

ATTITUDES OF OLDER ADULTS TOWARD ILLUMINATION CHARACTERISTICS  
IN A SOCIAL SETTING

by

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requirements for the degree

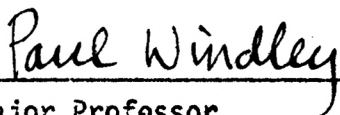
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## CHAPTER 1

### INTRODUCTION

#### Statement of the Problem

This study is concerned with identifying the attitudes of older adults toward certain characteristics of light in an interior environment. This writer regards the consideration of such attitudes essential to the functional design of the interior environment.

The attitudes of people toward lighting has not been of great concern to lighting designers, who are usually architects or illuminating engineers. According to the Illuminating Engineering Society's Handbook, the illuminating engineer's concern is to provide the quantity of light necessary to perform a task with some regard to visual comfort factors, but only in terms that can be measured and formulated. Traditionally the architect would follow the formulas set down by the engineer for task lighting and then where no specific task was being performed, he would disregard the formulas and illuminate the architectural details of the building, "for mood or atmosphere," (Lam, 1960). In this vein lighting was an ambiguous aesthetic, not a functional part of the interior environment. Somewhere between the extremes of the ambiguous aesthetics and the simplistic formulas lies the approach this writer believes to be the most valid for lighting design criteria; that being the use of lighting to communicate information about the environment. It is the belief of

lighting consultant William M.C. Lam, that "as human beings we evaluate an environment according to how well that environment is structured, organized and illuminated to satisfy all of our needs for visual information. These needs derive from both the activities in which we choose to engage and the biological information needs" (Lam, 1977, P. 5).

This writer views the intentional communication of information through lighting as a possibility only after it has been determined what information is communicated and by which lighting characteristics. Through studying the attitudes of people toward illumination characteristics, we will discover what some of this information is. Therefore, the question to be answered by this research is: What is the attitude of older adults toward illumination characteristics in a social setting?

### Objectives of the Study

The objectives of the study are as follows:

- 1) To determine what the attitudes of older adults are toward illumination characteristics in a social setting.
- 2) To determine which lighting characteristics are preferred by the participants for this setting.
- 3) To propose design recommendations for the lighting in the setting studied

### Theoretical Background

The rationale for this study is based on the theories from the field of man-environment relationships. Man-environment theories are numerous and involve different methods of research, although they are all used to



understand human behavior in an environmental context. One specific theory in this area is especially applicable to this thesis, that is Competency/Environmental Press. This theory is more specifically concerned with the relationship between older people and the environment in which they carry out their daily activities.

### Man-Environment Relations

There are currently two opposing views concerning the impact the environment plays in determining human behavior. Social scientists expound on the theory that it is in the interpersonal, social and cultural aspect of the environment where influence on behavior is found. Wohlwill (1970) states that "it is people who administer rewards and punishments; the natural and artificial surroundings in which people live thus have little power to influence behavior" (pp. 84, 85).

The opposite point of view, referred to as "architectural determinism," states that the physical setting directly influences social behavior (Lipman, 1969).

While proponents of these two theories have been narrowly seeing only their own point, another group of researchers has found a middle course between these two extreme points of view to be more palatable. Therefore, the man-environment relationship referred to here concedes the influences of many determinates of human behavior, both human and non-human. It is made up of people from different disciplines, who are attempting to bridge the gap between disciplines and broaden their scope of study. These are the environmental designers, who want to build the environment in terms of man's capabilities and needs, and the behavioral scientists who feel that their discipline has neglected man's unity with this physical environment (Atman, 1976). The research in this thesis

is based on the assumption that the physical environment can be a constraint directly or indirectly effecting the opportunity for an individual or group to satisfy their basic human needs.

#### Competence/Environmental Press

The value of this theory is that it is a basis for understanding the relationship between older people and their environment. The two major variables in the theory are the competence of the individual and the complexity of the environment. The hypothesis is that the greater the person's competence, the less effect the environment will have upon his behavior, and conversely; the less competent the person, the greater the influence of the environment will be (Nahemow and Lawton, 1976, p. 316). The theory is based on the conception that behavior is a function of the person and the environment. The competence of the individual is affected by health, sensory capacity, cognitive ability, motor skills, and ego strength. This theory is useful when discussing older adults because it is assumed that older people may be less competent in some or all of these areas than younger adults. This thesis is only concerned with a reduced competency in visual acuity which will be discussed in chapter two.

The environment is made up of a number of dimensions such as the amount and kind of sensory stimulus. The environmental press is measured by the amount of adaptive behavior it demands from a person performing a given task. An environment which is difficult to negotiate because of its ambiguity, weak sensory stimuli, or demands on physical strength, exerts a strong environmental press on the individual. A strong environmental press on a person of low competence can lead to negative affect

and maladaptive behavior. Similarly, if the environment demands too little of the person, is overly supportive, maladaptive behavior may occur, even death, as shown in a study by Blenkner (1967, p. 101).

The Competence/Environmental Press theory provides a basis for understanding how a person and his environment interact.

### Justification of the Study

#### Intent of the Thesis

This study is undertaken by a designer who has become aware of the need to better understand the individual's interaction with the environment. It is this writer's belief that functional design solutions occur when decisions are made from rational design criteria that are based on research. In the proposed study, a special population has been selected, that being older adults, and a condition particular to this population, though not exclusively, is the focus of the design problem. The condition is a decline in visual acuity which progresses with age. The writer has studied the population and the visual condition in an attempt to better understand both. The research has been designed to give the writer additional information directly from the population being designed for. It is the desire of this writer to be able to determine what the lighting needs of older adults are and to propose a design solution.

#### The Focus on the Older Adult Population

This writer has chosen to focus on the attitudes of older adults toward illumination characteristics for four reasons: 1) their visual condition has been developing over their life-time and is to the point where visual impairment may be marked enough to be noticeable; 2) the

visual problems of the older adult population have not been a major concern of architectural designers or researchers in illumination engineering in the past; 3) since the decline in visual acuity begins in the young adult years and develops progressively with age, it is this writer's belief that lighting designs which are found to aid older adults may also aid many young adults as well; and 4) the number of older adults in the total population has been increasing steadily for several years and is expected to continue to increase.

## CHAPTER 2

### LITERATURE REVIEW

This review of literature has been divided into two parts. First, the documentation of visual changes due to the aging process is presented. The majority of this documentation was written by ophthalmologists during the 1950's. Once these age related changes were documented, professionals in fields dealing with lighting and older populations became aware of the medical facts. The second part deals with the publications stemming from this awareness which have appeared in the 1960's and 1970's. At that time, publications appeared which linked lighting to a person's behavior while negotiating his way around the environment. Other articles have looked specifically at the behavior of older adults.

#### Documentation of Visual Changes Due to the Aging Process

Several studies have been conducted to determine what the changes are in human eyes due to the aging process. Among these Chapanis (1950) reported that young and old subjects do not attain visual ratings as good as those individuals do in the age range of 15 to 50. The subjects under age 15 did not earn scores as high as adults did on the color vision test. This paper was concerned with color vision tests which measure red-green discrimination. Chapanis found no evidence that very old examinees are handicapped on these color vision tests. Between visual acuity and color

vision there was an almost complete lack of relationship.

Gordon (1965) reports that the older person is often handicapped by a situation in which an adequate amount of light is prevented from entering his eye (decreased aperture plus lens opacity) at the very time in life when he requires more light to compensate for the lens opacity. Guth (1957) reports that older workers require considerably higher levels of illumination in order to achieve a given ability to see.

Kornweig (1954) reports that visual acuity is reduced by the lens becoming opaque with age. He states that, "this can be corrected by removal of the cataract, however studies show that cataract formation is inevitable." He also reports light and dark adaptation is reduced beyond age 60 and the pupil has a tendency to become smaller and sluggish in its reaction to light in old people. The pupil gets gradually smaller as the person gets older until it remains almost the same size under all conditions. The lens of the eye increases in size steadily throughout life, thus the anterior chamber becomes smaller. The same amount of fluid having to occupy a relatively smaller space and being compressed, will raise the intraocular pressure which results in glaucoma. There is also a loss of accommodative power, presbyopia, because the lens loses its elasticity and cannot expand and contract sufficiently to allow for the necessary change in dioptric power and there is a change in ability of the ciliary muscle to expand and contract.

