 882

Table 15

Stepwise Regression of the Amount of Verbal Interactions of Male Users (MVBS) in the Seating Clusters predicted by Variables at both Levels

| Variable | Correlation Coefficient (r) | Beta | Partial R-Square | Model R-Sq. | Prob > F |
|---|---|---|---|---|---|
| Step 1<br>FD (space) | -0.24 | -0.25 | 0.06 | 0.06 | 0.0001 |
| Step 2<br>WLR (space) | 0.07 | 0.99 | 0.10 | 0.16 | 0.0001 |
| Step 3<br>SD (cluster) | 0.2 | 0.06 | 0.1 | 0.26 | 0.0001 |
| Step 4<br>FAS (cluster) | 0.02 | 0.003 | 0.01 | 0.27 | 0.0001 |
| Step 5<br>Light | 0.08 | 0.05 | 0.02 | 0.29 | 0.0001 |
| Step 6<br>FD (Cluster) | -0.18 | -0.013 | 0.005 | 0.295 | 0.0042 |
| Step 7<br>Noise | 0.15 | -0.05 | 0.005 | 0.30 | 0.0123 |

Note:

Adjusted R-Square = 0.297

Total F value = 54.06, p = 0.0001

Total degrees of freedom = 881

implies that the furniture density and width to length ratio of the larger space are two important physical characteristics in predicting the amount of verbal interaction in the seating clusters within that space. The regression of the verbal interaction for females (displayed in Table 14) did not show any difference from the earlier regression analysis at the cluster level, suggesting that room characteristics are not important predictors for women's interaction. However, it should be noted that the furniture density has a negative relationship with the amount of verbal interaction, contradicting previous research. As mentioned earlier, the designation of spaces, the broader range of the space types and the verbal interactions in the cluster containing a billiard table, which does not have any seating, might have contributed to these findings.

# CHAPTER FOUR

## Conclusions

The first issue addressed by this study was whether there are any significant differences in the sociopetal design characteristics between spaces designated for interactive activities and spaces designated for non-interactive activities both at larger space level and seating cluster level. The characteristics examined were the furniture arrangement score, furniture density, width to length ratio and height to length ratio at the space level, and the same characteristics, with the exception of the height to length ratio, at the cluster level. At the space level, the study did not find any significant differences in these characteristics between interactive and non-interactive spaces. At the cluster level, only furniture density was found to be significantly higher in interactive spaces than in non-interactive spaces. These findings imply that either these sociopetal design characteristics were not considered in the design of these spaces or the spaces are not being used for its designed purpose.

The second issue addressed was whether there are significant differences in the amount of verbal interactions between spaces designated for interactive activities and spaces designated for non-interactive activities, at both the space level and cluster level. The amount of verbal interactions in interactive spaces was found to be greater than in non-interactive spaces both at space level and cluster level. These findings show that more interactions are taking place in interactive spaces than in non-interactive spaces, although there are no differences in sociopetal design characteristics. This result does not imply that sociopetal characteristics have no role in the amount of verbal interactions, but rather shows that the official designation outweighs the design characteristics in influencing the amount of verbal interaction.

The third issue addressed was to explore the relationship between the physical and social environmental variables and the amount of verbal interactions taking place in spaces as well as clusters. The regression analyses conducted indicated that at space level the amount of verbal interactions by all users and by males are predicted by environmental variables more than in the case of female users. This similarity might be attributed to the fact that 63% of the users sampled were males. However in the case of clusters, the success of the prediction was similar. It was noted that in contradiction to previous research findings, furniture density consistently had a negative correlation with the amount of verbal interactions. This might be due to the designation of spaces restricting verbal interactions.

It also might have been due to the different procedure for the scoring of verbal behavior. Earlier research considered the rankings of different behaviors, whereas this research recorded the amount of verbal interactions. The final regression analyses indicated that two physical characteristics of the space, together with other characteristics of the clusters, predict the amount of verbal interactions in the clusters in that space. These analyses indicate the most important characteristics to be considered in designing spaces for verbal interaction are: width to length ratio and furniture density of the space, furniture arrangement and furniture density of the clusters, and optimum noise levels and lighting levels in the room.

