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PROXEMIC ZONES AND THE SPATIAL ORGANIZATION OF THE MICRO-ENVIRONMENT

A Thesis

Presented for the

Master of Science

Degree

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Donna Everhart Liberto

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ABSTRACT

Spatial organization of the environment has a tremendous impact on people. The organization, or structure, governs interactions between man and object and between individuals within groups, and is important in establishing and maintaining relationships (Hall, 1966). Spatial organization is related to a person's culture. Unfortunately, people usually live in environments designed by individuals whose expectations and perceptions of how to structure the environment differ from theirs. As a result, the space's design often does not meet the user's needs.

The purpose of this research was to discover some of the cultural constraints in the organization of space. A user-articulated scale model environment (1"=1') was used to investigate the affect on spatial organization of reducing an environment's size.

Findings indicate the relationships of the 4' and 7' boundaries of the personal and social proxemic zones identified by Edward T. Hall are important in spatial organization to determine preferred, acceptable and intolerable distances between areas and establish minimum width of a room. This information is crucial in designing environments that support and enhance individuals' relationships and ways of life.

TABLE OF CONTENTS

SECTION	PAGE
1.0 INTRODUCTION	1
2.0 CONCEPTUAL FRAMEWORK	4
2.1 Cultural Influences on Human Spatial Behavior	4
2.2 The Spatial Environment's Structure	7
2.3 Coding the Environment	15
2.4 The Discovery Process	16
2.5 Using Scale Models	18
3.0 PROBLEM STATEMENT	23
4.0 METHOD	24
4.1 Sample	24
4.2 Procedure	25
4.3 Data Collection	28
4.4 Data Analysis	28
5.0 RESULTS	30
5.1.0 Formal Living Room	31
5.1.1 Informal Living Room	32
5.1.2 Bedroom	34
5.1.3 Kitchen	35
5.2.0 Change Categories	37
5.3.0 Area Proxemic Zone Relationships	38
5.3.1 Proxemic Zone Interactions Experiment	41
5.3.2.0 Proxemic Zone Interactions Experiment Results	43
5.3.2.1 Informal Living Room	43
5.3.2.2 Kitchen	45
5.3.2.3 Bedroom	47
5.3.3 Hypothesis Supported	49
5.4.0 Proxemic Zones and Dimensional Changes	51
6.0 CONCLUSION	56
6.1 Specific Issues	56
6.2 Generic Issues	58
BIBLIOGRAPHY	60

APPENDICES. 64
Appendix A: List of Equipment Used in the Design Procedure. 65
Appendix B: Dimensioned Floor Plans. 67
Appendix C: Floor Plans with Perceived Areas and List of Added or Deleted Furniture Elements Per Room Per Plan. 72
Appendix D: List of Activity Changes Per Room Per Plan. 77

VITA. 80

LIST OF FIGURES

FIGURE PAGE

1. "Units of spacing" which influence a viewer's perception of the structure of the spatial environment 10
2. Perception of units 11
3. Arrangement of furniture elements perceived as a barrier 13
4. Functionally equivalent distances for the same interpersonal relationships depending upon the orientation of chairs 14
5. Comparative sizes of subject-designed home environments 27
6. Schematic representation of informal living room area change 33
7. Schematic representation of bedroom area changes 35
8. Schematic representation of kitchen area changes 36
9. The subject's Plan 3 of informal living room 39
10. The subject's Plan 3 of bedroom 39
11. The subject's Plan 3 of kitchen 40
12. Diagram of hypothesis testing procedure 42
13. Preferred relationship between informal living room areas 43
14. Acceptable relationship between informal living room areas 44
15. Intolerable relationship between informal living room areas 44
16. Preferred relationship between kitchen areas 45
17. Acceptable relationship between kitchen areas 46
18. Intolerable relationship between kitchen areas 46
19. Acceptable relationship between bedroom areas 47
20. Modified acceptable relationship between areas in the bedroom 48
21. Intolerable relationship between areas in the bedroom 48
22. Hypothesized proxemic zone relationships 49
23. Proxemic zone tangencies 51
24. Similarity of space widths in Plans 3 and 4 52
25. Widths of rooms in Plan 4 in relation to subject's 7' social-far boundary 53
26. Door-to-door distance changes in the bedroom relative to: a. room dimension changes; b. percentage of area reductions 55

1.0 INTRODUCTION

"No matter what happens in the world of human beings, it happens in a spatial setting, and the design of that setting has a deep and persisting influence on the people in that setting" (Hall, 1966, p. xi).

This thesis is about how the organization, or structure, of space affects individuals' activities and interactions. Specifically, it's about how structure changes when you reduce living environment size and what happens when space becomes too small for its intended use.

What is structure? An example of structure is found in the composition of the complex sentence: "The hissing, yellow tiger cat, without a tail, scratched the mangy-looking, three-legged dog on the nose." Descriptive phrases such as "hissing yellow tiger, without a tail", and "mangy-looking, three-legged" add interest to the sentence, but are not necessary to convey the basic message "cat scratched dog". However, reversing the nouns, cat and dog, to read "dog scratched cat", does alter the sentence's message. The word organization constitutes a part of the sentence's structure. When you change the organization, you affect the sentence's meaning

You establish spatial environment structure by the way you organize elements (sofas, tables, chairs, etc.) within the space. These elements' spatial relationships convey the environment's message, signaling the activities and

interactions that can take place in the space. Spatial organization can either facilitate or inhibit behavior and type and amount of activity. For example, chairs in a circular arrangement so people face each other send one message, while chairs side-by-side so that people sit shoulder-to-shoulder send a different message. People seated in the circular arrangement would be more likely to talk to each other than would those seated shoulder-to-shoulder.

We know that animals use space to organize their activities and behavior, both intraspecifically and interspecifically. If a species doesn't maintain its needed spatial structure, the lives of its members are threatened. For example, to insure species continuation specific distances are necessary to provide sufficient feeding and mating areas and insure safety from predators.

Spatial structure is also important to people. It communicates messages that tell people what to do in space. The structure governs interactions between man and object and between individuals within groups. Proxemic zones constitute people's micro-environment spatial structure. Individuals use these zones to maintain the appropriate amount of space between themselves and other individuals and between themselves and objects, the same way animals use space to keep a comfortable distance between themselves and other animals. The proxemic zones Hall (1966) identified form the basis for analyzing structural change that results when you reduce an environment's size. A primary concept of this research is that a person has specific physical environment spatial

requirements that create meaningful relationships with other individuals or groups. These spatial requirements relate to a person's culture. Whenever possible, individuals structure the environment to allow for these relationships.

Unfortunately, people generally live in spaces planned and built by others who either have limited knowledge of individuals' specific spatial needs, or who choose financial or aesthetic priorities at the expense of individuals' needs. As a result, spatial design directs the activities and interactions of individuals instead of allowing individuals to be in control.

If we learn how people structure their environment and what happens when structure changes, we can then design environments that fit people instead of trying to make people fit the environment.

The thesis begins by considering: how culture influences human spatial behavior; what constitutes an environment's structure; how an environment's structure acts as a code for environmental communication; and how to identify and communicate spatial needs. The thesis then reports and discusses findings of an empirical study demonstrating how reducing an environment's size affects its spatial structure.

2.0 CONCEPTUAL FRAMEWORK

2.1 Cultural Influences on Human Spatial Behavior

Culture plays an important part in shaping individuals' views and expectations of the world, including its physical suroundings (Hall, 1966; Altman and Chemers, 1980; Barash, 1985). Abbott (1952) wrote about this cultural influence in an imaginary Flatland where the inhabitants' perceptions were based on their experience living in either a one-, two- or three-dimensional world. People from diverse cultures inhabit different sensory worlds that they reflect in the varying ways they use space (Saarinen, 1976). In the built environment, the amount of privacy and how it is achieved, the functions that occur in a space, and interaction distances between individuals are all outcomes of cultural preferences.

Privacy is controlling the access other people have to an individual. It does not necessarily mean being completely separated from others, but relates to the desired degree of separateness (Altman and Chemers,1980). People control access by creating either physical or psychological boundaries. They may achieve degrees of privacy by closing the door to a space, thereby completely shutting themselves off, or by orienting furniture so individuals do not face one another.

Placing furniture in a room's center, as in the Japanese culture, or around a

room's perimeter, as in Western culture, are examples of how different cultures arrange space (Hall, 1966). Zeisel (cited in Saarinen, 1976) found that people's social needs depended upon their culture. He hypothesized that spatial design could support these needs. In a comparative study of different cultures' social needs, working-class Puerto Ricans preferred the kitchen at the home's center, while they considered the living room a "revered" space used for relaxing and religious occasions. For middle-class white families, however, the living room is where they entertain guests.

Interaction distances between individuals for the same relationships also vary between cultures. When conversing with strangers, middle-class white Americans consider it inappropriate to be so close it is possible to smell the stranger's breath. In Arab cultures, however, people stand closer to each other because the olfactory sense is an important part of their communication (Hall, 1966).

Hall (1966), as a result of observing interactions between people, identified four spatial zones people use in their face-to-face interactions with others. Each zone's size depended upon the interactions' degree of intimacy and formality. People set zone boundaries where physiological and perceptual changes occurred. They paired spatial behaviors and relationships in each zone. It is important to emphasize that Hall's zone boundaries, which apply to face-to-face interactions, are age- and culture-related. For example, due to their decreased

sensory acuity the elderly require closer distances to function properly in their spatial environments (De Long, 1974). In addition to distance variations due to age and culture, the boundaries vary when people are seated within furniture arrangements. The variations are systematic, leading De Long (1978b) to conclude that Hall's categories are valid. From analyzing personal space studies that provided distance measurements, Altman and Vinsel (cited in Altman and Chemers, 1980) also supported the validity of interaction distances in Hall's proxemic zones.

Hall theorizes these proxemic zones and accompanying activities as appropriate for interactions between middle-class, white Americans:

1. The intimate zone (0"- 18") is for activities such as love-making, comforting and protecting, found in very close personal relationships. These activities usually do not take place in public places.
2. The personal zone (18"- 4') deals with activities occurring in normal day-to-day activities between individuals who are related or well acquainted. Interactions between husband and wife typically occur in this zone.
3. Social distance (4'- 12') involves ordinary business and impersonal contacts with an important distinction being made between the types of interactions that take place between 4' and 7' (social-close) and 7' and 12' (social-far). People who work together generally interact with

each other between 4′ and 7′. More formal business contacts take place in the 7′ to 12′ zone.

4. The public zone, 12′ to 25′ or more , includes interactions with high-status individuals and activities in public or very formal settings.

An important aspect in proxemic zones' relationship to the micro-environment's structure concerns individuals' comfort. For individuals to feel comfortable interacting with others, actual behavior must match expected behavior. When there is a discrepancy between the two, pulse rate may increase, the skin may feel damp, and increased tension may result. Individuals seek to avoid this discomfort by changing distance so it is appropriate to the relationship within the setting's context[1].

To summarize, culture influences spatial behavior in two very important ways: the functions that take place and the distances individuals maintain within space.

2.2 The Spatial Environment's Structure

Structure provides a framework that imposes restrictions on the ways people

1. Context is the situation or attributes of surroundings that influence perception of an event. It applies primarily to size in this study.

assemble events or objects. Using a corollary from nature, the growth pattern of each variety of fruit is the framework that places constraints. The result of the constraints is a product with recognizable characteristics. Spatial environment structure also provides a framework, setting very specific limits on the ways people can organize space. In order for the structure to be recognized, constraints must be consistent, occuring enough times to create a pattern (Von Foerster, 1974).

In the small-scale environment this thesis considers, individuals place elements (furniture and decorative objects) in a very specific manner with respect to each other and to architectural elements such as entranceways. They combine elements to form units, which in turn they may group to form larger units. For example, two chairs and a table may form one unit, while a fireplace and a plant may form another unit. Together they may constitute a third, larger unit. What is considered a unit, or what goes together and what is separate is dependent upon individual perception. By itself, an element does not necessarily convey a spatial message to an individual. Individuals perceive the meaning from the distance between and the orientation of the structuring elements within a unit, and between units.

Delong (1976a) found six categories of distances or "units of spacing" that conveyed different meanings to people and affected the environmental structure. Figures 1a-f show the elements and arrangement he used to discover "units of

spacing." The distance categories and their meanings are:

1. "Touching" Unit (0 - 2") - People perceive elements as "touching", even if they are not physically touching, until they are approximately two inches apart. People perceive this spacing as a formal, public setting and view it as being stiff and uncomfortable (Figure 1a).
2. "Not touching" Unit (2"- 4") - People consider this spacing unit as more relaxed and comfortable. They may find it in public lounges or lobbies, offices and in the home (Figure 1b).
3. "Apart" Unit (4"- 12") - People see objects at this distance as "being apart from each other", but do not consider them to be in separate units. They still "go together". Conversation centers on more personal topics, and the atmosphere is cozy. This unit of spacing occurs in homey living rooms and pleasant lounges (Figure 1c).
4. "Fingertips" Unit (12"- 24") - People consider the chair and table as belonging to one unit, but "away from each other." The relationship between subjects seated in this arrangement now has an element of dominance, because people perceive the table as belonging more to one chair than the other. The person who "has the table" is considered dominant (Figure 1d).
5. "Beyond reach" Unit (24"- 36") - People now consider one chair as almost separate from the table and second chair. Acquaintances

comfortably use this distance to converse, but it is too far for close friends to use. The space between the two elements is wide enough to suggest use as a passageway, which would disrupt conversation (Figure 1e).