McFarland (1968) reports that older people require a greater absolute increase in intensity of light than younger people to achieve an equal improvement in level of visibility. He also suggests that the decline of dark adaptation with age is so predictable that it could be used as an index representing the aging process. McFarland and Fisher (1955)

state that there is a consistent decline in ability to see at low levels of illumination with increasing age. Also, dark adaptation proceeds in two stages; the first (cone vision) is over in a few seconds and the second (rod vision) begins six to eight minutes later and goes on for half an hour or more. The limitation in ability to adapt to the dark is quite marked in older subjects.

Weale (1965) states that the pupil area becomes smaller with age, consequently, the amount of light reaching the retina becomes progressively smaller as we get older. The lens becomes less transparent throughout the whole spectrum, especially in the blue part since it takes on a yellow color. In white light a 60 year old retina receives one third of light that a 20 year old retina receives. In blue light this is decreased to one eighth of the amount a 20 year old retina receives. Wolfe (1960) reports that at the age of 40, a sudden acceleration in sensitivity to glare occurs for which opacity of the lens is primarily responsible.

### Summary

This is an overview of the studies that document the changes in the eye due to the aging process and supports the fact that people do have different needs as they become older in order to maintain the level of visual perception necessary to receive visual information.

### Relationship of Visual Condition, Illumination, and Behavior

One outcome of these studies on age related vision losses has been an increasing awareness of the problem by professionals in the fields of engineering, ophthalmology, and gerontology. Articles such as the one by Crouch (1967) "Lighting Needs for Older Eyes," emphasize determining what

the lighting needs are for older eyes. He states that "since all the data that has been collected for determining illumination levels for specific viewing tasks has been for young, normal eyes, this data cannot pertain to older eyes, which we know from various studies are deviations from the young normal eyes." He proposes that we know we have more older people in the population now than we have had in the past, therefore the need to be concerned with their visual problems is vital.

### Illumination and Behavior

Another body of literature appeared in the seventies calling for research to be done in the area of lighting and behavior. Lam (1977) states, "it should be obvious that biological needs for environmental information are extremely important, yet in lighting codes and in the normal processes of programming and design, these needs are given no explicit recognition whatsoever" (p. 19). Hayward (1974) proposes that people in most societies rely more on visual perception than on other perceptual systems to obtain information about the environment and their relation to it. He states that "the quantity and quality of light available in any setting...has a strong effect on human emotions, communication and behavior" (p. 120). Wohlwill (1972) notes that illumination has been of concern to industrial designers, architects, and planners for some time, "although, outside of an industrial context, there has been little systematic research on the effects of different levels of... visual intensity on behavior (p. 87). Flynn, Spencer, Martyniuk and Hendrick (1973) from tests done at the General Electric Lighting Institute concluded that lighting can be discussed as a vehicle that alters the information content of the visual field, and that this intervention



has some affect on behavior and on sensation of well-being. John E. Flynn, (1977) Professor at Pennsylvania State University has been involved in several studies involving subjective impressions derived from lighting. He states that "as the designer changes lighting modes, he changes the composition and relative strength of visual signals and cues; and this in turn alters some impressions of meaning for the typical room occupant of user."

### Behavior of Older Adults

Recently, literature has appeared which points out the relationship between older people receiving visual information and their movement or behavior. A study done by Pastalan (1975) reported the normal age related visual losses, as experienced through the use of emphatic lenses, to be those of blinding glare, fading of blue and green colors, undistinguishable boundaries, lack of depth perception, difficulty with light-dark adaptation, light-dark contrast, and the inability to discriminate fine detail. He concluded that the work using the simulation device has demonstrated that age-related sensory decrements can seriously constrain a person from freely using buildings, facilities and other environments as they are presently designed. Schwartz (1975) stresses that "the design of environments for the aged must be aimed at alleviating stresses, minimizing the effects of losses, and compensating in ways to enhance the individuals' effectiveness."

### Summary

The literature in the second part of the review looks at a hypothesized relationship between illumination and behavior, although there is no experimental research to substantiate the relationship. Literature

is also cited that looks at the behavior of older people in the environment. While the Swartz article proposed changing the environment to be more supportive of older people, Pastalan reported the visual problems of older adults as experienced with a pair of glasses to simulate the way an average 70 year old sees.

It appears that there is a large gap in the literature pertaining to behavior related to illumination, and more specifically, the behavior of older adults as it relates to illumination. This thesis will attempt to fill some of the gap in the literature by looking at the relationship of changes in illumination to attitudes of older adults.

### Conclusions

The literature reviewed in this chapter shows that the conditions attributed to the aging process in the human eye are; 1) decreased pupil aperture, 2) slower adaptation rate, 3) lens opacity, and 4) yellowing lens color. These are the visual conditions that this thesis will be concerned with. The corresponding illumination characteristics to be investigated are as follows:

    Illumination Level - variation can increase or decrease the amount of light entering through the pupil aperture.

    Room Contrast - refers to contrast of light to dark as in adaptation.

    Brightness Ratio - the opacity of the lens increases the amount of glare seen by the eye.

    Color Temperature - colors will appear differently when seen through a yellowed lens.

## CHAPTER 3

### METHODS AND PROCEDURE

#### The Setting and Population Selected for the Study

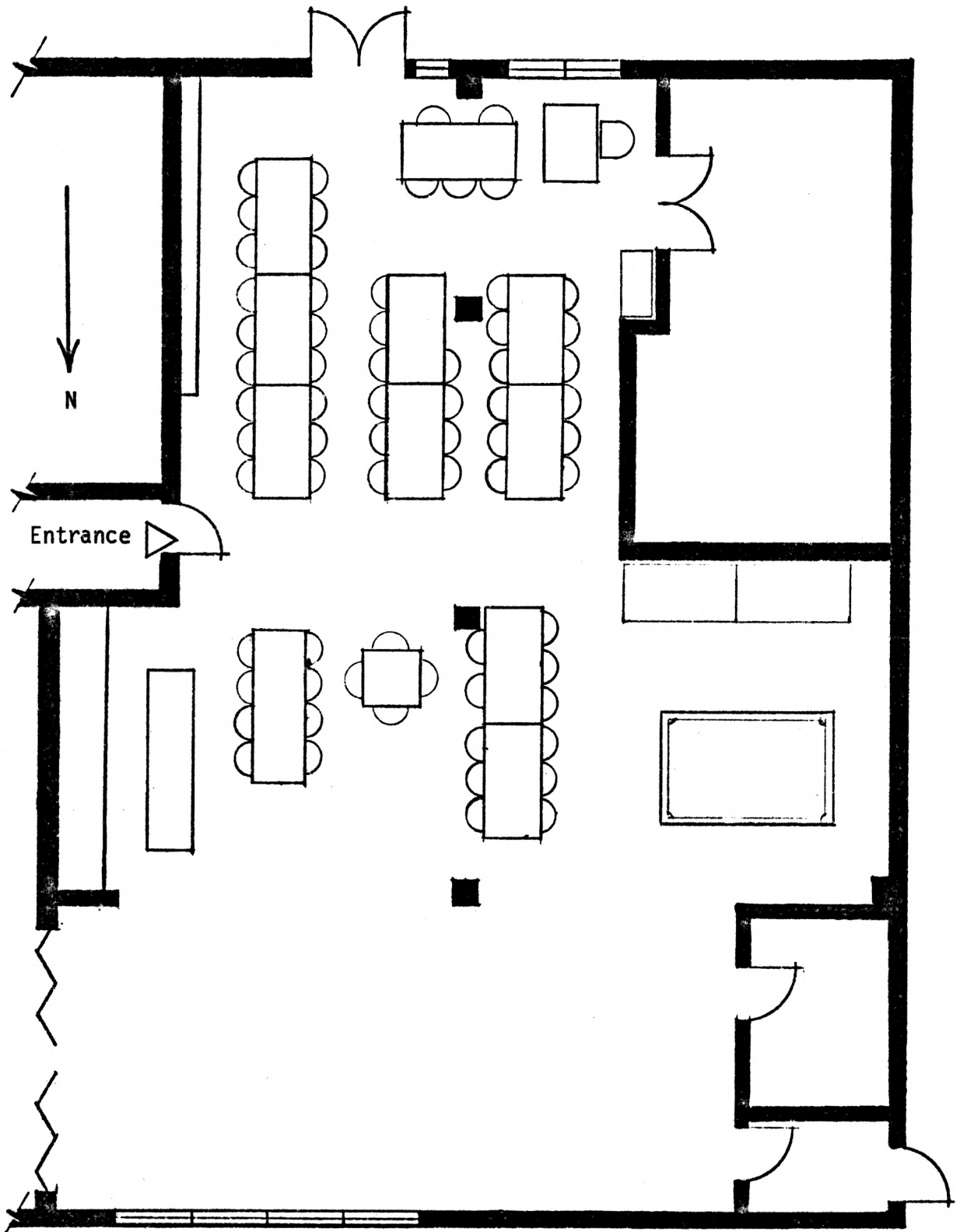
##### The Setting

The setting used for this study was the Apollo Towers in Clay Center, Kansas. This building was built in 1970 under a United States government program to provide adequate housing for older Americans of low income. It is a high rise apartment tower with social areas on the ground floor. There are 100 apartments in the building with 116 residents. Most of the apartments are located on floors two through eight. The laundry room is located on the second floor in the space of one apartment, while there are three apartments on the first floor. The remainder of the first floor is divided into the support areas of the office, trash room and mechanical equipment room, and the social areas of the lobby, crafts room, and community room.