These analyses, although contradicting some aspects of earlier research, do indicate that the amount verbal interactions is predicted by the physical and social environmental characteristics. Although the variance accounted for by the model for clusters is lower than the one for spaces, the predictors in the cluster level are consistent across different users and indicate that these variables are more important at the cluster level than at the space level. This study also suggests that in addition to the type of furniture arrangement, the proximity and social distance of the seating are important for sociopetal arrangement of furniture.

Suggestions for Future Research.

More research is necessary on the physical and social environmental attributes of sociopetal design before making any conclusions, especially in the areas where findings appear contradictory. Previous research found furniture density to have a strong positive relationship with the social behavior, but that study sampled only one type of space: dormitory lounges. This relationship could be explored for same type of spaces using the techniques used in this study to confirm or contradict previous findings. The social behavior score measured in the study of Ortiz Gonzalez (1983) was different from the score used in this study. The present study could be repeated using the above scoring technique to explore whether this different measurement of behavior might have led to the contradiction. Further research also should be conducted in lounge spaces without specifically designating them for any particular use to find whether the designation of spaces play a major role in the amount of verbal interactions. A more controlled study could be conducted by having fixed furniture arrangements and fixed furniture density. It also should be noted that this study did not include some other important factors such as color and materials used in the space which also might influence the social interaction. Therefore in addition to the contradictory findings of this study, future research should also focus on the impact of color and materials of the space on the social interaction of users.

Design Considerations.

It is important to note that despite the contradiction with previous research in terms of furniture density, this study has confirmed the findings of other previous research that social density, width to length ratio of the room and furniture arrangement of the cluster are important characteristics which are supportive of social interaction. This study also has found that optimum level of the sounds of life and lighting are important for social interaction. Based on these findings, the following design considerations are being suggested for the designers of sociopetal spaces and are graphically displayed as a generic space in Figure 39.

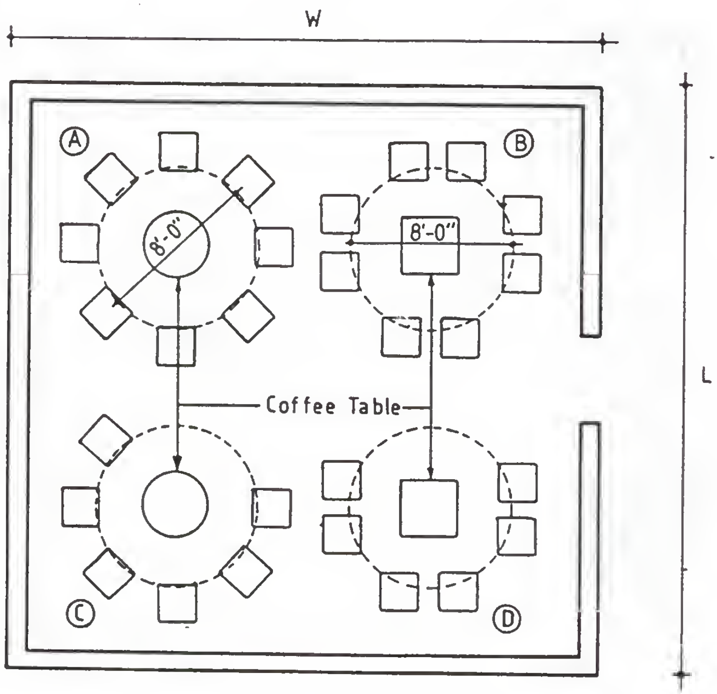
* Provide higher width to length ratio for the space.

* Arrange most of the seating in the space with all or most of the sides closed.

* Avoid back to back seating and shoulder to shoulder seating.

Figure 39

Optimum Design Conditions for a Generic Sociopetal Space




A & B - Seating Clusters with all sides closed

C & D - Seating Clusters with most of the sides closed

| | | |
|---|---|---|
| W/L | = | 1 |
| Lighting Level | > | 40 Footcandles |
| Sound Level | = | 60 Decibels |

* Provide seating within eight feet of each other in a cluster. In other words, the distance of any seating from the center of the cluster should not be more than four feet.