6. "Separate" Unit (36"- 48") - People perceive one chair to be in a separate unit from the other chair and the table. The distance between is clearly a passageway. Strangers seated in the two chairs would not feel compelled to talk to each other (Figure 1f).

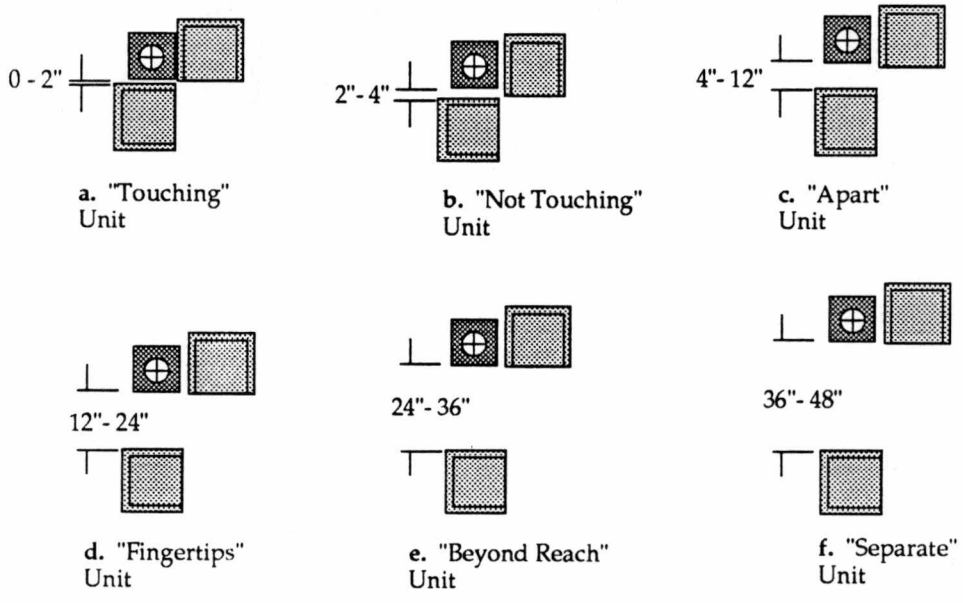


Figure 1. "Units of spacing" that influence a viewer's perception of the spatial environment structure. The arrangements of elements in a, b, c and d are each perceived as one unit; e as "almost" two units; f as two units.

In addition to the distance between elements affecting spatial structure by influencing people's perception of how space is segmented, the type of elements used can also have an effect on the perception of segmentation. In Delong's arrangement, the table can act as a connector. People then perceive three separate pieces as one unit until one chair is more than 36" from the table (Figure 2a). If a large plant replaces the table, it creates a visual barrier and people now see two separate units (Figure 2b). This arrangement would inhibit conversation between friends but would be appropriate for two people who did not wish to interact (De Long, 1978a).



a. One Unit b. Two Units

Figure 2. Perception of units. Number of structural units influenced by choice of furniture elements.

In addition to dividing a space into perceived units, element arrangement may appear to enclose and define a space or to function as a barrier. When people perceive an arrangement as a barrier, it controls access to a space. In a home where the front door opens directly into a small living room (12′ x 16′), the inhabitant placed a small table (15″ x 15″) holding decorative objects at a distance of 24″ from the arm of the sofa. Because the 24″ spacing, one of the six "unit of spacing" categories that are significant to a person's perception of structure, corresponds to the width of a personal passageway, a stranger must wait for an invitation into the room's more private area (De Long, personal communication, 1989). In addition to limiting access to the room's private area, the arrangement's location created the effect of a separate entry space. The arrangement, instead of the walls, defined the entry's boundary.

In this example, the room's size and the door's location influenced spatial structure. Because the distance from the entrance to the room's private area was less than the public distance of 12′ (Hall, 1966), the inhabitant used a barrier, created by furniture, decorative objects and spacing, as a substitute for the appropriate interaction distance with strangers (Figure 3).

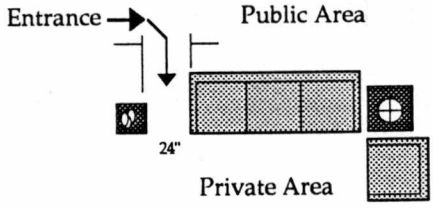


Figure 3. Arrangement of furniture elements perceived as a barrier. Access to private part of informal living room is controlled.

While examining body orientation as a contextual feature related to spacing, De Long (1978b) found that changes in body orientation resulted in changes in distance between seated subjects attempting to achieve the same interpersonal relationship. For example, the subjects in the study felt a face-to-face orientation at a distance of 4'10", a side-by-side orientation at a distance of 3'8", and a right-angle orientation at a distance of 4'9" embodied the same relationship (Figure 4). The subjects considered the three distances as functionally equivalent and substitutable for each other depending upon chair orientation. In earlier studies on orientation and distance relationships, researchers did not consider that people might perceive visually different arrangements as functionally equivalent (Sommer, 1959, 1962, and 1969; Mehrabian and Diamond, 1971). They

concluded there was one orientation and distance relationship appropriate for each situation.

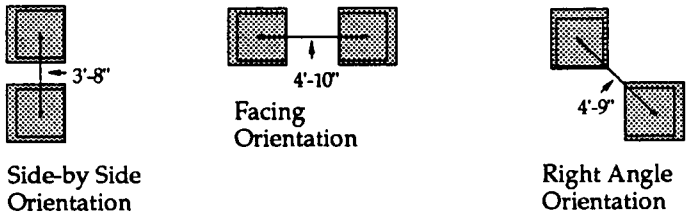


Figure 4. Functionally equivalent distances for the same interpersonal relationships depending upon chair orientation.

How an individual perceives spatial structure is important because of the association between context, behavior and relationship embodied in the arrangement. Context signals appropriate behavior that results in a perceived relationship. Contextual change results in altered behavior, thereby revising the relationship (Delong, 1978b).

Since perception of spatial structure is important in establishing and maintaining relationships, we must know how structure conveys environmental information.

2.3 Coding the Environment

All communication between individuals takes place through using codes. The way we dress, what we eat, and the kinds of cars we drive all convey information about us. For example, when we see what people are wearing we can draw conclusions about their age, economic status or occupation, among other things. In the spatial environment, the structure is part of the code that conveys information to others.

Coding simplifies a complex world by creating categories. Events in the same category can be substituted for each other without changing the message. This means people don't have to remember as many different events and communication is faster because of redundancy (De Long, 1974, 1976a, 1980).

In the spatial environment, the ability to substitute one arrangement for another, when various arrangements are considered functionally equivalent, is a form of categorizing. Arrangements that have the same meaning even when they are visually different belong to the same category and can serve as substitutes for each other depending upon the context (De Long, 1978b).

Codes involve shared expectations by members of a cultural group. People of the same cultural group have agreed how to segment and order the environment and have similar expectations. Coding enables people to match behaviors and expectations (De Long, 1982). However, when spatial

environment coding is different from an individual's expectation, the individual becomes uncertain about the type of behavior appropriate for the space. Confusion can result when viewing a spatial environment encoded by a member of a different group with a separate point of view about structuring the environment.

Compared to the public, designers belong to a different group. Through their education and training, designers develop their own sets of criteria for environmental design. Design (encoding) decisions involve value judgements and designers' values are different from the public's (Hershberger, cited in De Long, 1976a). Because of their visual orientation, designers' spatial priority will likely be aesthetics, or how it looks. Also, designers often try to create something new for newness' sake. Using novelty as a priority for design decisions may disorient the public who seek familiarity in their environment (De Long, 1976a).

To make design decisions that match user needs and expectations, it is necessary to learn the meaning people associate with environmental structuring.

2.4 The Discovery Process

Identifying the codes people use to communicate about their environment is difficult. Most behavior, including spatial behavior, occurs out-of-awareness and

cannot be verbalized (Hall, 1966). Birdwhistell (1970) estimated that approximately 65% of our communication takes place non-verbally, through facial expressions, body movements, vocal cues, physical appearance and physical environment design. However, we can learn the meaning spatial arrangement has for an individual the same way we learn a new language.

Any language, including spatial language, is a system of component contrasts and their patterns of organization. Mastering a language requires learning the components and determining how to organize them. Organizing patterns are known only by those who speak the language, or who are part of the communication system. Pike (1967) refers to these individuals as "insiders". Outsiders can begin to learn organizing patterns through a procedure called "differential meaning." People are able to distinguish when components are the same or different (Hall, 1959). By asking insiders to contrast pairs of words that may initially look similar, it is possible for outsiders to identify what signals a difference in meaning[2] (Hall, 1959).

In the spatial environment, which is also a system of communication with components, contrasts and patterns of organization, only those who belong to the same culture are insiders and know the correct code interpretation for their culture (De Long, 1976a). Outsiders attribute their own interpretations, which

2. In the composition of sit and sat, the letters "i" and "a" signal a difference in meaning of the two words.

are likely to be wrong (Von Foerster, 1974). Designers, because of their education and interest, are outsiders. Biases resulting from their specialized training and interest lead them to make assumptions about spatial meaning that are likely to be incorrect for other groups.

To learn the correct code meaning for a particular group, the designer must depend upon the group members to articulate when spatial arrangements have "differential meaning." This is done by comparing two arrangements at a time and grouping into categories those arrangements that have similar meanings. This isolates arrangements perceived as different that would change environmental structure.

2.5 Using Scale Models

For people to communicate about spatial structure needs requires a method that allows them to accurately perceive spatial relationships. Two important considerations for choosing a method are: the accuracy of space perception using two- versus three-dimensional representation and the value of scale- versus full-sized models.

Designers, because of their visual orientation and education, typically use two-dimensional modes to represent the environment. While those trained in the design field can understand two-dimensional representations, the public

does not accurately perceive the real three-dimensional environment from using this technique (Hershberger and Cass, 1985).

In spatial-behavioral research, studies have shown that representing the spatial environment with reduced-scale furniture pieces and human figures provides a satisfactory way for individuals to non-verbally communicate spatial needs[3]. By manipulating scaled elements, subjects are able to articulate preferences for structuring the environment. The sight of the articulated space triggers memories of similar settings, accompanying relationships and appropriate behaviors. Based on past experience, individuals know what kinds of relationships to create (De Long 1976a).

There are some important factors to consider to obtain valid results when working with scale models . Using the scaled environment, the subject must be aware of subjective feelings about spatial relationships. If the individual "thinks", tries to be "accurate" or "rationalize" about a relationship, the result is less accurate (De Long, 1977). To assist in uncovering the "feel" of a spatial relationship, subjects use a scale-model figure to "perform" the activity(ies) of a space.

A literature search revealed support for both the three-dimensional and scale-model techniques.

Lawrence (1980) investigated representing the spatial environment. Subjects

3. The scale ratios that have produced satisfactory results are 1: 10, 1:12 and 1:14.

designing a home used a questionnaire, consultation with an architect, and visual evaluation of a full-scaled model constructed of modular plastic building blocks. Lawrence's opinion was that this three-dimensional simulation of the house enabled participants to better visualize its design than did the use of two-dimensional sketches.

Hershberger and Cass (1985) evaluated two-dimensional environmental representations. They concluded that subjects did not accurately perceive attributes of three-dimensional space when using two-dimensional modes. Media they used were film, slides and video tapes.

Support for the use of scale models comes from numerous studies. De Long (1976b) replicated Sommer's study of "limits of comfortable conversation" at a scale of 1:12 with results similar to Sommer's full-size study. In a second study (Delong,1977), subjects duplicated spatial relationships within furniture arrangements at full- and scale-model conditions. The results showed perception of spatial relationships between conditions did not deviate more than repeated trials in full-size.

Dirisamer et al. (1978), conducting a study of user participation in planning individual units for a subsidized housing project, used a scale model (1:20) clients could reconfigure to need their needs. Subjects made choices regarding unit location and size, room divisions, and the number, type and location of openings. Project findings indicated a high level of user interest and

involvement.

Edwards (1973) and Little (1965) both used doll placement to study interactions between individuals. Little studied the affect of degree of acquaintance and setting on interaction distance. He measured the congruity of a quasi-projective technique (silhouettes at 1:12 ratio) and "live" interactions. The two techniques were significantly correlated ($r = .77$ at the .005 level). Edwards, investigating cross-cultural social orientation, also concluded that using scale-model dolls (1:10 ratio) was a worthwhile technique.