This study took place in the community room of Apollo Towers, as shown in Figure 1. It has windows along the north and south walls and is illuminated by these windows and recessed incandescent light fixtures. The room is set up to accommodate several different activities including buffet meals, club meetings, bingo and card games, and other gatherings. It is also used by individuals, for sewing, shooting pool, or putting a jigsaw puzzle together, but the provisions for the individual activities are along the periphery of the room. The furniture mainly consists of

Figure 1

Floor Plan of Community Room in Apollo Towers



SCALE 1/8" = 1' 0"

metal folding chairs and tables, except for a desk, a piano, and a pool table.

### The Population

The respondent population consisted of older adults who came to the community room regularly for either morning coffee or noon meals. Most of the respondents lived in Apollo Towers, others worked in the building or came in especially for the lunch program. The respondents of the study were predominately female; 33 were female and 9 were male, totalling 42. All of the respondents were over 60 years of age and none were over 90.

### Definition of Terms

#### Lighting Conditions

The three lighting conditions that were used in this study are the ones that are normally present in the room. These are sunlight only, incandescent light only, and a combination of sunlight and incandescent light.

The condition of sunlight only was achieved by opening the drapery and allowing the sunlight in through the windows while the artificial lights were turned off. For the condition of sunlight and incandescent light, the drapery remained open and the artificial lights were turned on.

The condition of incandescent light only was achieved by closing the drapery over the windows and turning on all the artificial lights in the room. Some light came through the drapery, but it was not direct

sunlight. It was filtered by the drapery in intensity and color so that the measurements at the window were essentially the same as under an incandescent light fixture. All of the artificial lights were incandescent fixtures, recessed into the ceiling and contained one 75 watt bulb. Their placement is shown in Figure 2.

These lighting conditions will be analyzed according to the illumination characteristics they consist of.

The illumination characteristics that will be considered in this study are; 1) illumination level, 2) brightness ratio, 3) room contrast ratio, and 4) color temperature.

#### Illumination Level

The level of illumination refers to the amount of light falling on a surface. The incident light is measured in footcandles which refers to lumens per square foot. The light source emits luminous flux (light) which is measured in units called lumens.

#### Room Contrast Ratio

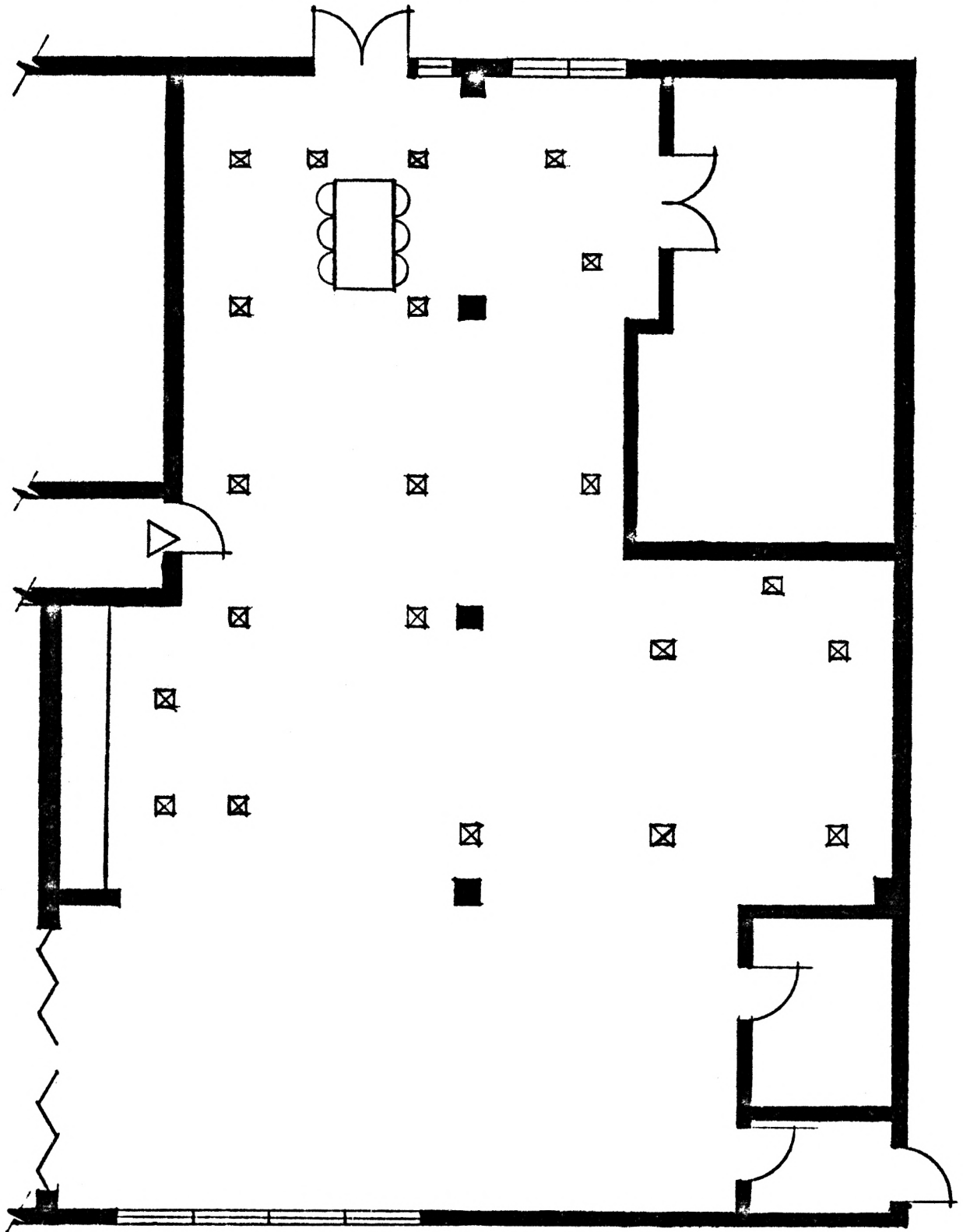
This refers to the contrast in light level between two areas. For this study the contrast will be between the area of the room where the respondents are seated, and the room periphery. The human eye has to accommodate to different light levels by the pupil changing size to let in more light in dimly lit areas, or less light in brightly lit areas.

#### Brightness Ratio

The amount of glare will be measured as the brightness ratio in the subject's cone of vision. Direct glare is caused by light sources in the field of vision, while veiling reflection is caused by reflection of a

Figure 2

Floor Plan With Location of Light Fixtures and Table Used in The Study



SCALE 1/8" = 1' 0"

light source in a viewed surface. Glare is a problem which affects visual comfort and ability to see objects.

### Color Temperature

Color temperature of a light source is an indication of the color of the light produced and is measured in degrees Kelvin.

## Collection of Data

### Measurements

Measurements were taken in the community room under each of the three lighting conditions. For each of these conditions the researcher recorded the illumination characteristics by measuring the incident light level and room contrast ratio in footcandles. The brightness ratio was measured in footlamberts and the color temperature in degrees Kelvin, as shown in Figure 3.

Measurements were taken at 29 inches from the floor on the surface of the table where the respondents were seated, except for the room contrast ratio, which compared the brightest area of the room to the darkest area. The brightest area was next to the window or under a light fixture, while the darkest area was in the center of the room between light fixtures. This measurement was taken at the seated eye level height of 46 inches.