* Provide a prop such as a coffee table in the center of the seating cluster.

* Provide a lighting level of at least 40 footcandles for each cluster.

* Design to allow some of the sounds of everyday life from outside to penetrate the space. In other words, do not provide a soundproof enclosure.

The above considerations are for the design of sociopetal spaces used by both males and females. The design consideration suggested for the spaces used exclusively by males are given below.

* The first six considerations described above.

* Avoid allowing outside sounds above the level of 60 decibels.

For spaces used exclusively by females, the following design considerations are suggested.

* Arrange most of the seating in the space with all or most of the sides closed.

* Avoid back to back seating and shoulder to shoulder seating.

* Provide seating within eight feet of each other in a cluster. In other words, the distance of any seating from the center of the cluster should not be more than four feet.

* Provide a prop such as a coffee table in the center of the seating cluster.

* Design the space to allow some of the sounds of everyday life to penetrate the space. In other words, as in the case of all users, do not provide a soundproof enclosure.

In conclusion, this study, while providing a base for future research, has strongly confirmed findings of previous research and has outlined some guidelines for the designers. Consideration of these guidelines in the design of sociopetal spaces such as lounges and lobbies will enhance the success of these spaces by facilitating social interaction.

# References


Baum, A., Harpin, R.E. and Valins, S. The Role of Group Phenomena in the experience of crowding. Environment and Behavior. 1975. 7. 185-198.

Baum, A. and Valins, S. Architecture and Social Behavior: Psychological Studies in Social Density. Hillsdale, N.J: Lawrence Erlbaum. 1977.

Boyce, P.R. "Age, Illuminance, Visual Performance and Preference." Lighting Research Technology. 1973. 5. 125-144.

Bronzaft, A.L. "The Effect of Noise Abatement Program on reading ability." Journal of Environmental Psychology. 1981. 1.

Brunetti, F., "Noise, Distraction and Privacy in Conventional and Open School Environments." In W.J.Mitchell (Ed) Environmental Design: Research and Practice. Los Angëles: University of California. 1972.

Butler, Darrel L. and Biner, Paul M. "Preferred Lighting Levels: Variability among Settings, Behavior and

Individuals." Environment and Behavior. Nov. 1987. 6. 695-721.

Cohen, S., Evans, G.W., Krantz, D.S., Stokols, D. and Kelly, S. "Aircraft Noise and Children: Longitudinal and Cross-sectional evidence on adaptation to Noise and the Effectiveness of Noise abatement." Journal of Personality and Social Psychology. 1981. 40. 331-345.

Epstein, Y.M. and Karlin, R.A. "Effects of Acute Experimental Crowding." Journal of Applied Social Psychology. 1975. 5. 34-53.

Flynn, E., Spencer, T.J., Martyniuk, O. and Hendrick, C. "Interim Study of Procedures for Investigating the Effect of Light on Impression and Behavior." Illuminating Engineering Society Journal. 1973. 3. 87-94.

Hall, E.T. The Hidden Dimension. Garden City, N.Y.: Doubleday. 1966.

Holahan, Charles J. Environmental Psychology. New York: Random House. 1982.

Hutt, C. and Vaizey, M.J. "Differential Effects of Group Density on Social Behavior." Nature. 1966. 209. 1371-1372.

Jacobson, Max. "Let's Be Seated - More Comfortable." American Institute of Architects Journal. 1974. 53. 74.

Kenrick, D.T. and Johnson, G.A. "Interpersonal Attraction in Aversive Environments: A Problem for the Classical Conditioning Paradigm." Journal of Personality and Social Psychology. 1979. 37. 572-579.

Loo, C.M. "The Effect of Social Density on the Social Behavior of Children." Journal of Applied Social Psychology. 1972. 2. 372-381.

Loo, C.M. "Important Issues in Researching the Effects of Crowding on Humans." Representative Research in Social Psychology. 1973. 4. 219-227.