After replicating Kendon's "F-formation system"[4] study with similar results, Smith (1980a) suggested that using scale-model figure placement (1:14 ratio) is valid and reliable enough to use in future interactional space studies. As a consequence, Smith (1980b) used doll placement in scale-model rooms (1:14) to examine the influence of area size, presence or absence of furniture, and the effect of the dominant person on a conversational group's structure.

However, in reviewing methodology used in personal space interaction studies, Hayduk (1983) felt that evidence weighed against using projective techniques. Correlations were low (.39) between projective and real-life measures for miniature figures, silhouettes, dolls and paper-and-pencil drawing. However, Hayduk combined three-dimensional and two-dimensional projective

4. Kendon's "F-formation system" (originally called facing- or F-formations), consists of concentric spatial zones used to ensure the continuous interaction for which the group came together.

techniques. Separating the two techniques might yield entirely different results.

Another consideration in using scale- or full-sized models is their impact on efficiency in research methodology. De Long (1981, 1983, 1985) has shown that using scale models provides significant time saving in research.

Experimenting with the affect of scaled environments on individuals, De Long concluded that using reduced scale affects the central nervous system resulting in the illusion of time compression. For example, at a scale of 1"=1', people experience the passage of one hour of time in five minutes. This means that research takes much less time with reduced scale environments. Additionally, he found it easier for subjects to consider alternate arrangements because their feedback to the researcher is immediate (De Long, 1976b).

Using scale models enables the subject to articulate the desired environmental structure and plan space utilization that permits preferred activity choices and meaningful relationships.

3.0 PROBLEM STATEMENT

Spatial needs, which include types of activities as well as interaction distances appropriate for the activities, are culturally determined. To fulfill these needs, people require a micro-environment structured very specifically. People know how to structure their own environments to meet their needs and communicate to others the types of behaviors they deem appropriate for the spaces.

Unfortunately, people are usually forced to live in spaces designed according to criteria set by "other" individuals unfamiliar with the space users' needs. The shapes and sizes of "other"-designed spaces set limits on the users' organization of furniture elements, thereby affecting users' spatial activities and interactions.

The problem, therefore, is to learn how people structure space, what factors affect that structure, and how it is affected. To investigate this problem, a study examined the affect of size reduction on the spatial organization of a user-articulated living environment.

4.0 METHOD

4.1 Sample

The subject chosen is a white, upper middle-class, American woman. The subject is in her early 50's, married, has four adult daughters and numerous grandchildren. She works full time as an office manager in an academic environment. A life-long resident of East Tennessee, she is very actively socially and has traveled extensively. Specific interests are participating in church-related functions, gardening and motorcycle-riding activities through the Gold Wing Club. She maintains a close relationship with her family, but she and her spouse, who is a scientist, are now the only inhabitants of their home. They entertain family, friends and business guests frequently.

Since the research's purpose was to investigate how reducing size affects an environment's spatial structure, it was necessary to have the same subject plan all of the environments. Additionally, in order to eliminate preconceived ideas about "correct" design according to criteria set by those with education and training in design, the subject had to have no training in design. The subject's spatial needs governed all plans.

4.2 Procedure

The subject used a scale model (1"=1') to plan the environments. This allowed her to convey her spatial needs by placing scaled furniture pieces in configurations suitable for the activities she desired. Appendix A contains a list of equipment used in the study.

An initial meeting with the subject determined the furniture pieces and decorative objects she desired to furnish her home. The subject selected all but two of the furniture pieces from an inventory of generic types and sizes. It was necessary to construct an antique washstand for the formal living room and a bookcase headboard for the master bedroom. The headboard had a high shelf to hold a 24" TV.

The subject received instructions to plan an "ideal home environment" by initially placing only the furniture pieces and decorative objects anywhere she wished on a blank styrofoam base, 4' x 4'. The maximum size of the initial environment was limited to 2,300 square feet represented by the size of the base. As she proceeded planning the home, the subject was told she could add a few wall sections, if necessary, to help with placement of furniture. It was important not to constrain location of the furniture elements by placing the wall sections first and completely enclosing the space.

While creating the plan, the subject moved scale-model figures through the

spaces to "perform the activities" as a guide to correctly placing furniture elements.

During the process, the subject received assistance in recalling the activities and relationships that would take place within the spaces. For example, she responded to questions such as "Where do you sit when you talk to a friend?", "Where would your husband sit when just the two of you were in the room?", and "What kind of entertaining do you do?" She sometimes changed her original placement of elements. At times, she tried several locations for one piece. In most cases, the subject was very certain how to organize the spaces. When she did seem to have difficulty placing furniture, the researcher would move a piece or pieces and ask if the new arrangement "seemed different". If the change suggested did not meet her approval, the subject instructed the researcher to return the piece to its previous position. After positioning all furniture elements, she added wall, door and window sections to complete the spatial enclosure.

The subject planned four different-sized living environments (Shown in Appendix B). After completing her "ideal" plan of 1,513 square feet (Plan 1), the subject received instructions to reduce its size by approximately 200 square feet. Plan 2 contained 1,302 square feet. Plan 3, which had to be approximately 250 square feet less than Plan 2, contained 1,057 square feet. Plan 4, which contained 622 square feet, was restricted to a maximum of 625 square feet. The researcher chose the amount of decrease for each plan to force a change in environmental

structure. Figure 5 shows the comparative size of each plan, represented by a rectangle. After completing each plan, the subject was asked to identify each room's separate areas and list the activities that would take place in each room (Shown in Appendix C).

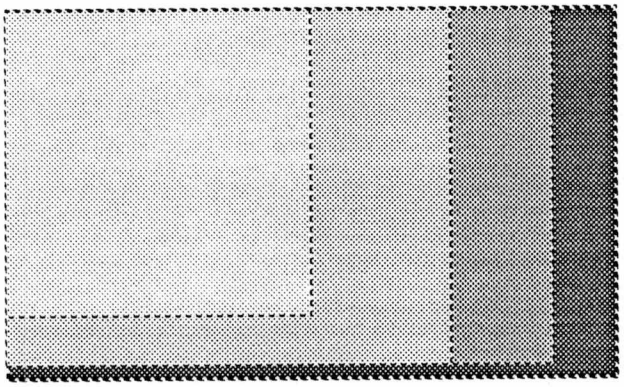


Figure 5. Comparative sizes of subject-designed home environments. Shapes are not representative.

4.3 Data Collection

Data collection involved plotting the position of each piece of furniture, decorative object, wall, door and window sections, and the perceived areas on 1/4" graph paper. This information then went into the Apple Macintosh II computer using a McDraw II software application.

4.4 Data Analysis

Analysis was done on the computer by overlaying each plan's spaces with templates of proxemic zones, adding dimensions, distances between furniture elements, location of circulation paths, and overlaying each plan's furniture arrangements as well as the rooms' shapes to illuminate similarities and differences in configurations and dimensions. In analyzing room dimensions, the length, or long dimension, became the "X" dimension, and the width, or short dimension, became the "Y" dimension.

Factors considered in analyzing room and area spatial structure were:

1. The "X": "Y" dimension ratio.
2. The percentage reduction numerous dimensional categories of Plan 1 to Plans 2-4, Plan 2 to Plan 3 and Plan 3 to Plan 4.
3. The relationship of room entrances and the 4', 7', and 12' proxemic zone boundies to the subject's favorite seat and to the rooms seating areas.
4. The relationship of multiple entrances within the rooms.
5. The intersections of proxemic zones of individuals in seating arrangements.
6. The distance between areas.
7. The distance between furniture elements.
8. The location of circulation paths.

5.0 RESULTS

Living environment spatial structure depends upon the interaction of proxemic zones, primarily the personal and social-close zones. The size reductions in Plans 2 and 3 did not disrupt acceptable relationships between areas nor result in activitity changes. However, the size reduction in Plan 4 created numerous apparently intolerable relationships between the interactional area proxemic zone boundaries, resulting in significant structural alterations. These force changing activities considered appropriate and their accompanying interactions to such an extent the subject commented she "might as well be living in a travel trailer."

Other specific findings from comparative analysis of the four plans are:

1. When the interaction of two area's proxemic zones is intolerable, the subject eliminated one of the areas. As a result, the intended use of the space changed. The attendant activites are eliminated or consolidated with the retained area.
2. The size changes in Plans 2 and 3 result in reorientation of furniture elements and minor area changes.
3. Dimensional changes in Plans 3 and 4 indicate a similarity of room width (11') that doesn't relate to the room type.
4. The door-to-door distance in the bedroom is consistent across all

plans. The distance is always at least 12'.

With the exception of the formal living room's elimination with the first size reduction, the only other change in the number of rooms was the dressing room's elimination in Plan 4. Reducing the number of areas within a room occurred much more frequently than did reducing the number of rooms. The floor plans in Appendix C show the reduction in number of rooms and areas.

This finding is the basis for analyzing changes in spatial structure. Changes are compared room-by-room rather than plan-by-plan.

For analysis, each room's areas will be referred to by the area's primary activity.

Appendix C lists detailed information about furniture element changes that accompanied plan changes. Activity changes per room per plan are in Appendix D.

5.1.0 Formal Living Room

The formal living room in Plan 1 contains a conversation area, fireplace area, display area (the antique washstand) and relaxing area (the floor cushions). With the first reduction in size, the subject eliminated the formal living room. She made no effort to rearrange the furniture elements to reduce the room's size. Instead, she chose to relocate some of the furniture elements to the informal

living room. This solution is interesting and the reason for it will be suggested later in the discussion.

5.1.1 Informal Living Room

The informal living room in Plan 1 consists of a conversation area, TV area and dining area (Figure 6a). In Plan 2 (Figure 6b), the number of areas is the same. However, the subject added to the conversation area the fireplace, bookshelves and antique washstand from the formal living room of Plan 1. The room now becomes an appropriate space for entertaining business guests. Relationships of both a formal and informal nature take place in the same room. A second change revises the conversation area's orientation. Its seating arrangement remains the same, however, and there is no change in the desired interaction patterns of those seated within the area.

The informal living room areas and their structure in Plan 3 are the same as in Plan 2, therefore, no comparison is necessary.

From Plan 3 to Plan 4, significant changes occur on two levels in the informal living room's structure. At the room level, the subject eliminated the dining area and combined the TV and conversation areas. Thus, she now perceives the entire room as one area (Figure 6c). Accompanying this change in her perception is elimination of all activities related to entertaining business guests, and some

activities related to entertaining family and friends: she specifically mentioned serving meals to business guests, acquaintances and friends, and playing board games with grandchildren. At the unit level, she changed some furniture elements, replacing the two chairs with a sofa. The seating arrangement now consists of two sofas instead of a sofa and two chairs, which alters the interaction pattern of those seated in the area. The new structure makes conversation more difficult between everyone except those seated in the inside corners of the sofas. In addition, the subject commented that people would not have a choice of seat type. In previous plans, an individual could choose to sit either alone in a chair or beside another person on the sofa.

With the last size reduction in living space, the subject severely curtailed activities in the informal living room. As a result, the remaining interactions are more appropriate to relationships between close family and friends, and specifically to husband and wife.

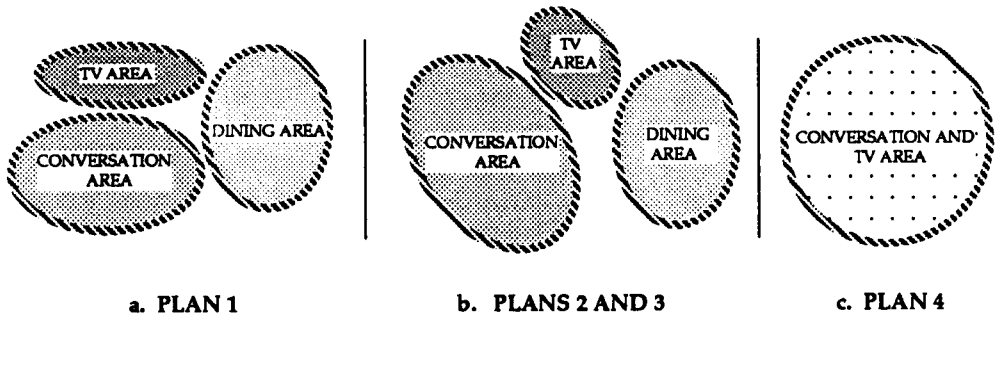


Figure 6. Schematic representation of informal living room area changes.

5.1.2 Bedroom

The bedroom is a very important space to the subject. Even though the subject and her husband are the home's only inhabitants, she considers the bedroom a very private place used for many activities in addition to sleeping. The subject refers to it as a "hide-away."

Most important, in Plans 1-3, the bedroom includes a sitting area in addition to sleeping and relaxing areas (Figure 7a). Reading, eating, talking and watching TV take place in the sitting area. According to the subject, the sitting area is what makes the room special.