### Participants

Two weeks before the data were collected, the researcher visited Apollo Towers, explained the experiment to the residents during lunch, and asked for volunteers. Several people volunteered to participate at that time and other volunteers were recruited by the members of the staff



Figure 3

## Illumination Characteristics of the Lighting Conditions

Lighting Conditions	Illumination Characteristics			
A	fc	BR	RCR	K <sup>0</sup>
B	fc	BR	RCR	K <sup>0</sup>
C	fc	BR	RCR	K <sup>0</sup>

Note.

fc = footcandles  
 BR = brightness ratio in footlamberts  
 RCR = room contrast ratio in footcandles  
 K<sup>0</sup> = degrees Kelvin

A = sunlight only  
 B = incandescent lights only  
 C = sunlight and incandescent lights

of Apollo Towers. On the two days of the study the researcher called those people who had left their name as a volunteer, and asked them to participate. Almost all were still willing, only a few had other obligations. As a whole the residents of Apollo Towers were quite interested in the study and very willing to participate.

The location of the table used for the study is shown in Figure 2. The respondents participated in six different groups, each at a different time. This allowed the order in which the three lighting conditions were presented to be randomized, thus controlling for any effects that could have been caused from sequence of lighting changes. The groups consisted of seven people in each of six groups, totalling 42 respondents, as shown in Table 1.

The data were collected on two consecutive days of full sunshine, with three groups each day. This occurred between 10:00 a.m. and 12:30 p.m. on March 12 and 13, 1979.

### Development of the Attitude Scale

Since this study was interested in attaining attitudes, an attitude scale such as that described by Liekert (1974) was used for measurement. The scale consisted of a statement followed by a five point scale on which the respondents marked their level of agreement or disagreement. The respondents were also asked for some biographical information on the questionnaire. This provided specific information pertaining to the visual condition of the respondents, their attitudes toward the room, and some background information.

The items selected for the attitude scale were chosen by this writer

Table 1  
Randomization of Lighting Conditions

Respondent Group	Lighting Sequence	Number of Respondents
1	A - B - C	7
2	B - A - C	7
3	C - A - B	7
4	A - C - B	7
5	B - C - A	7
6	C - B - A	7

Note.

A - Sunlight only  
B - Incandescent lights only  
C - Sunlight and Incandescent lights

Total Number of Respondents - 42

based on studies done by Hershberger (1970) involving the meaning of architecture and Flynn and Spencer (1977) involving the effects of light source color on user impression and satisfaction. These studies both used a semantic differential to measure attitudes. Combined, the studies provided 46 separate semantic responses. Hershberger reports his results separated into three factors; space evaluation, organization, and potency. Flynn and Spencer report their findings in five factors; evaluative, clarity, spaciousness, complexity-novelty, and miscellaneous. This writer grouped these factors together where there was an overlap of semantics and came up with three dimensions; space evaluation, complexity, and clarity. These dimensions were be used to determine the attitudes of the respondents.

### Item Analysis

An item analysis was performed from a pre-test group consisting of 27 people who work in the departments of Foods and Nutrition, and Clothing, Textiles and Interior Design at Kansas State University. This group was predominately female, with ages ranging from 22 to 70. The item analysis was used for each of the three dimensions; space evaluation, complexity, and clarity. Eight statements were originally aimed at each of the three dimensions. In each dimension the individual items were correlated with the total to determine the contribution of the items to the total score reliability. In the dimension of complexity, the corrected odd even reliability was .66 and all of the individual items were above .46. In this case all eight items remained on the questionnaire. In the dimension of space evaluation, the corrected odd even reliability was .62. In this case the lowest item correlation of .22 was deleted and the cor-

rected odd even reliability rose to .75. The other seven items remained in this dimension on the questionnaire. In the dimension of clarity, the corrected odd even reliability was .26. In this case the two lowest correlations of .29 and .25 were deleted and the corrected odd even reliability rose to .75. The six items remaining in clarity were used in the questionnaire. The questionnaire was then compiled and coded according to the items listed in Table 2.

### Methods of Analysis

Two analyses were performed on the data collected. For the lighting conditions, a one-way multivariate analysis of variance was performed. Multivariate analysis is a procedure for summarizing, representing, and analyzing multiple quantitative measurements obtained on a number of individuals. In the one-way multivariate analysis, response measures are simultaneously obtained for each subject. This test is used to find the differences among several treatments where the subjects are randomly assigned to the treatments (Timm, 1975, p. 369). In this case the treatments are the lighting conditions and the multiple quantitative measurements are obtained by the attitude scale.

For the biographical data, a one-way multivariate analysis of covariance was performed. The covariates are fixed observed variables; in this case they are the biographical data. Analysis of covariance is used so that environmental effects are eliminated from the estimates of the treatment effects, with the result that these estimates are more accurate (Cochran and Cox, 1957, p. 82). The lighting conditions are the environmental effects that are controlled for and the attitude scale is the treatment administered.

Table 2  
 Numbering of Questions and Coding of Positive Responses

Questions	Positive Response
1. This room appears to be large.	strongly agree
2. This room makes me feel relaxed	strongly agree
3. This room appears to be cheerful.	strongly agree
4. This room appears to be a public space.	strongly agree
5. This room feels secluded.	strongly disagree
6. This room appears to be beautiful.	strongly agree
7. This room appears to be ordinary.	strongly disagree
8. This room appears to be frustrating.	strongly disagree
9. This room appears to be cluttered.	strongly agree
10. This room appears to be confining.	strongly disagree
11. This room appears to be stimulating.	strongly agree
12. This room appears to be orderly.	strongly agree
13. This room appears to be complex.	strongly agree
14. This room appears to be functional.	strongly agree
15. This room appears to be straightforward.	strongly agree
16. The atmosphere in this room appears to be hazy.	strongly disagree
17. The light in this room appears to be bright.	strongly agree
18. This room appears to be subdued.	strongly disagree
19. The objects in this room appear to be distinct.	strongly agree
20. This room appears to be visually warm.	strongly agree
21. This room appears to be colorless.	strongly disagree

Note. Responses: 5 = high 1 = low

strongly agree agree neutral disagree strongly disagree

For both the MANOVA and the MANOCOVA an assumption was made, which was that the data was normally distributed. The data were not normally distributed however. The data were averaged and averages tend to be more normally distributed than the actual data. Since the data are not normally distributed, the F statistic is said to be approximate rather than exact. This is not of major concern because the F statistic is known to be robust against non-normality ie., it performs well even when the data is not normally distributed (Kleinbaum and Kupper, 1978, p. 44).

Both the MANOVA and the MANOCOVA analyses were performed using the Statistical Analysis System (Barr, Goodnight, Sall and Helwig, 1976).

## CHAPTER 4

### FINDINGS and DISCUSSION

#### Analysis of Lighting Conditions

##### Findings of the One-Way Analysis of Variance

The initial findings of this study showed that the dimension of Clarity was the only dimension which changed significantly between lighting conditions. The other two dimensions, Space Evaluation and Complexity, showed no significant difference at the .05 level.

The differences were determined by a multivariate one-way analysis of variance test for the hypothesis of no overall lighting condition effect. This test compared the lighting conditions using four separate MANOVA tests for significance, these were Roy's maximum root criteria, Pillai's trace, Hotelling-Lawley trace and Wilks' criterion. For the dimension of Clarity all four MANOVA tests showed significance at the .05 or .01 level. For Space Evaluation and Clarity there was no significant difference at the .05 level on any of the four tests. The results of the MANOVA tests are shown in Tables 3, 4, and 5. Even though all four are standard tests for the multivariate analysis of variance, they are not equivalent statistics and may yield different results. Roy's maximum root criterion analyzes the greatest characteristic root of the matrix and is best used for large differences in the F values. Pillai's trace used the sum of the diagonal of the matrix and has the greatest power of the four tests to distinguish small differences. Hotelling-Lawley trace used the sum



Table 3

One-Way Analysis of Variance for Lighting Conditions  
and the Dimension of Space Evaluation

			F value	p value		
Hotelling-Lawley Trace			1.0	0.45		
Pillai's Trace			0.99	0.46		
Wilks' Criterion			0.99	0.46		
Roy's Maximum Root Criterion			6.39			

attitude statement	degrees of freedom	mean squared	F value	p value	standard deviation
1	model 2 error 115	1.99 0.57	5.47	0.03*	0.76
2	model 2 error 115	1.33 0.47	2.97	0.06	0.69
3	model 2 error 115	0.72 0.50	1.43	1.43	0.71
4	model 2 error 115	0.02 0.64	0.03	0.97	0.80
5	model 2 error 115	0.62 0.55	1.12	0.33	0.74
6	model 2 error 115	0.18 0.58	0.31	0.73	0.76
7	model 2 error 115	0.88 0.64	1.37	0.26	0.80

Note.