McCauley, C., Coleman, G. and De Fusco, P. "Commuters' Eye Contact with Strangers in City and Suburban Train Stations: Evidence of Short-term Adaptation to Interpersonal Overload in the City." Environmental Psychology and Nonverbal Behavior. 1978. 2. 215-225.

McGrew, P.L. "Social and Spatial Density Effects on Spacing Behavior in Pre-school Children." Journal of Child Psychology and Psychiatry. 1970. 11. 197-205.

Miller, James D. Effects of Noise on People. Washington, D.C.: U.S. Environmental Protection Agency. 1971.

Newman, J. and McCauley, C. "Eye Contact with Strangers in City, Suburb and Small Town." Environment and Behavior. 1977. 9. 547-559.

Ortiz Gonzalez, Jose Benjamin. "The Impact of Sociofugal and Sociopetal Attributes of University Dormitory Lounges on Social Interaction of Residents." Master's Thesis. Manhattan, KS: Dept. of Architecture, Kansas State University. 1983.

Osmond, H. "Function As the Basis of Psychiatric Ward Design." Mental Hospitals. 1957. 8. 23-30.

Sommer, R. and Dewar, R. "The Physical Environment of the Ward." in E.Friedson (Ed) The Hospital in Modern Society. New York: The Free Press. 1963.

Sommer, R. and Gilliland, Gwynneth W. "Design for Friendship." American Institute of Architects Journal. 1962. 38. 84-86.

Sommer, R. and Ross, H. "Social Interaction in a Geriatric Ward." International Journal of Social Psychiatry. 1958. 4. 128-135.

Traister, John E. Practical Lighting Applications for Building Construction. New York: Van Nostrand Reinhold Company. 1982.

Valins, S. and Baum, A. "Residential Group Size, Social Interaction and Crowding." Environment and Behavior. 1973. 5. 421-440.

Ward, Lawrence M. and Suedfed, Peter. "Human Responses to Highway Noise." Environmental Research. 1973. 6. 306-326

Worchel, S. and Tedlie, C. "The Experience of Crowding: A Two-Factor Theory." Journal of Personality and Social Psychology. 1976. 34. 30-40.

# THE IMPACT OF THE ENVIRONMENTAL ATTRIBUTES ON THE VERBAL INTERACTION OF THE USERS IN THE LOUNGE SPACES IN THE CAMPUS BUILDINGS

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ABSTRACT

This thesis examines the relationship between the environmental attributes of lounge and study spaces in campus dormitory and Union buildings and verbal interaction of the people in those spaces. It also examines the differences in the sociopetal design characteristics and the amount of verbal interaction between spaces designated as intended for verbal interaction and those that are not. Previous research has identified important relationships between some environmental attributes, especially room proportion, furniture arrangement, and density, and social behavior. However, these studies have not considered some additional important physical and social environmental attributes in predicting social behavior. In this study, measurement of environmental attributes has been refined and expanded. Eight social and physical environmental characteristics (furniture arrangement, furniture density, social density, gender distribution, width to length ratio, height to length ratio, noise and lighting level) were defined and measured for each space as well as for each seating cluster. The verbal interaction of people in the lounge or study spaces was recorded using a behavioral mapping technique. Two categories of behaviors were observed in this study: verbally interactive behavior and verbally non-interactive behavior. Statistical analyses were conducted to test the differences in sociopetal design characteristics and in verbal interaction between spaces designated as interactive and non-interactive. Analyses were conducted using data for spaces and for seating clusters. No significant differences in sociopetal characteristics were found at the larger space level. However, significant differences were found at the seating cluster level. Significant differences in verbal interaction at both levels were found. Regression analyses were conducted to explore the relationship between environmental attributes and verbal interaction at both space and cluster levels. A Significant relationship between furniture density, width to length ratio and gender of occupants and verbal interaction was identified for all users at the room level. Predictors differed when interactions of men and women were analyzed separately. At the cluster level, social density, furniture density and arrangement predicted the verbal interaction of males, females and all users, although the variance explained was substantially lower than for rooms. Findings regarding furniture density contradicted previous research. Conclusions and implications of the findings are discussed for theory, design practice and future research.