The number of areas did not change from Plan 1 to Plan 3 (Figure 7b). The only changes in the bedroom at the area level in Plans 1-3 were the orientation of the bed in Plan 2, and replacing a king-size bed with a queen-size and removal of the footstools in Plan 3. The subject moved the head of the bed to face the bathroom entrance instead of the room entrance. This new position did not affect spatial activities. Again with the size reduction from Plan 3 to Plan 4, significant changes occur. The subject eliminated the sitting area, replacing it with a clothing storage unit. Eating becomes limited to snacking while in bed instead of eating full meals in the sitting area. Watching TV, reading and talking can still take place. However, the subject perceives the room's special quality is lost. As

in the informal living room, she now perceives the entire room as one area (Figure 7c).

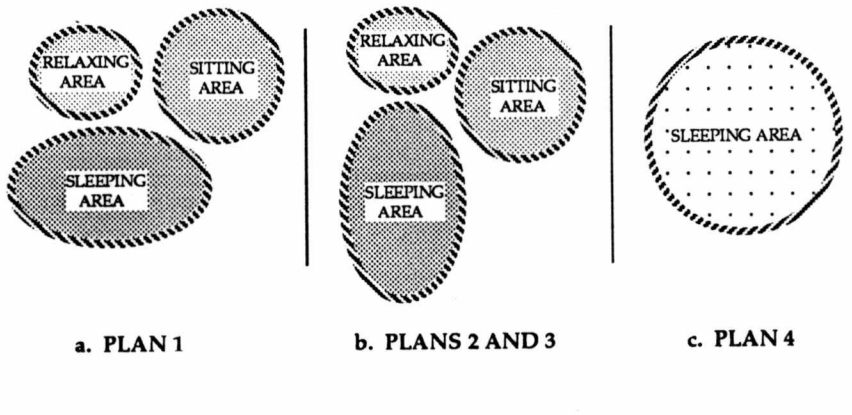


Figure 7. Schematic representation of bedroom area changes.

5.1.3 Kitchen

The kitchen initially consisted of three areas: food preparation, "formal" dining and display areas (Figure 8a). Kitchen activities in Plan 1 included entertaining family, friends and business guests by serving dinner to them. The number of guests the subject could serve at the table ranged from three to ten. She would serve any "overflow" in the informal living room. With the decrease in size from Plan 1 to Plan 2, the hutch and the side chairs in the display area became

part of the dining area. She now perceived the space as containing two areas instead of three (Figure 8b). Spatial activities, however, remain the same. Neither the number of areas nor the activities change from Plan 2 to Plan 3.

Consistent major changes occur with the size reduction from Plan 3 to Plan 4. The subject omits the "formal" dining area and once more perceives the entire space as one area (Figure 8c). Eating now takes place at a counter with stools . The room is no longer appropriate to entertain business guests. Limited space makes serving meals to more than two adults difficult. The subject indicated she and her husband would eat most meals from "TV type" tables in the informal living room instead of the kitchen.

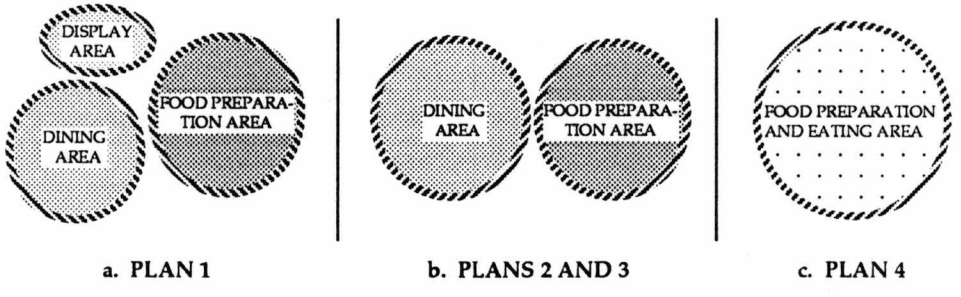


Figure 8. Schematic representation of kitchen area changes.

5.2.0 Change Categories

The subject's reduction in the number of areas and relocation, addition or elimination of furniture elements within areas indicates that reducing the size of an environment produces two change categories in spatial organization. One category consists of visual variations that have very minor impact on desired spatial activities or relationships. Variations of this type, which occur only in Plans 1-3, are functionally equivalent and serve as substitutes for each other. For example, the interaction pattern of individuals using the informal living room's seating arrangement in Plan 2 is the same as those seated in the arrangement in the room's Plan 1.

Other contextual changes, however, affect space utilization through the elimination of one of its interactional areas. As a result, activities and relationships that normally took place there are also eliminated or altered. Changes of this kind occured primarily with the size reduction from Plan 3 to Plan 4 and are of major importance in this study.

5.3.0 Area Proxemic Zone Relationships

Analysis of the major change that occurs between Plan 3 and 4, with the subject's elimination of one area in each room, indicates there is a very important distance relationship between the eliminated area and the room's remaining area. The relationship is shown with an overlay of Hall's proxemic zone boundaries on each Plan 3 room.

The informal living room's two interactional areas are 18'6" apart, measured from the subject's seat choice in the conversation area to the dining areas's focal point, which is the table's center.(Figure 9a). At this distance, each area's 7' boundaries are well separated. Overlaying the dining area on the informal living room of Plan 4 shows the distance between the two areas would be 5'6" (Figure 9b). The two 4' personal zone boundaries now overlap by 2 1/2'.

In the Plan 3 bedroom, the distance from the bed's center to the subject's sitting area seat is 10'0" (Figure 10a.). At this distance, the 7' and 4' boundaries overlap slightly. Super-imposing the eliminated bedroom sitting area on Plan 4 shows that the space is too small for the sitting area (Figure 10b). The distance between areas if this is done is 7', with the two 4' boundaries overlapping.

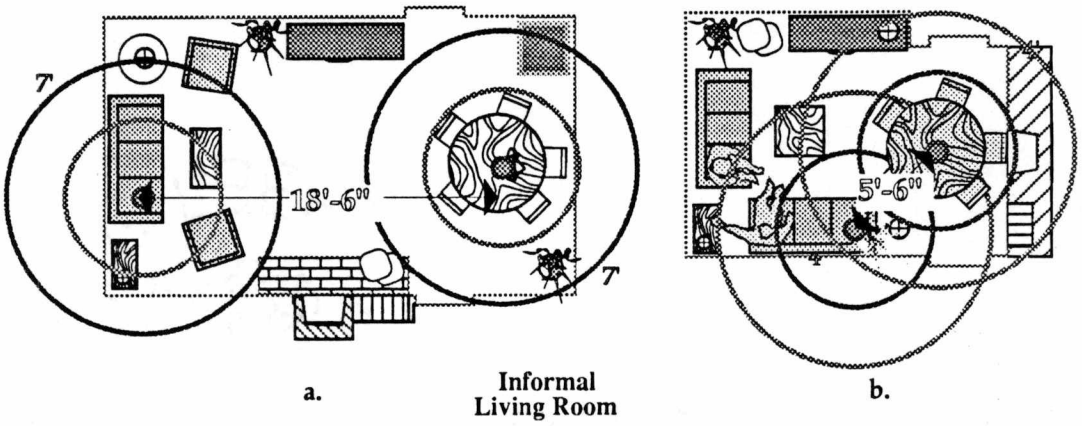


Figure 9. The subject's Plan 3 of informal living room. a. Overlays show each area's proxemic social-close zone boundaries (outer circles) and proxemic personal zone boundaries (inner circles), plus distance between area centers. b: The subject's Plan 4, with eliminated dining area superimposed. Overlays are as in Figure 9a.

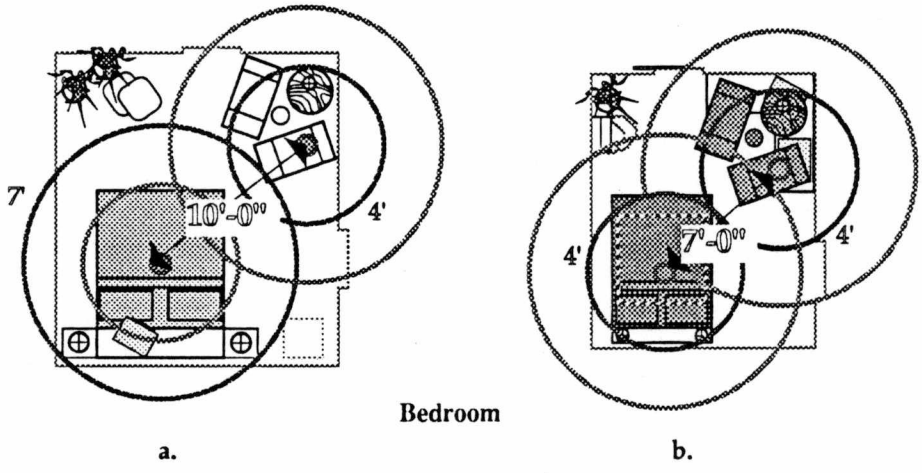


Figure 10. The subject's Plan 3 of bedroom. a. Overlays are as in Figure 9a. b. The subject's Plan 4, with eliminated sitting area superimposed. Overlays are as in figure 9a.

In the Plan 3 kitchen, where the two areas are 10'3" apart, the 7' and 4' boundaries overlap slightly (Figure 11a). The distance between the two areas with the table superimposed on Plan 4 is 6'3" (Figure 11b). Again, the two 4' boundaries greatly overlap.

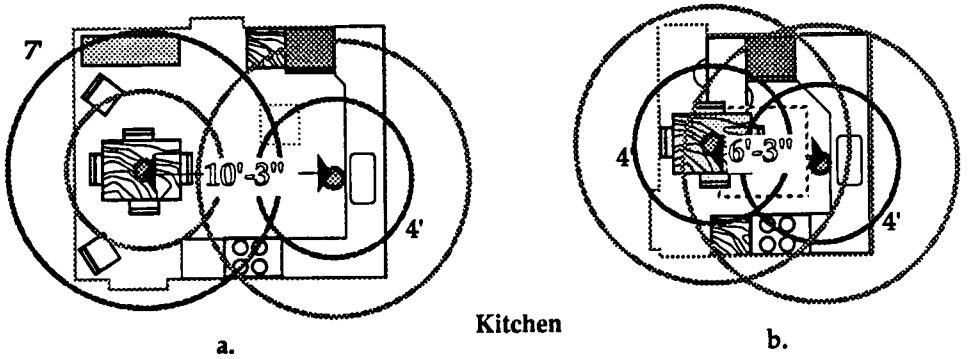


Figure 11. The subject's Plan 3 of kitchen. a. Overlays are as in Figure 9a. b. The subject's Plan 4, with Plan 3 dining area superimposed. Overlays are as in Figure 9a.

5.3.1 Proxemic Zone Interactions Experiment

At this point, it was hypothesized that areas disappear as a function of the interaction of the proxemic zones. Specifically, in the preferred relationship between two interactional areas of a room, the 7' boundaries should not touch. When the 7' and 4' boundaries are tangent or slightly overlap, the relationship is acceptable to the subject. However, when the overlap increases, the relationship becomes intolerable and the subject eliminates one of the two areas.

To test this hypothesis, an experiment was conducted in which the subject indicated how she felt as the distance between each room's interactional areas changed.

Methodological considerations included:

1. Placing only the furniture elements from a single room's interactional area on the 4' x 4' base at any one time. In order not to constrain the subject by her completed floor plans shapes and sizes, room walls, doors and windows were specifically omitted.
2. Using only the subject's Plan 3 area spatial designs.
3. Having the researcher, rather than the subject, manipulate the scale models.
4. Leaving one area stationary while moving the entire second area either

towards or away from the stationary area (See Figure 12 for an example).

5. Instructing the subject to comment whenever she "felt a difference" in spatial relationships between areas as the distances changed between them.
6. Moving the variable area slowly and continuously, stopping when the subject responded or requested.

At each stopping point, distances between area's were measured. The base had no markings to help the subject gauge distances. In addition, the subject's description of what she felt at each stopping point was recorded.

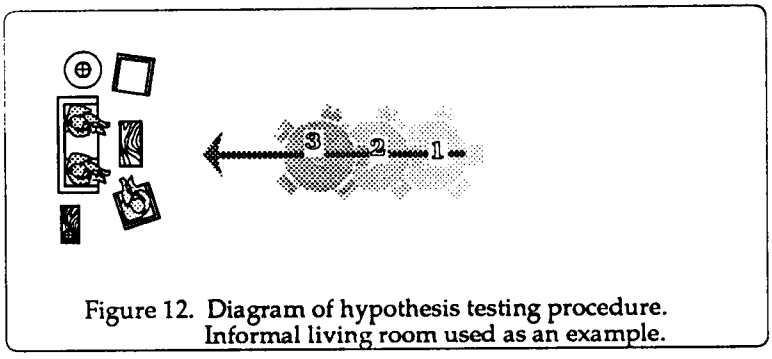


Figure 12. Diagram of hypothesis testing procedure. Informal living room used as an example.