\* significant at .05 level

\*\* significant at .01 level

Table 4

One-Way Analysis of Variance for Lighting Conditions  
and the Dimension of Complexity

			F value	p value		
Hotelling-Lawley Trace			1.08	0.38		
Pillai's Trace			1.09	0.36		
Wilks' Criterion			1.08	0.37		
Roy's Maximum Root Criterion			5.78			

attitude statement	degrees of freedom	mean squared	F value	p value	standard deviation
8	model 2 error 115	1.05 0.50	1.79	0.17	0.76
9	model 2 error 115	0.22 0.79	0.28	0.75	0.89
10	model 2 error 115	1.25 0.59	2.11	0.12	0.77
11	model 2 error 115	1.28 0.42	3.02	0.05	0.65
12	model 2 error 115	0.36 0.53	0.68	0.51	0.73
13	model 2 error 115	0.57 0.63	0.90	0.41	0.71
14	model 2 error 115	0.15 0.19	0.81	0.45	0.45
15	model 2 error 115	0.16 0.36	0.46	0.63	0.60

Note.

\* significant at .05 level

\*\* significant at .01 level

Table 5

One-Way Analysis of Variance for Lighting Conditions  
and the Dimension of Clarity

			F value	p value	
Hotelling-Lawley Trace			2.63	0.0027**	
Pillai's Trace			2.44	0.005**	
Wilks' Criterion			2.54	0.0038**	
Roy's Maximum Root Criterion			15.32**		

attitude statement	degrees of freedom	mean squared	F value	p value	standard deviation
16	model 2 error 115	2.73 0.84	3.24	0.0426*	0.916
17	model 2 error 115	6.98 0.67	10.36	0.0001**	0.821
18	model 2 error 115	0.196 0.593	0.33	0.72	0.77
19	model 2 error 115	0.10 0.58	0.18	0.83	0.76
20	model 2 error 115	0.036 0.43	0.08	0.91	0.658
21	model 2 error 115	2.73 0.67	4.07	0.02*	0.82

Note.

\* significant at .05 level

\*\* significant at .01 level

of the roots as a test criterion. Wilk's criterion, which is the oldest test, is a generalized likelihood ratio principle.

The three dimensions and the items that make them up were also looked at in correlation to each other. Table 6 gives the correlations between dimensions showing each dimension's correlation to each other. The dimensions of Space Evaluation and Clarity show the highest correlations. Tables 7, 8, and 9 give correlations between and within each dimension by items. These show the highest item correlations to be within the dimension.

Even though Clarity was the only dimension found to be significantly different for the lighting conditions by the multivariate analysis of variance, these correlations show that Clarity cannot be singled out and looked at alone. The other dimensions also have an effect on the lighting condition differences.

#### Comparison of Lighting Conditions

In order to determine the differences between the lighting conditions, the mean scores for each question were averaged together by dimension to yield an average response. The average responses for each dimension under each lighting condition are given in Table 10. The scores range from one to five on each question, with five being the most positive condition. The lighting condition with the highest average responses is considered to be the most positive, while the lowest average response indicates the least positive condition. The highest averages are shown to be under lighting condition C, and the lowest averages are under condition B. This determined the most positive lighting condition according to the questions asked by the researcher and the researcher's interpreta-

Table 6

Correlations of Total Scores for Dimensions

	Space Evaluation	Complexity	Clarity
Space Evaluation	1.00	0.40	0.56
Complexity	0.40	1.00	0.39
Clarity	0.56	0.39	1.00

Note. All correlations were significant at the .0001 level

Table 7

Correlations of Dimension Items to the Total Score  
for Space Evaluation

Space Evaluation Items		Complexity Items		Clarity Items	
large	0.48***	frustrating	0.47***	hazy	0.40***
relaxed	0.48**	cluttered	-0.21*	bright	0.39***
cheerful	0.57***	confining	0.32**	subdued	0.22*
public	0.34**	stimulating	0.35***	distinct	0.17
secluded	0.45***	orderly	0.33**	visually warm	0.38***
beautiful	0.52***	complex	-0.12	colorless	0.30**
ordinary	0.59***	functional	0.19		
		straightforward	0.16		

Note.

\* significant at the .05 level

\*\* significant at the .01 level

\*\*\* significant at the .001 level

Table 8

Correlations of Dimension Items to the Total Score  
for Complexity

Space Evaluation Items		Complexity Items		Clarity Items	
large	0.15	frustrating	0.47***	hazy	0.22*
relaxed	0.24*	cluttered	0.26	bright	0.22*
cheerful	0.43***	confining	0.49***	subdued	0.11
public	0.10	stimulating	0.30**	distinct	0.32**
secluded	0.12	orderly	0.37***	visually warm	0.24**
beautiful	0.22*	complex	0.20*	colorless	0.17*
ordinary	0.12	functional	0.37***		
		straightforward	0.43***		

Note.

\* significant at the .05 level

\*\* significant at the .01 level

\*\*\* significant at the .001 level

Table 9

Correlations of Dimension Items to the Total Score  
for Clarity

Space Evaluation Items		Complexity Items		Clarity Items	
large	0.40**	frustrating	0.48***	hazy	0.75***
relaxed	0.27*	cluttered	-0.28*	bright	0.60***
cheerful	0.52***	confining	0.37***	subdued	0.42***
public	-0.13	stimulating	0.26**	distinct	0.53***
secluded	0.20*	orderly	0.40***	visually warm	0.40***
beautiful	0.40***	complex	-0.30**	colorless	0.52***
ordinary	0.32**	functional	0.18*		
		straightforward	0.21*		

Note.

\* significant at the .05 level

\*\* significant at the .01 level

\*\*\* significant at the .001 level



Table 10

Scores for Lighting Condition by Attitude Dimension

		Mean	Standard Deviation	Average Response
Space Evaluation	A	23.27	2.55	3.32
	B	23.03	2.85	3.29
	C	24.54	2.40	3.49
Complexity	A	26.90	2.11	3.34
	B	27.11	1.64	3.38
	C	27.68	1.80	3.46
Clarity	A	19.87	2.87	3.27
	B	18.95	2.66	3.16
	C	20.87	2.41	3.46

**Note.**

A - sunlight only

B - incandescent light only

C - sunlight and incandescent lights

tion of what was considered a positive answer. The researcher's direction of coding was shown in Table 2. As a check, each participant was asked which lighting condition he preferred at the end of the experiment. These results are given in Table 11, with the majority favoring lighting condition C.

### Illumination Characteristics of Lighting Conditions

Since lighting condition C was rated most positive by the attitude questionnaire and most preferred by the respondents, the illumination characteristics of Condition C will be considered to be the most desirable characteristics. Condition C was measured to have the highest illumination level and brightness ratio. The measurements for color temperature and room contrast ratio were neither the highest or lowest for the three lighting conditions. The measurements are shown in Table 12.

Lighting condition B received the lowest average responses for each dimension in Table 10, therefore condition B was analyzed for the least desirable illumination characteristics. Condition B measured the lowest illumination and brightness ratio, also the lowest color temperature and room contrast ratio. Photographic representation of the three lighting conditions is shown in Figure 4.

## Analysis of Biographical Data

### Findings of the One-Way Analysis of Covariance

A one-way multivariate analysis of covariance was used to test for effects of the biographical data on the attitude scale dimensions after they had been adjusted for lighting conditions. For Space Evaluation, the items of sex, age, and amount of reading were significant at the .05 level. More significant was the item asking whether the respondents had

Table 11  
Respondent Preference for Lighting Conditions

Lighting Condition	No. of Responses	Percentage of Response
A - Sunlight only	8	19%
B - Incandescent lights only	9	21.5%
C - Sunlight and Incandescent lights	25	59.5%

Note.

Total no. of responses = 42

**Table 12**  
**Record of Illumination Characteristics for**  
**Each of the Lighting Conditions**

Lighting Conditions	Illumination Characteristics			
	footcandles	brightness ratio	room contrast ratio	degrees Kelvin
A	100	1:3.1	1:400	5,000
B	50	1:2.7	1:40	3,000
C	120	1:3.3	1:250	4,000

**Note.**

Brightness ratio = the ratio between footlamberts. Footlamberts were determined by the formula, footcandles X reflectance factor. The reflectance factors used were 32% for the table surface and 99% for the questionnaire paper.

A = sunlight only

B = incandescent lights only

C = sunlight and incandescent lights

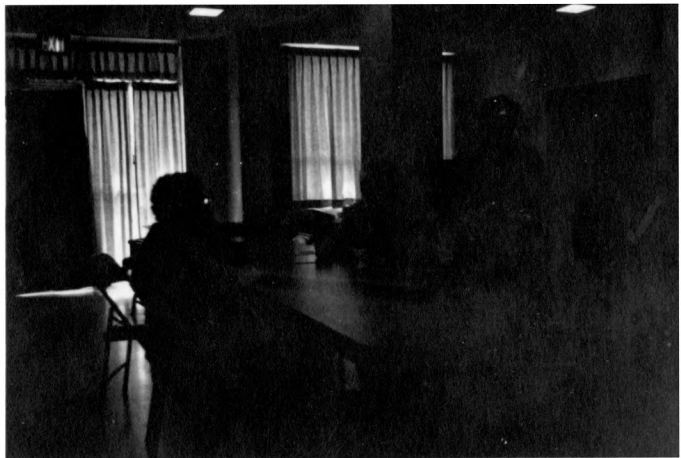
Figure 4

Photographs of the Community Room Taken for Each of the Three Lighting Conditions with Controlled Photography.

Lighting Condition A



Lighting Condition B



Lighting Condition C



problems with their eyesight. This proved significant at the .01 level. These results are shown in Tables 13, 14, and 15.

For Complexity, the items of age and respondents' rating of their own eyesight showed significance at the .05 level. For Clarity, problems with eyesight was significant at the .05 level. Table 16 shows the distribution of biographical data. Since two factors, age and problems with eyesight, are significant in two categories, these are the factors considered to have the most bearing on the answers given by the respondents. These two factors are related to each other and explained in the literature review of this thesis. This finding helps substantiate the case made by this thesis; that special consideration needs to be given for illuminating the environment for older people.

#### Discussion of Covariates

The covariates used were the six biographical questions recorded. The first question of wearing glasses showed no significance since 90% of the respondents wore glasses most of the time. The other five questions did show significant difference under one or more of the attitude dimensions. These covariates were analyzed according to the individual items which also showed significance as shown in Tables 13, 14, and 15.

The second question, self rating of eyesight, showed significance under Complexity. Those who rated their eyesight better than most found the room to be more frustrating, while those who rated their eyesight worse than most found the room to be more cluttered and more stimulating.

Question three, problems with eyesight, showed significant difference under Space Evaluation and Clarity. Those who said they had no problems with their eyesight found the room larger, more cheerful and less public.

Table 13

One-Way Analysis of Covariance for Biographical Data and  
the Dimension of Space Evaluation

attitude statement	degrees of freedom	mean squared	F value	p value	standard deviation
1	model 8 error 93	1.53 0.54	2.83	0.007**	0.74
2	model 8 error 93	0.51 0.35	1.45	0.18	0.59
3	model 8 error 93	1.32 0.40	3.26	0.0026**	0.64
4	model 8 error 93	1.37 0.58	2.34	0.026**	0.76
5	model 8 error 93	0.73 0.47	1.54	0.15	0.69
6	model 8 error 93	0.74 0.52	1.42	0.20	0.72
7	model 8 error 93	0.69 0.64	1.08	0.38	0.80
B1	Wearing glasses		1.20	0.31	
B2	Rating of eyesight		1.19	0.32	
B3	Problems with eyesight		3.71	0.0016**	
B4	Amount of reading		2.26	0.0368*	
B5	Age		2.71	0.0136*	
B6	Sex		2.77	0.0120*	

**Note.**

\* significant at .05 level

\*\* significant at .01 level

Table 14

One-Way Analysis of Covariance for Biographical Data and  
the Dimension of Complexity

attitude statement	degrees of freedom	mean squared	F value	p value	standard deviation
8	model 8 error 94	1.25 0.54	2.32	0.025*	0.73
9	model 8 error 94	1.66 0.62	2.68	0.01**	0.79
10	model 8 error 94	0.63 0.48	1.31	0.25	0.70
11	model 8 error 94	1.50 0.34	4.46	0.0001**	0.58
12	model 8 error 94	0.36 0.47	0.76	0.64	0.69
13	model 8 error 94	0.34 0.62	0.55	0.82	0.79
14	model 8 error 94	0.25 0.16	1.57	0.14	0.40
15	model 8 error 94	0.19 0.36	0.54	0.82	0.60
B1	Wearing glasses		0.76	0.64	
B2	Rating of eyesight		3.06	0.004**	
B3	Problems with eyesight		1.30	0.25	
B4	Amount of reading		0.71	0.68	
B5	Age		3.52	0.0014**	
B6	Sex		0.86	0.55	

Note.

\* significant at .05 level

\*\* significant at .01 level



Table 15

One-Way Analysis of Covariance for Biographical Data and  
the Dimension of Clarity

attitude statement	degrees of freedom	mean squared	F value	p value	standard deviation
16	model 8 error 93	2.42 0.70	3.45	0.0016**	0.84
17	model 8 error 93	2.60 0.62	4.19	0.0003**	0.79
18	model 8 error 93	0.40 0.54	0.74	0.66	0.74
19	model 8 error 93	0.99 0.55	1.79	0.09	0.74
20	model 8 error 93	0.28 0.37	0.77	0.63	0.61
21	model 8 error 93	0.95 0.64	1.48	0.17	0.80
B1	Wearing glasses		1.44	0.21	
B2	Rating of eyesight		0.62	0.72	
B3	Problems with eyesight		2.16	0.05*	
B4	Amount of reading		0.75	0.61	
B5	Age		1.58	0.16	
B6	Sex		1.11	0.36	

**Note.**

\* significant at .05 level

\*\* significant at .01 level

Table 16

## Biographical Data Response

Question	Number	Percentage
<b>Wearing Glasses</b>		
Never	0	0
Part time	4	.10
Most of the time	38	.90
<b>Rating of Eyesight</b>		
Worse	3	.07
Average	24	.57
Better	15	.36
<b>Problems with Eyesight</b>		
No	26	.62
Yes	13	.31
<b>Reading</b>		
Seldom	9	.21
Occasionally	12	.29
Often	19	.45
<b>Age</b>		
60-70	6	.14
71-80	22	.53
81-90	14	.33
<b>Sex</b>		
Male	9	.21
Female	33	.79

Note. 42 total respondents

Those who reported problems with their eyesight found it hazier and dimmer.

Question four, amount of reading or close work done, showed significance under Space Evaluation. Those who read often found the room to be larger, less cheerful and more public.

The question of age, number five, showed significance under Space Evaluation and Complexity. The older respondents found the space to be larger, more public and more cheerful. The younger respondents found it less frustrating, more cluttered and less stimulating.

Question six differentiated between sex and showed significance under Space Evaluation. The female respondents found the space to be larger, more cheerful and less public.

#### Background Data Reported by the Respondents

The first page of the biographical questionnaire asked some background information of the respondents. It was found from this information what activities these people used the community room for and what activities they would like to have in a different type of room. The room was said to be used for all of the activities listed in the questionnaire, but the most overwhelming response was for meals. The activities they would like to see in a different type of room were those involving a small group, card playing and exercise. The room they described for these activities was smaller and more private, with fewer windows than the community room. It seems that a room of this type is needed in the building, but the recommendations for a separate room are outside the scope of this thesis.

Almost all of the respondents used the community room over two hours a day and were pleased with the community room. Also, most of them

were from the area closely surrounding Clay Center, Kansas.

## Discussion and Conclusions

### Review of Objectives

The objectives as listed in the first chapter of this thesis are as follows:

- 1) To determine what the attitudes of older adults are toward illumination characteristics in a social setting.
- 2) To determine which lighting characteristics are preferred by the participants for this setting.
- 3) To propose design recommendations for the lighting in the setting studied.

We know what the attitudes of the respondents are toward the three lighting conditions presented, and we know which lighting condition they preferred. To determine their attitudes and preferences of illumination characteristics, the lighting conditions were analyzed for their differences in illumination characteristics. Table 12 showed the illumination characteristics of each condition as measured by the researcher.

### Explanation of Findings

We know that the change in lighting conditions only affected the dimension of clarity, and did not affect the other two dimensions. The reason for this is not known, however, there are several factors which could have contributed to this finding. First, the relationship of lighting to clarity seems to be the most obvious. The terms used for clarity, which were hazy, bright, subdued, distinct, visually warm, and colorless, are commonly used to describe lighting conditions. The terms

used for space evaluation and complexity are not normally used to describe lighting.