5.3.2.0 Proxemic Zone Interactions Experiment Results

5.3.2.1 Informal Living Room

Analysis of the informal living room data shows that when the areas' 7' boundaries slightly overlap (Figure 13), the subject said the relationship "feels just right." As the 7' boundaries overlapped approximately 2' (Figure 14), she perceived the "dining area now in with the rest." However, she wouldn't make changes, being willing to accept the relationship with reservations. When the 7' boundary was tangent with the 4' boundary (Figure 15), it was "too close." She would eliminate the separate dining area, but incorporate a version of its activity into the remaining single area by using fold-up TV tables.

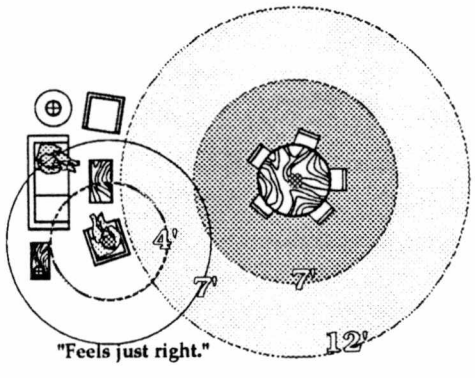


Figure 13. Preferred relationship between informal living room areas. Subject desired slight overlap of the 7' boundaries.

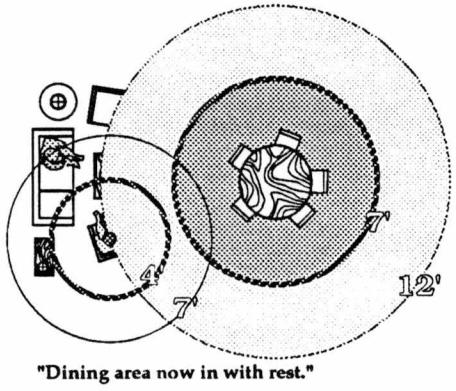


Figure 14. Acceptable relationship between informal living room areas. Subject indicated 2' overlap of the 7' and 4' boundaries makes her feel areas are joining.

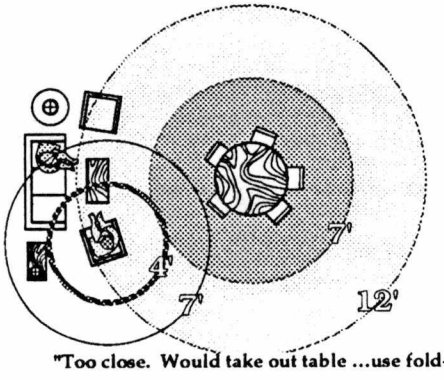


Figure 15. Intolerable relationship between informal living room areas. Subject indicated when the 7' boundary and the 4' boundary touch, the areas are too close.

5.3.2.2 Kitchen

In the kitchen, the "best distance according to the subject was when the 7' boundaries overlapped approximately 1 1/2' (Figure 16). When the 7' boundary and the 4' boundary touch (Figure 17), the subject found the relationship to be "OK, but not the best distance." When the overlap is approximately 2' (Figure 18), the subject "would take out the table and put in a bar", and now consider the kitchen one area.

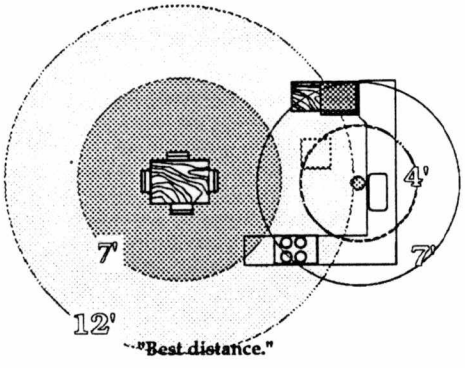
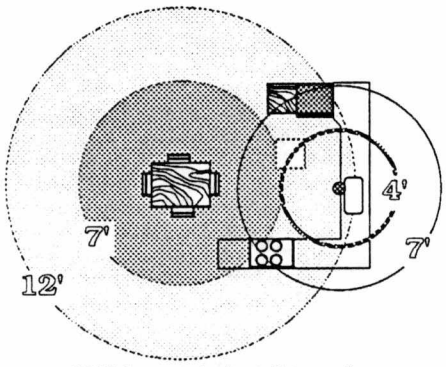
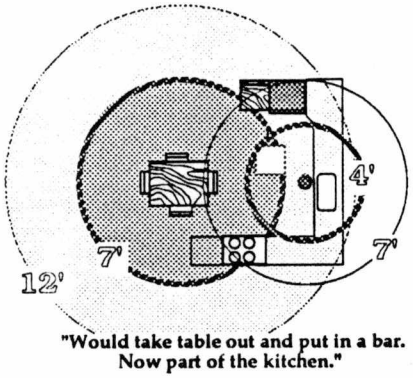


Figure 16. Preferred relationship between kitchen areas. Subject again desired slight overlap of the 7' boundaries.



"OK, but not the best distance."

Figure 17. Acceptable relationship between kitchen areas. Subject indicated touching of 7' and 4' boundaries is "OK, but not the best distance."



"Would take table out and put in a bar.
Now part of the kitchen."

Figure 18. Intolerable relationship between kitchen areas. Subject indicated 2' overlap of the 7'and 4' boundaries is unacceptable.

5.3.2.3 Bedroom

When the 7′ boundaries overlapped approximately 1′ (Figure 19), the subject felt the space was "closing in." When the 7′ and 4′ boundaries were tangent (Figure 20), the subject said she would need a smaller bed. With an overlap of approximately 1 1/2′, subject would remove the sitting area's footstools. When the two boundaries overlapped by 4′ (Figure 21), she would remove the chairs and now consider the room as one area. She commented that it becomes "just a bedroom."

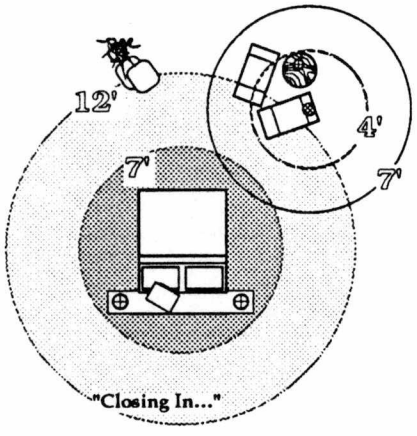


Figure 19. Acceptable relationship between bedroom areas. Subject indicated 1' overlap of the 7' boundaries was "closing in".

This is the only room in which the subject was willing to alter area furniture elements to preserve area identity as the distance between areas narrowed from the acceptable to intolerable points. She did alter furniture in the kitchen dining area, but only after eliminating that area.

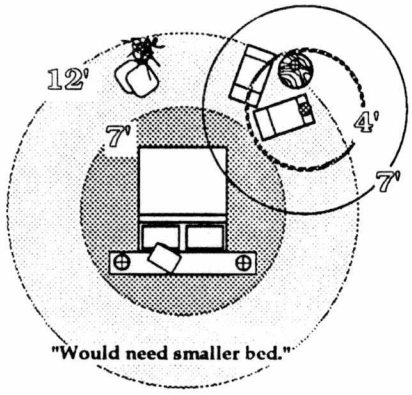


Figure 20. Modified acceptable relationship between bedroom areas. Subject indicated tangency of the 7' and 4' boundaries would necessitate furniture change.

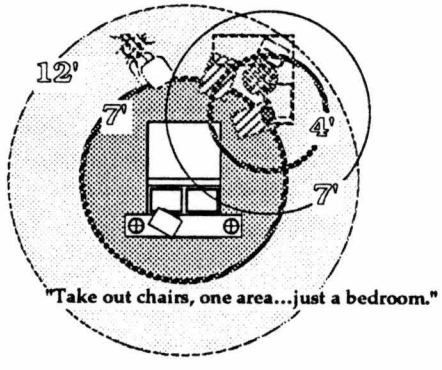


Figure 21. Intolerable relationship between bedroom areas. Subject indicated 4' overlap of the 7' and 4' boundaries is unacceptable.

5.3.3 Hypothesis Supported

Analysis of the informal living room, bedroom and kitchen spatial relationship diagrams supports the hypothesis that areas are eliminated as a result of proxemic zones' interactions. The relationships between the areas' 7' boundaries and between one area's 7' boundary and another's 4' boundary are very important. At a distance of 14' between areas, when the two 7' boundaries are touching or close to each other, the subject indicated she was comfortable. At 11' between the areas, she could accept the relationship. But when the distance is less than 11', she would have to eliminate one of the areas. Figure 22 graphically represents these relationsips, which are the same for all three rooms.

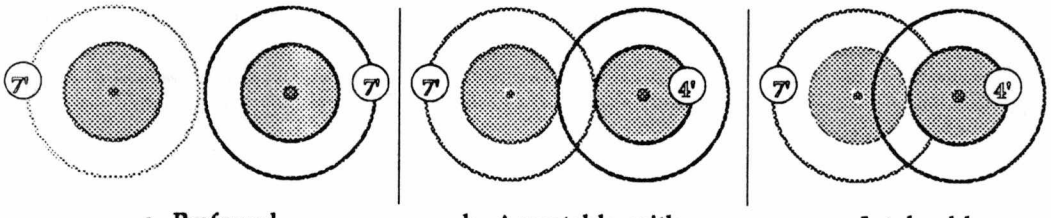


Figure 22. Hypothesized proxemic zone relationships.

Earlier discussion noted the subject eliminated the formal living room with the first decrease in square footage. Instead of trying to rearrange the room, she relocated some of its furniture elements to the informal living room. Since we know from the above proxemic zone analysis that violating the necessary spatial relationship between two areas results in elimination of one of the areas, it may be that a reduction in the formal living room's size would produce the same result. In a room used for formal activities of a less personal nature (entertaining business guests), the social-far (7'-12') and public (12' and over) proxemic zones would be very important. Reducing the room's size would preclude these distances; therefore, the subject eliminated the room.

A diagram of the acceptable tangency relationship between the 4' and the 7' zones indicates that all three Plan 4 rooms are too small for more than one area. Plan 3 rooms, however, are all large enough for two areas, allowing the subject to use the rooms for their intended purposes (Figure 23). As additional support for the hypothesis, in all three rooms, the subject chose the same points at which she felt changes occured in the proxemic zone relationships. It is important to note that the change from an acceptable area relationship to an intolerable one involves a matter of inches. Small amounts of change can make a large difference in the underlying structure.

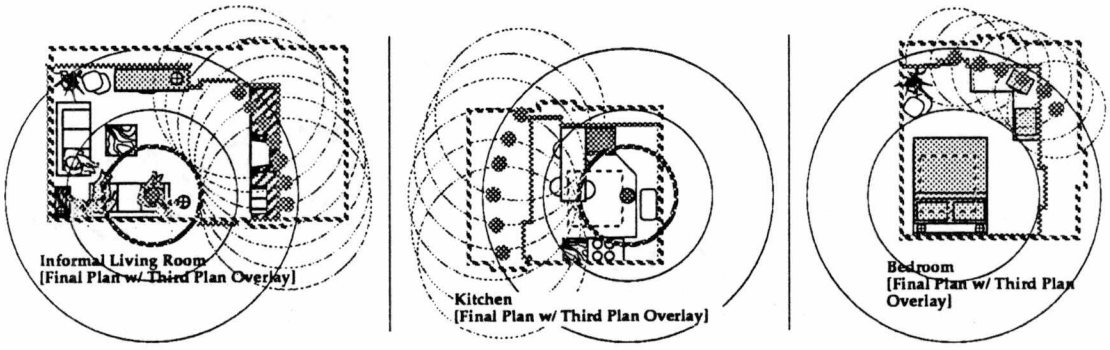


Figure 23. Proxemic zone tangencies. Acceptable proxemic zone relationship between areas indicates that Plan 4 rooms are too small for the intended use of the spaces. The Plan 3 room sizes will accomodate the acceptable proxemic relationship.

5.4.0 Proxemic Zones and Dimensional Changes

With the size reductions to Plan 3 and Plan 4, the changes that occur in the "Y", or short dimension, of each room indicate a similarity of width for all three rooms. An overlay of the Plan 3 room outlines with the "Y" dimensions parallel to each other (Figure 24a) shows little variation in the room widths, which range from 12'6" (kitchen) to 14'6" (informal living room) with an average 13'8" for the three rooms. An overlay of the Plan 4 room outlines also shows a similarity in the widths (Figure 24b), which range from 11'0" (kitchen) to 12'6" (informal living room) with an average of 11'8". This information suggests that the type of

room does not affect dimensional changes in room width when room size diminishes, since variation in room widths is only 14% for Plan 3 and 12% for Plan 4.

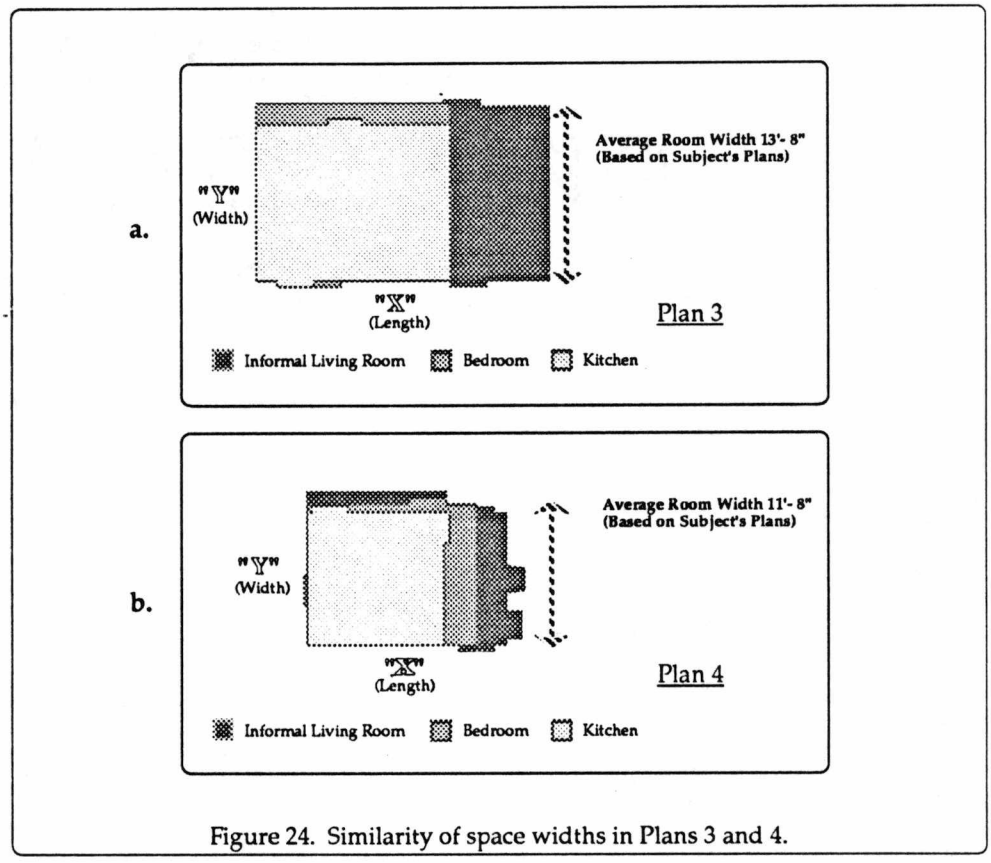


Figure 24. Similarity of space widths in Plans 3 and 4.

It is also apparent that the minimum width of 11′ in Plan 4 is not a function of the same proxemic zone interaction that determined the presence of two areas in a room. While the smallest Plan 3 width's dimension permitted at least acceptable interaction distances between areas, none of the Plan 4 width's allow acceptable interaction distance between areas. The subject's choice of a minimum 11′ width may relate to her social-far zone's inner boundary, which is 7′. At this distance, there is just enough space in all rooms for a person to enter the room and not intrude upon that inner boundary (Figure 25).

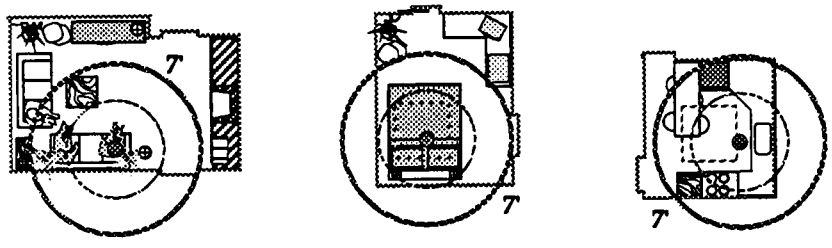
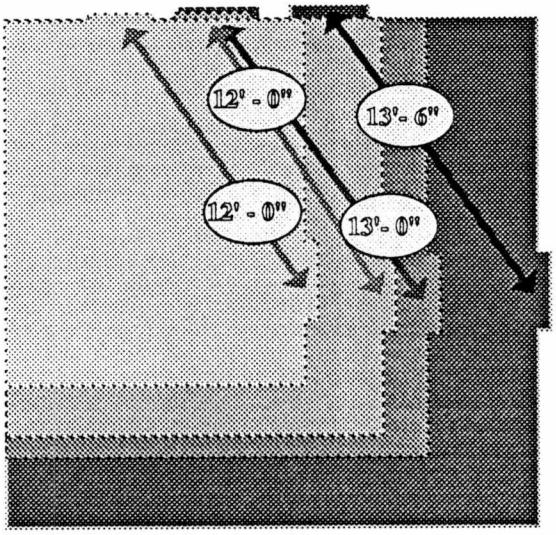


Figure 25. Widths of rooms in Plan 4 in relation to subject's 7' social-far boundary.

An additional finding from size reduction occured in the bedroom. For all four plans in this room the distance between its entrance door and the bathroom door was very consistent, ranging from 13'6" to 12'. The door-to-door distances as a percentage of the original plan are 96% (Plan 2), 89% (Plan 3) and 89% (Plan 4). In comparison, the room's "X" dimensions were 83% (Plan 2), 78% (Plan 3) and 68% (Plan 4) of the original. The "Y" dimension changes to 83% (Plan 2), 74% (Plan 3) and 59% (Plan 4) of the original (Figure 26a). The square footage diminished to 69% (Plan 2), 58% (Plan 3), and 40% (Plan 4) of the original (Figure 26b).

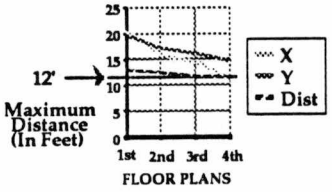
The door-to-door distance in Plan 4 is just 11% less than in Plan 1. In contrast, the square-footage reduction is 60%, the width reduction is 41%, and the length reduction is 32%.

These comparisons suggest there is a very important spatial relationship between room entranceways. Since the subject considered the bedroom a very private place, it's possible the minimum door-to-door distance of 12', which is the inner boundary of the public zone, is significant there.

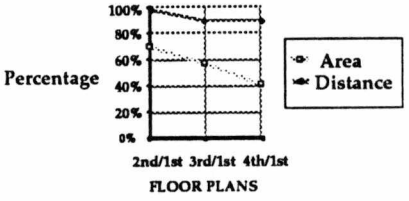


DOOR-TO-DOOR DISTANCES

Plan 1 Plan 2 Plan 3 Plan 4



a. Dimensions of Bedroom ("X" & "Y") and Distance Between Bedroom and Bathroom Doors (Dist.)



b. Percentage of Bedroom Area Reduction Compared to Percentage of Distance Reduction Between Bedroom and Bathroom Doors.

Figure 26. Door-to-door distance changes in the bedroom relative to: a. room dimension changes; b. percentage of area reductions.

6.0 CONCLUSION

6.1 Specific Issues

An individual's culture influences expectations and interpretation of the spatial environment (Hall, 1966; Altman and Chemers, 1980; Barash, 1985). This means the interaction distances between individuals and objects and between individuals within a group are outcomes of cultural preferences. It also means individuals who belong to the same cultural group have similar expectations and interpretations of the environment. As a result, it is likely the findings of this study apply to other members of the subject's cultural group. However, it is suggested that the study be repeated with additional members of her group before making generalizations. Since the important proxemic zone relationships are identical for each room type, designing one room instead of a complete living environment should be sufficient to validate the study's findings.

Replicating the study for the same cultural group leads naturally to the recommendation of comparative studies with other cultural groups to determine their micro-environment needs. Since we are a nation of diverse cultures, it is presumptuous to assume that "one size fits all." By using a participatory design process and the scale-model method of representing the environment, individuals can easily articulate their spatial needs without learning new skills.

Several factors related to design criteria and the method used in this study need elaboration.

First, since the research emphasis was on the spatial relationship of elements as determined by the subject, the rooms' visual arrangement may not meet aesthetic criteria established by individuals trained in design. For example, except in the informal living room, the subject limited the ability to relate to the outside through windows. The only other window was over the kitchen sink. Thus, most of the home's natural light would enter through skylights in the bedroom and kitchen. Also, the plan would not meet fire codes since the bedroom's only egress is through other parts of the house.

Although the subject carefully considered clothing and other storage needs when she designed the dressing room in Plans 1-3 and the bedroom storage unit in Plan 4, storage facilities in the home seem very limited.

Using a scale-model environment to conduct spatial behavior research has many advantages, including the process's shortened length of time and immediate feedback to the user and designer. However, there are several suggestions for future use of the method.

The method's most difficult part was ensuring the subject used the scale-model figure to check the furniture element's spatial relationship. This was done by handing the figure to the subject and asking her to "perform the activity". Providing scaled figures that were more realistic and easier to manipulate would

possibly have eliminated some of the subject's reticence to use the model.

Care must be taken, however, not to influence the subject's space planning. As a designer with preconceived ideas about the way to arrange a space, it was difficult not to lead the subject, especially during Plan 4 when she had a difficult time designing the informal living room.

6.2 Generic Issues

Investigating the effects of reducing a living environment's size shows an individual attempts to realize a basic spatial structure and maintain it through size changes. The important criterion in maintaining spatial structure is proxemic zone interaction. As long as the distance between functional areas is acceptable, a room is useful for its intended purpose. Functional equivalents, which occur at the area, room and home level, allow some size variation without changing the basic relationships. For this study's subject, the Plan 3 design is an acceptable minimum living environment that allows her to choose how she wants to live. Further reduction in the size, however, affects room utilization through eliminating one of its major functions, which also eliminates the accompanying relationships. The subject found Plan 4 unacceptable because the size dictates a spatial organization different from her needs.

As evidenced by this study, people perceive very small changes in their

environment's spatial organization. A matter of inches can affect their tolerance of this organization. Knowing the points that affect a room's intended use is crucial for the designer creating new environments that will support and enhance an individual's chosen way of life, environments in which the individual controls the amount and kinds of interactions.

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APPENDICES

APPENDIX A
LIST OF EQUIPMENT USED IN THE DESIGN PROCEDURE

~ Styrofoam base, 4'-0" x 4'-0" x 2" thick, which represents 2304 square feet at a 1'=1' scale

~ Wall, door and window section constructed of corrugated cardboard with toothpicks inserted into the bottom of each section

Widths of the wall sections - 2', 4', 6', 8'
Heights of the wall sections - 8'

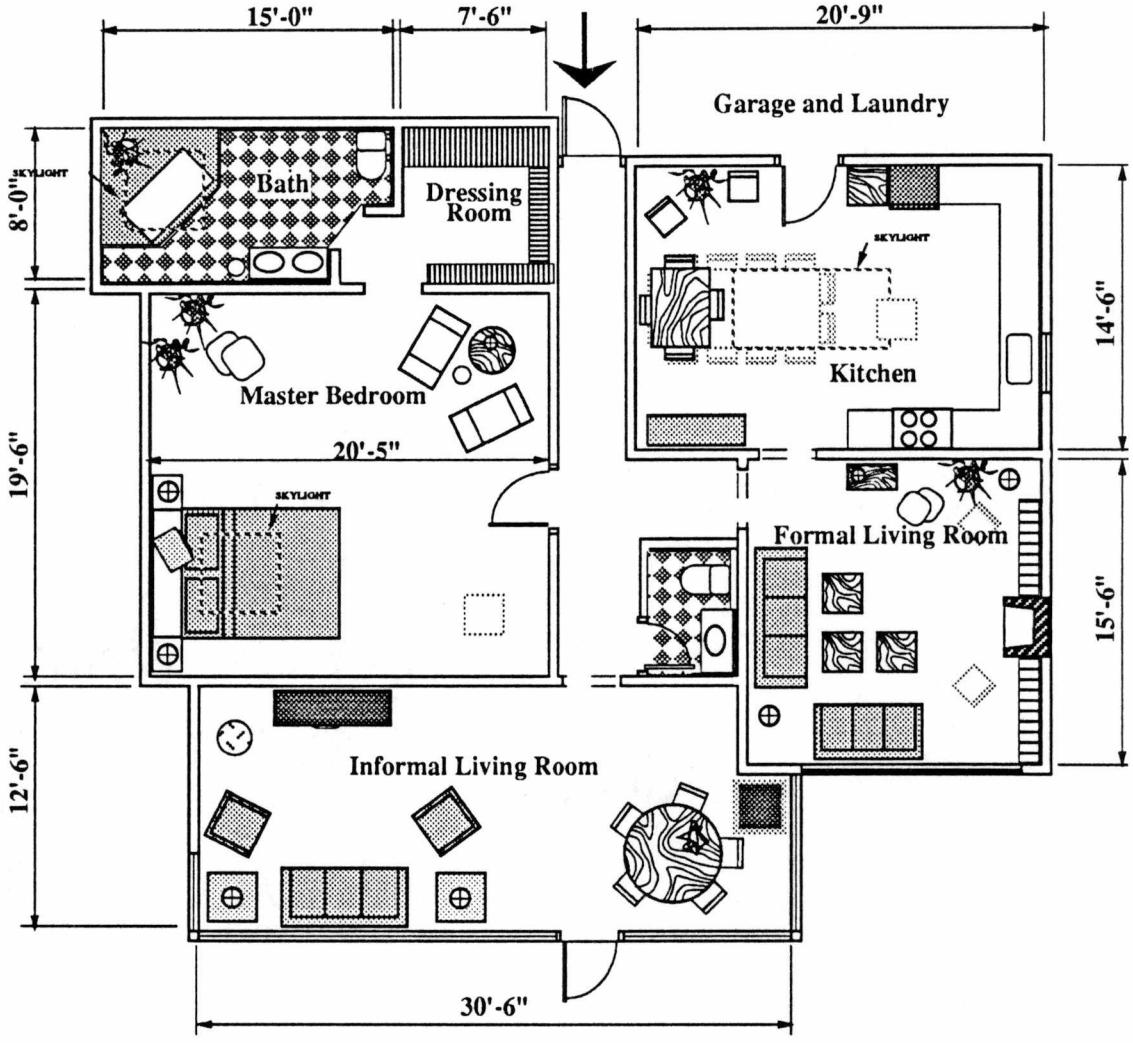
~ Human figures cut out of corrugated cardboard

~ Furniture pieces constructed of 3/32" chipboard or wood

~ Elements - books, table and floor lamps, TV set, stereo, baskets, decorative objects, floor cushions, paintings, photographs, wall coat rack, mirrors

All furniture, wall, door and window sections and human figures are at a scale of 1" = 1'.