The second factor that may have affected the outcome is that the people were seated in one place while the lighting conditions were changed. Because of this, the terms in the dimension of complexity, could not be experienced. The terms of frustrating, cluttered, confining, stimulating, orderly, complex, functional, and straightforward, are used to describe a behavior setting. This room was not being used as a behavior setting at the time of the study, but rather as a space observed by the respondents.

As for speculation on why the dimension of space evaluation did not change, there are two possibilities. One is that there was not enough of a change between the lighting conditions to be noticeable in the terms of large, relaxed, cheerful, public, secluded, beautiful, and orderly. This could be a factor, although the illumination characteristic measurements did show a noticeable difference. The explanation that seems more realistic is that these people were so familiar with this space that they did not look at it anew for each lighting condition. Rather, they marked their mental attitude toward the room which had been developing since they first used the space. The reason for this explanation is based on observations made by the researcher.

The reason for lighting condition C, sunlight and incandescent light, to be the most preferred on both the attitude scale and the direct question must be based on more than just the illumination characteristics. The characteristics of lighting condition C are, a high illumination level of 120 footcandles, a moderate brightness ratio of 1:3.3, a room contrast

ratio of 1:250, which is high, but not the highest one presented, and a color temperature that is a combination of white light and warm colored light. Condition A, sunlight only presented white light, while Condition B, incandescent light only, presented warm colored light. Since these are compared to the least favorable lighting condition of incandescent light only, a few conclusions can be drawn: 1) a high illumination level was acceptable, 2) a brightness ratio of 1:3 is acceptable, 3) a moderate room contrast ratio is acceptable, and 4) a combination of yellow and white light is acceptable.

The measurements tell us some facts about the lighting conditions, but they are probably not the whole answer. The major disadvantage of sunlight only is probably in the fact that it had the highest room contrast ratio. This would make comfortable light-dark adaptation difficult to achieve. The major disadvantage of incandescent light only is probably in the low illumination level. There was also a lower brightness ratio and room contrast ratio, but they were a result of the low illumination level. Another reason why this may have been the least preferred condition could be the fact that the drapery was covering the windows. Not only did it block out the sunlight, but it also blocked the view. One way to determine if the view was a factor would be to do another study using windows without a view such as clerestories.

### Design Recommendations

The design recommendations are based on the analysis of lighting conditions for illumination characteristics and one comment that was repeated by several of the participants. The comment was, "I like the

sunlight, but I can't sit facing the window because of the glare." This is an important comment since the preferred lighting condition included sunlight. Therefore, a solution is needed to reduce the glare and still allow for the sunlight.

The other problems to be solved are those of lighting condition B. These consist of a low illumination level, a low brightness level, and a low color temperature. As noted in the literature review, as people age, the lens of the eye becomes yellow. A low color temperature indicates a warm color, usually considered yellow or orange. This color of light serves to worsen the problem of an aged lens. Going to the opposite end of the color temperature chart would give a blue color. However, this would not be recommended since this room is largely used for meals. The combination of blue and yellow, green, is not considered an appetizing color. A white light would be the solution here.

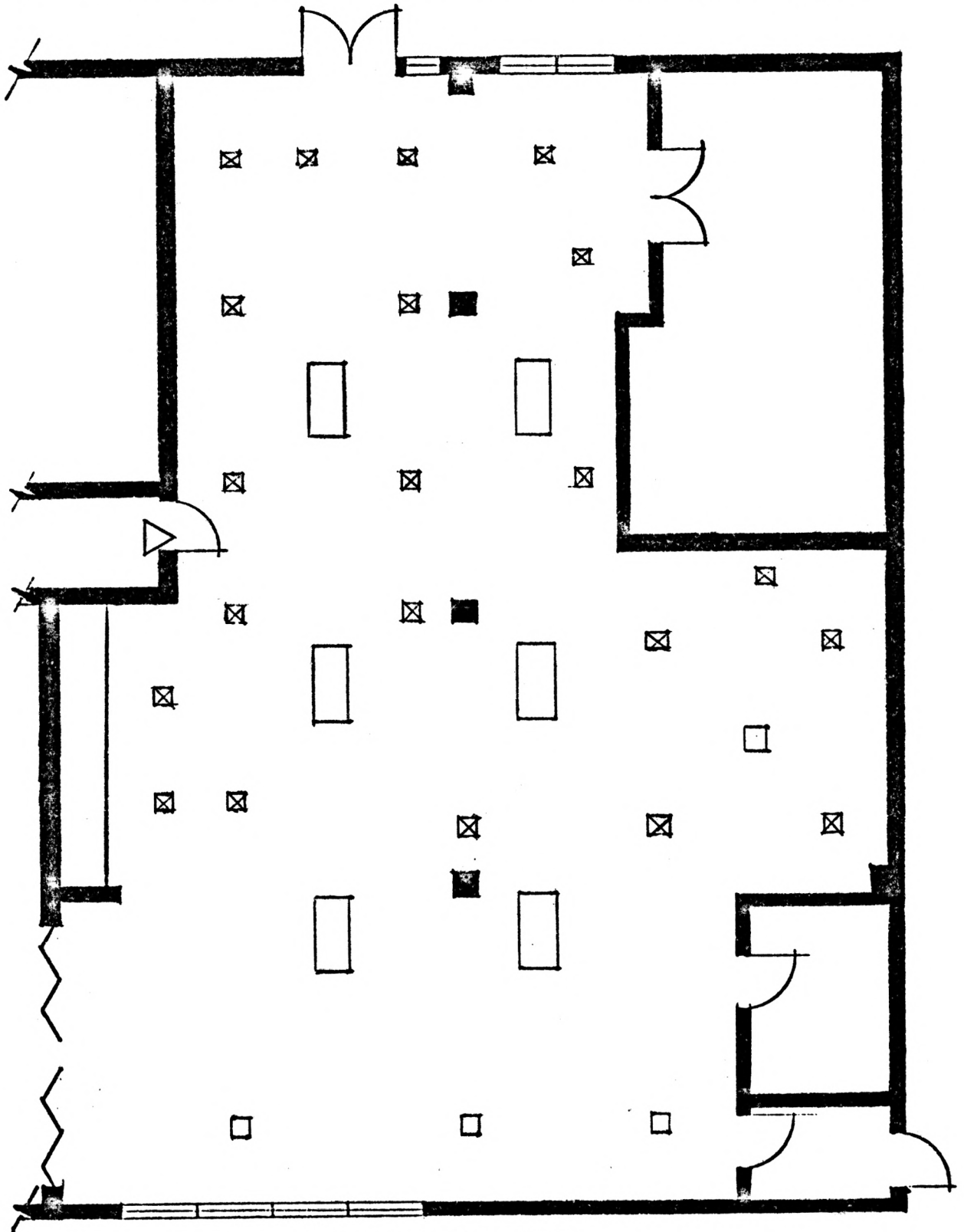
The design recommendations for the community room of Apollo Towers are as follows:

- 1) Install additional lighting between the existing incandescent light fixtures. This should be a white light which can be from a fluorescent white bulb as shown in Figure 5.
- 2) Change the present incandescent lamps to daylight incandescent lamps.
- 3) Filter the sunlight entering the room by using a special glass product, or a window covering that is sheer enough to still admit the sunlight.

Although these recommendations are specifically for this setting, the preferences for illumination characteristics found in this study may

Figure 5

Floor Plan with Existing and Proposed Light Fixtures Shown in Location



SCALE 1/8" = 1' 0"

⊠ Existing Light Fixtures

□ Proposed Light Fixtures



apply to the older adult population as a whole. This conclusion cannot be made until more studies of this type have been done.

### Implications of This Study

This study has attempted to partially fill a gap in the literature of age related to behavior. Behavior was not looked at specially, though attitudes toward illumination through an environmental context were. Since lighting is an important aspect of behavior in the environment, it is hoped that this study will be used to others studying behavior of older adults.

Future research in this area is needed in order to validate this study and get a more complete idea of what older adults attitudes are toward illumination characteristics. This study was performed in one setting at one time of day and it is very possible that a different setting, population, or time of day might have altered the findings.

Another possibility for future research lies in the redevelopment of the attitude scale. The attitude dimensions and items used in this study were based on items and factorial groupings shown valid in tests by Hershberger (1970) and Flynn and Spencer (1977). Those tests used a young adult population while this study used an older adult population. In the opinion of this researcher, it is very possible that the dimensions of Space Evaluation and Complexity did not show significance because either the items were not properly grouped by dimension for this population, or the items under these two dimensions were not as easily understood by the participants as those items under Clarity. In any future research of this type the attitude semantics should be checked to be sure they are thoroughly understood by the respondents.