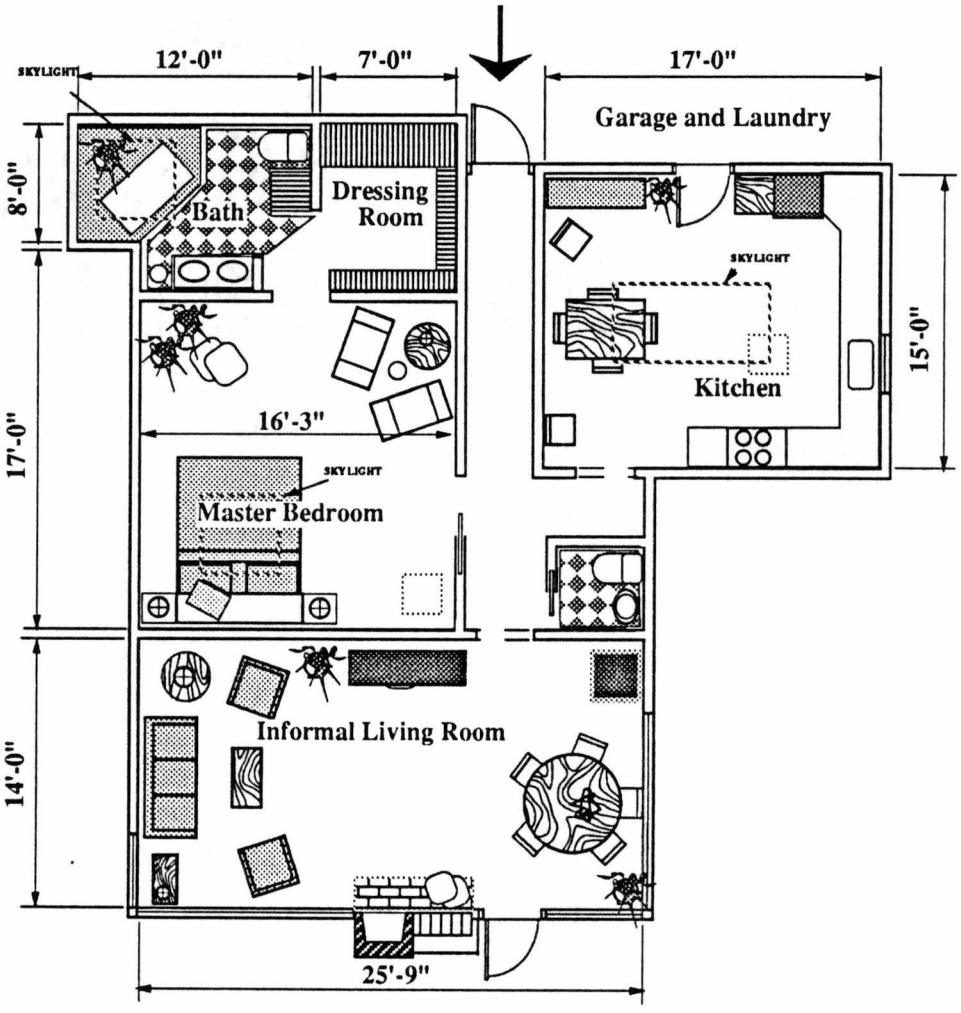
APPENDIX B
DIMENSIONED FLOOR PLANS



Plan 1

Room Dimensions

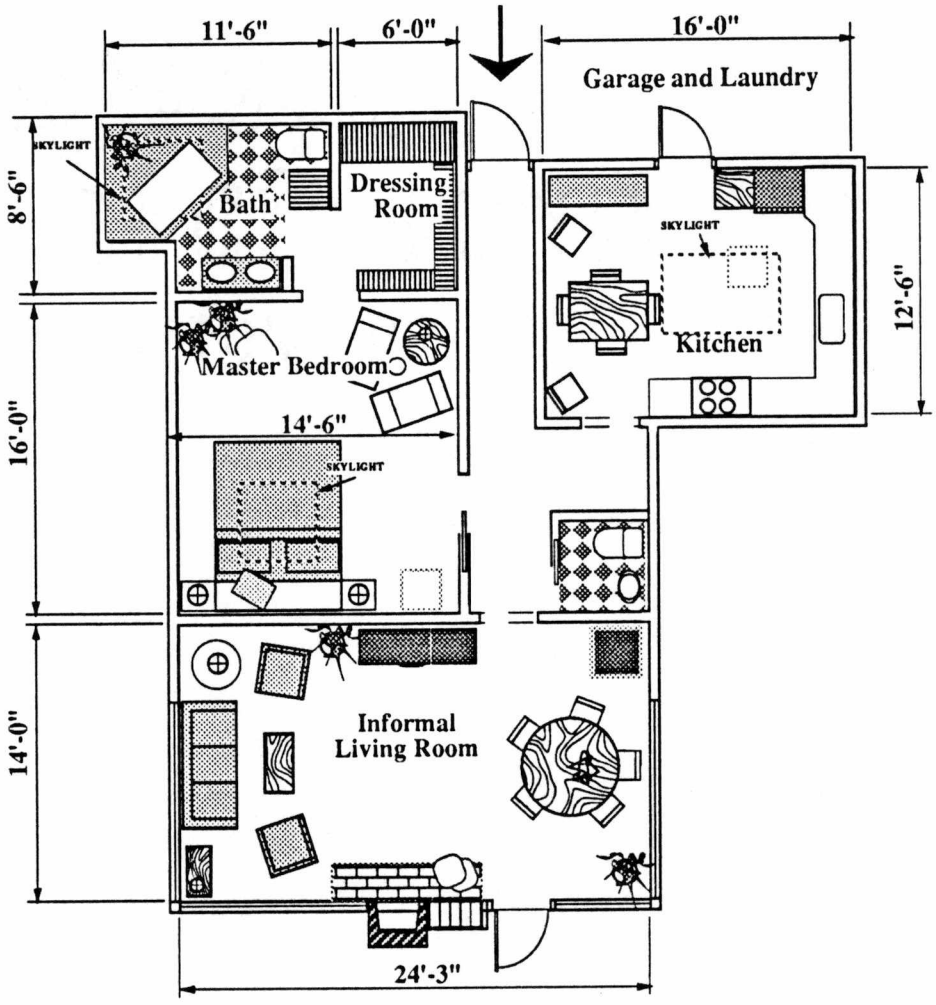
1513 SQUARE FEET



Plan 2

Room Dimensions

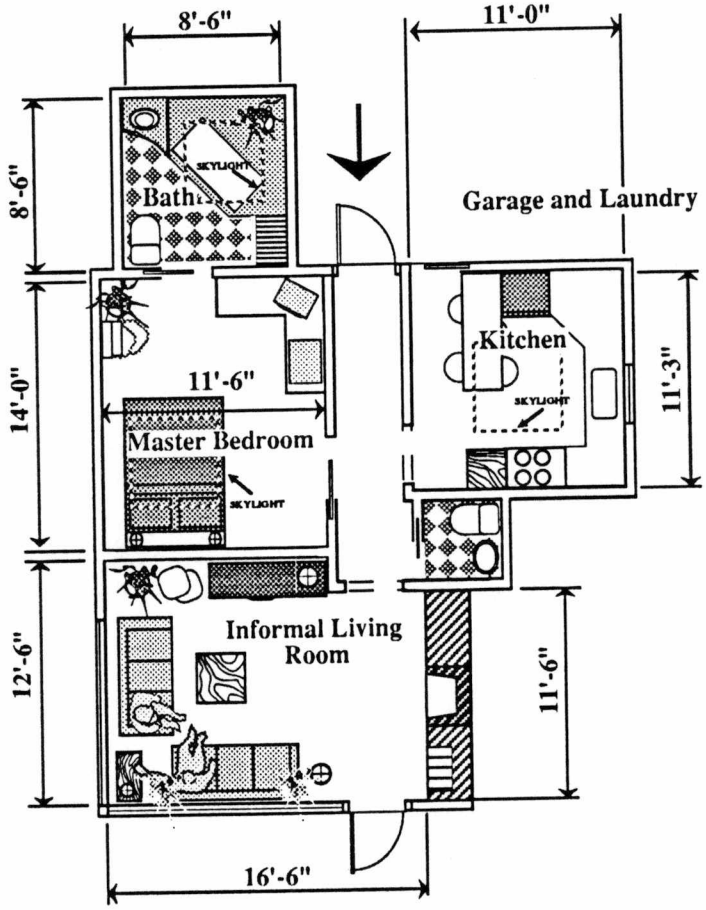
1302 SQUARE FEET



Plan 3

Room Dimensions

1052 SQUARE FEET

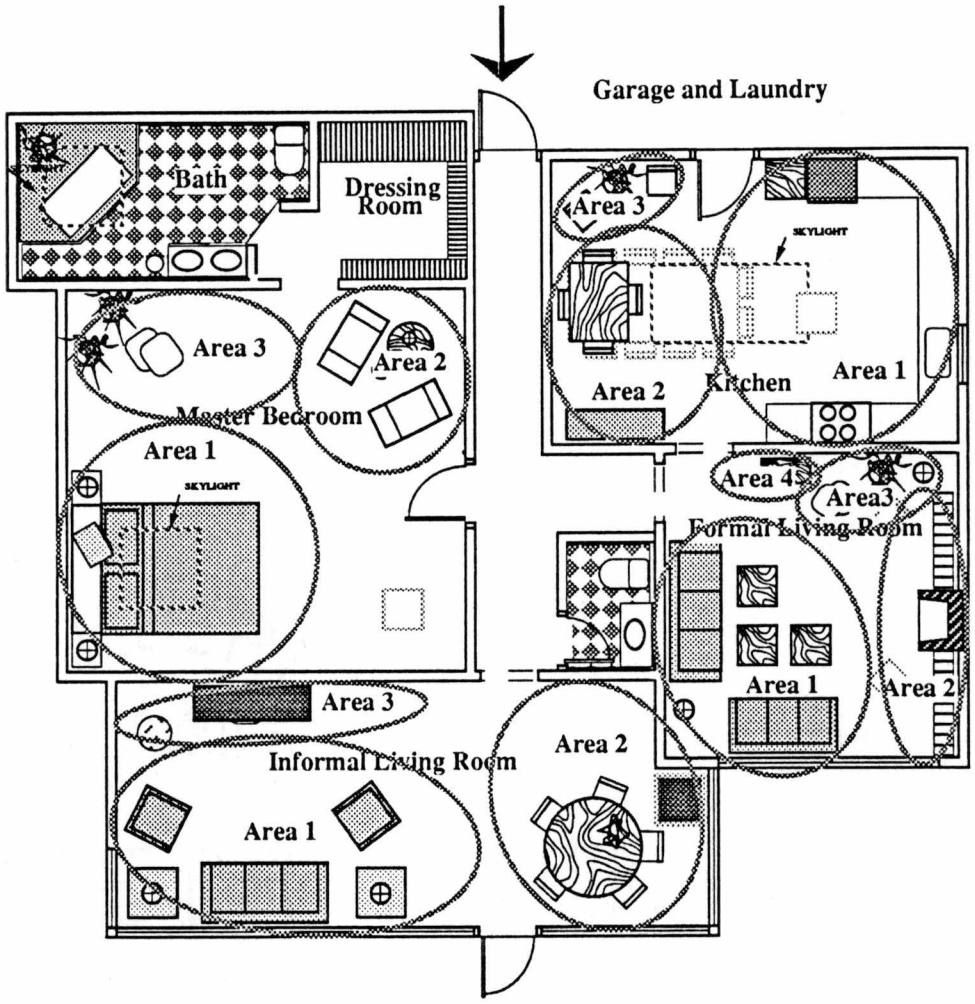


Plan 4

Room Dimensions

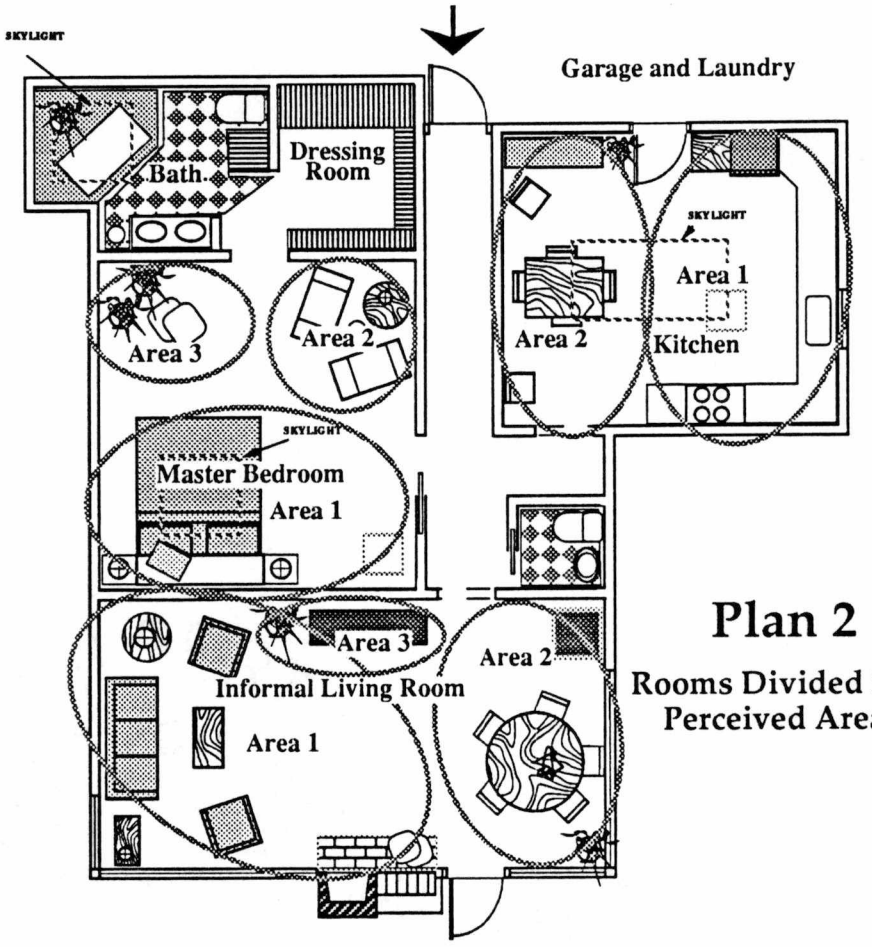
622 SQUARE FEET

APPENDIX C
FLOOR PLANS WITH PERCEIVED AREAS AND LIST OF ADDED OR DELETED FURNITURE ELEMENTS PER ROOM PER PLAN



Plan 1

Rooms Divided Into Perceived Areas

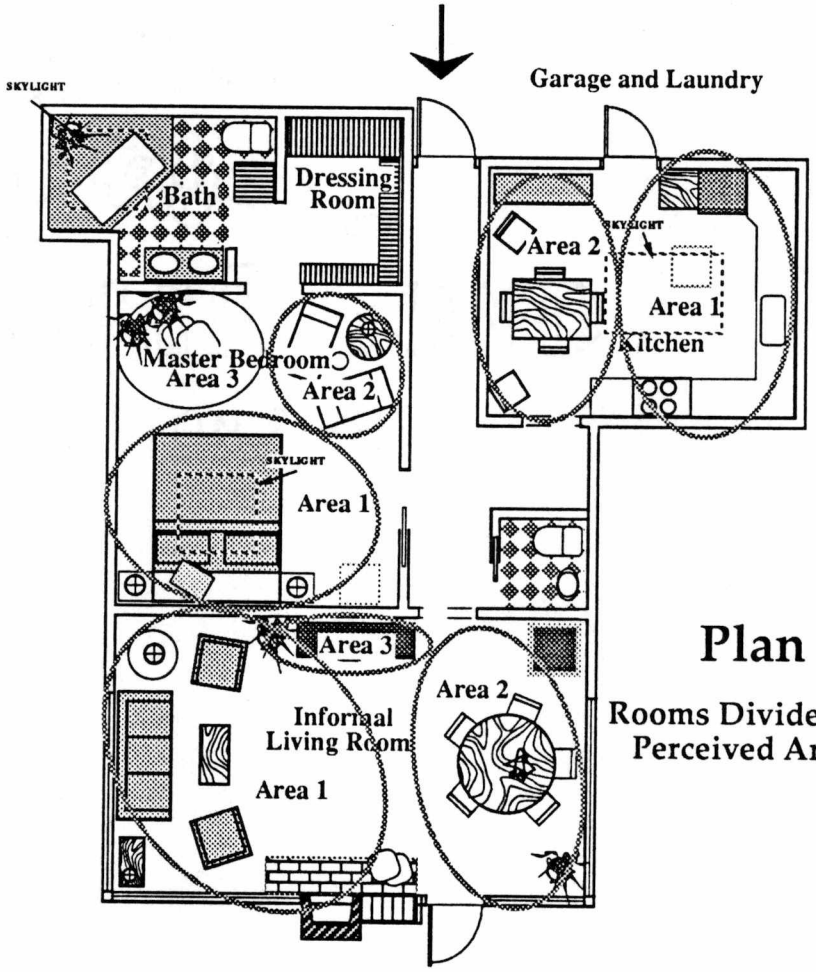


Plan 2

Rooms Divided into Perceived Areas

	Furniture Deleted				Furniture Added		
	Room	Qty.	Name	Size	Qty.	Name	Size
Plan 2	Formal Living Room	1 1 3 1 2 2 2 1 2	Sofa bed Sofa bed Coffee table Antique washstand Bookcase Floor cushion Floor plant Table lamp Floor lamp	33" x 66" 33" x 84" 24" x 24" 15" x 32" 12" x 66" 15" x 15" 15" d.			
	Informal Living Room	2 1 1	End table Table lamp Basket	30" x 30" 24" d.	1 1 1 1 1	Coffee table End table Bookcase Fireplace Floor plant	18" x 36" 24" d. 36"
	Bedroom		None			None	
	Kitchen		None			None	

List of furniture added or deleted per room for Plan 2

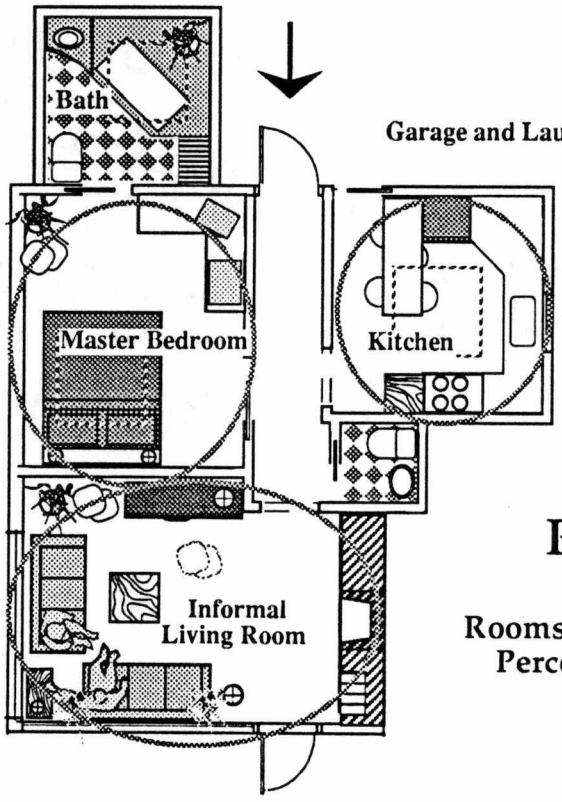


Plan 3

Rooms Divided into Perceived Areas

	Furniture Deleted				Furniture Added		
	Room	Qty.	Name	Size	Qty.	Name	Size
Plan 3	Informal Living Room		None			None	
	Bedroom		None			None	
	Kitchen	1	Floor plant				

List of furniture added or deleted per room for Plan 3.



Plan 4

Rooms Divided into Perceived Areas

Plan 4	Furniture Deleted				Furniture Added		
	Room	Qty.	Name	Size	Qty.	Name	Size
	Informal Living Room	2 1 1 1 5 1 1 1	Lounge chairs Coffee table Table Table Side chairs Bookcase Refrigerator Floor plant	33" x 33" 18" x 36" 24" d. 60" d. 18" x 18" 12" x 60" 33" x 33"	1 1 1 2	Coffee table Bookcase Floor lamp hanging plant	24" x 24" 12" x 24"
	Bedroom	1 1 2 1 1 1	Bed Bookcase headboard Lounge chair Foot stools Table Table lamp Floor plant	84" x 80" 18" x 10' 24" x 36" 12" x 24" 30" d.	1 1 1	Bed Bookcase headboard Storage unit	78" x 81" 12" x 78" 20" x 72"
	Kitchen	1 6 1	Table Side chair Hutch	36" x 48" 18" x 18" 18" x 60"	1 4	Counter Bar stools	24" x 9' 15" d.

List of added or deleted furniture per room for Plan 4.

APPENDIX D
LIST OF ACTIVITY CHANGES PER ROOM PER PLAN

Rooms	Plan 1	Rooms	Plan 2
Formal Living Room	Entertain - business guests, friends Relax - watch fire Snack Read Listen to music	Formal Living Room	Room deleted
Informal Living Room	Read Eat breakfast, dinner - two people Watch sunset View garden Watch TV Entertain - family, friends Serve meals - kitchen overflow, grandchildren Sleep - overnight guests Play video games - grandchildren Play board games - grandchildren	Informal Living Room	Read Eat breakfast, dinner - 2 people Watch sunset View garden Watch TV Entertain - family, friends, ***business guests*** Serve meals - kitchen overflow, grandchildren Sleep - overnight guests Play video games - grandchildren Play board games - grandchildren ***Relax - watch fire*** Snack ***Listen to music***
Bedroom	Sleep Watch TV Listen to music Eat dinner - 2 adults Talk on phone Read Relax - lie on floor Snack Talk	Bedroom	Sleep Watch TV Listen to music Eat dinner - 2 adults Talk on phone Read Relax - lie on floor Snack Talk
Kitchen	Food preparation Cleanup Eat - family, guests, - 2-12 people Talk on phone Snack Talk - family, business guests	Kitchen	Food preparation Cleanup Eat - family, guests, - 2-12 people Talk on phone Snack Talk - family, business guests

List of activities per room for Plans 1 and 2. Activities in italic lettering in Plan 2 list were added to informal living room activities when size of Plan 1 was reduced.

Rooms	Plan 3	Rooms	Plan 4
Formal Living Room	Room Deleted	Formal Living Room	Room Deleted
Informal Living Room	Read Eat breakfast, dinner - 2 people Watch sunset View garden Watch TV Entertain - family, friends, *business guests* *Serve meals - kitchen overflow, grandchildren* Sleep - overnight guests Play video games - grandchildren *Play board games - grandchildren* Snack Relax - watch fire Listen to music	Informal Living Room	Read Eat breakfast, dinner - 2 people Watch sunset View garden Watch TV Entertain - family, friends, business guests Sleep - overnight guests Play video games - grandchildren Snack Relax - watch fire Listen to music
Bedroom	Sleep *Watch TV (sitting area)* *Listen to music (sitting area)* *Eat dinner - 2 adults (sitting area)* Talk on phone *Read (sitting area)* Relax - lie on floor *Snack (sitting area)* *Talk (sitting area)*	Bedroom	Sleep Watch TV (sleeping area) Listen to music (sleeping area) Talk on phone Snack (sleeping area) Talk (sleeping area)
Kitchen	Food preparation Cleanup Eat - family, *friends, business guests* Talk on phone Snack Talk - family, friends, *business guests*	Kitchen	Food preparation Cleanup Talk on phone Talk - family Snack

List of activities per room for Plans 3 and 4. Activities in italics in Plan 3 list were deleted from list of Plan 4 activities list.

VITA

Donna Everhart Liberto was born in Bellefonte, Pennsylvania on April 7, 1939. She attended Ferguson Township Elementary and Junior High School and was graduated from State College Area High School in June 1957. The following September Ms. Liberto entered The Pennsylvania State University and in January 1961 received a Bachelor of Science degree in Home Economics with emphasis on apparel design and home related arts.

After raising a family, Ms. Liberto enrolled at The University of Tennessee in June, 1985 to begin study toward a Master's degree in Interior Design. During the period of time she was pursuing her studies, Ms. Liberto was a graduate teaching assistant and received a scholarship from the Student Chapter of the American Society of Interior Designers. Ms. Liberto was awarded her degree in May, 1990. Her special area of interest was human spatial behavior.

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