This study was based on the man-environment theories' assumption that the physical environment can be a constraint directly or indirectly affecting the opportunity for an individual or group to satisfy their basic human needs. The basic human need was to receive visual information from the environment. The respondents indicated that information relating to clarity did change according to the constraints of the environment ie., lighting conditions. Therefore, the assumption stands as it was stated.

Since the attitude dimensions used in this study were based on a study performed by Robert Hershberger, it is important to compare the findings of this study to the findings of his prior study. Hershberger's study was titled "A Study of Meaning and Architecture" and his first objective was "to determine if the physical attributes of buildings can be considered to constitute a 'code' capable of communicating an architect's 'intentions' to the users of his buildings." This thesis has also been concerned with communication but through the specific physical attribute of illumination.

Hershberger's study found that the same dimensions of connotative meaning were extracted for all his respondents groups and concluded "there is no fundamental reason why the physical attributes of buildings should not be considered to constitute a 'code' capable of use to communicate an architect's 'intentions' to the users of his buildings." He goes on to suggest that architectural students be taught how "forms, spaces, and the like are interpreted by layman, as well as architects, so that they can consciously manipulate them in such a way as to successfully communicate with both groups."

This thesis found that the communication through the lighting changed for one dimension, but not for the other two. The respondents were sensi-

tive to the dimension of Clarity, but were not sensitive to changes in Space Evaluation or Complexity when the lighting was altered. These findings support Hershberger's conclusion, but suggest that it is possible to put too much emphasis on the communication power of architectural elements. Since the dimensions of Space Evaluation and Complexity did not show a difference under the three lighting conditions, it is possible that too much credit was given to architectural communication in this specific instance. This is not saying that lighting does not communicate information about environmental complexity or spatial evaluation but rather, that it does not always communicate information about the environment.

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## **APPENDIX**

### **MEASUREMENT INSTRUMENT**

## INFORMED CONSENT AGREEMENT

## Purposes and Procedures of the Study

The purpose of this study is to determine what the attitudes of older adults are toward various lighting characteristics. To do this I would like to have you compare the three lighting conditions presented to you. By marking your answers to the statements on the questionnaire for each lighting condition, you will help me to determine what the differences are. The lighting conditions presented to you will be these three:

A - sunlight only

B - incandescent lights only

C - sunlight and incandescent lights

Please mark an answer to every question. The last page will ask for some information about yourself. Your name will not be attached to the questionnaire at any time. This information will only be used for the analysis of this study.

I, \_\_\_\_\_, have carefully read or listened to and fully understand the procedures and purposes of this study. I am aware that I can ask questions or terminate my involvement in this study at any point. I willingly agree to participate.

Date \_\_\_\_\_

Name \_\_\_\_\_



UNDER EACH STATEMENT PLEASE CIRCLE THE RESPONSE YOU AGREE WITH MOST

THIS ROOM APPEARS TO BE LARGE.

strongly agree    agree    neutral    disagree    strongly disagree

THIS ROOM APPEARS TO BE FRUSTRATING.

strongly agree    agree    neutral    disagree    strongly disagree

THE ATMOSPHERE IN THIS ROOM APPEARS TO BE HAZY.

strongly agree    agree    neutral    disagree    strongly disagree

THIS ROOM MAKES ME FEEL RELAXED.

strongly agree    agree    neutral    disagree    strongly disagree

THIS ROOM APPEARS TO BE CLUTTERED.

strongly agree    agree    neutral    disagree    strongly disagree

THE LIGHT IN THIS ROOM APPEARS TO BE BRIGHT.

strongly agree    agree    neutral    disagree    strongly disagree

THIS ROOM APPEARS TO BE CHEERFUL.

strongly agree    agree    neutral    disagree    strongly disagree

THIS ROOM APPEARS TO BE CONFINING.

strongly agree    agree    neutral    disagree    strongly disagree

THIS ROOM APPEARS TO BE A PUBLIC SPACE.

strongly agree    agree    neutral    disagree    strongly disagree

THIS ROOM APPEARS TO BE STIMULATING.

strongly agree    agree    neutral    disagree    strongly disagree

THIS ROOM APPEARS TO BE SUBDUED.

strongly agree    agree    neutral    disagree    strongly disagree

THIS ROOM FEELS SECLUDED.

strongly agree      agree      neutral      disagree      strongly disagree

THIS ROOM APPEARS TO BE ORDERLY.

strongly agree      agree      neutral      disagree      strongly disagree

THE OBJECTS IN THIS ROOM APPEAR TO BE DISTINCT.

strongly agree      agree      neutral      disagree      strongly disagree

THIS ROOM APPEARS TO BE BEAUTIFUL.

strongly agree      agree      neutral      disagree      strongly disagree

THIS ROOM APPEARS TO BE COMPLEX.

strongly agree      agree      neutral      disagree      strongly disagree

THIS ROOM APPEARS TO BE VISUALLY WARM.

strongly agree      agree      neutral      disagree      strongly disagree

THIS ROOM APPEARS TO BE FUNCTIONAL.

strongly agree      agree      neutral      disagree      strongly disagree

THIS ROOM APPEARS TO BE COLORLESS.

strongly agree      agree      neutral      disagree      strongly disagree

THIS ROOM APPEARS TO BE ORDINARY.

strongly agree      agree      neutral      disagree      strongly disagree

THIS ROOM APPEARS TO BE STRAIGHTFORWARD.

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THIS ROOM APPEARS TO BE STRAIGHTFORWARD.

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BIOGRAPHICAL QUESTIONNAIRE

Your identity will be kept completely anonymous.

What activities do you use the community room in this building for?

meals \_\_\_\_\_ meetings \_\_\_\_\_ exercise \_\_\_\_\_  
coffee hour \_\_\_\_\_ to see friends \_\_\_\_\_  
to get out of your apartment \_\_\_\_\_ others \_\_\_\_\_

Please mark which activities you think would be more comfortable in a different type of room.

meals \_\_\_\_\_ meetings \_\_\_\_\_ exercise \_\_\_\_\_  
coffee hour \_\_\_\_\_ seeing friends \_\_\_\_\_  
getting out of your apartment \_\_\_\_\_ others \_\_\_\_\_

How would you describe the room for these activities? (circle or comment)

activity 1 \_\_\_\_\_ (fill in activity you checked above)

large - small                      many windows - few windows or none  
open - secluded                    elegant - plain  
bright - dim                        simple - complex

\_\_\_\_\_

activity 2 \_\_\_\_\_ (fill in activity you checked above)

large - small                      many windows - few windows or none  
open - secluded                    elegant - plain  
bright - dim                        simple - complex

\_\_\_\_\_

Do you enjoy using the community room?

sometimes \_\_\_\_\_ all the time \_\_\_\_\_ seldom \_\_\_\_\_

How much time do you spend in the community room each day?

less than 30 minutes \_\_\_\_\_ approximately two hours \_\_\_\_\_  
 approximately one hour \_\_\_\_\_ more than two hours \_\_\_\_\_

How long have you lived in this building? \_\_\_\_\_

Where did you live most of your life?

what state \_\_\_\_\_ which city \_\_\_\_\_  
 what county \_\_\_\_\_ farm or rural \_\_\_\_\_

Do you wear glasses?

For what reason?

no \_\_\_\_\_ Part of the time \_\_\_\_\_ Most of the time \_\_\_\_\_

How would you rate your eyesight compared to others your age?

worse than most \_\_\_\_\_ about average \_\_\_\_\_ better than most \_\_\_\_\_

Do you have any problems with your eyesight? no \_\_\_\_\_ yes \_\_\_\_\_

What are your problems? \_\_\_\_\_

Do you read or do close handwork often?

very often \_\_\_\_\_ occasionally \_\_\_\_\_ seldom \_\_\_\_\_

What is your age please? 60 - 70 \_\_\_\_\_ 81 - 90 \_\_\_\_\_

71 - 80 \_\_\_\_\_ 91 or more \_\_\_\_\_

Are you male \_\_\_\_\_ or female \_\_\_\_\_?

This is the end. Thank you for responding.

If you have any questions about this study please ask them.



ATTITUDES OF OLDER ADULTS TOWARD ILLUMINATION CHARACTERISTICS  
IN A SOCIAL SETTING

by

EVELYN EVERETT KNOWLES

B. S., Kansas State University, 1975

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AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARCHITECTURE

Department of Architecture

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

1979

This thesis investigates the attitudes of older adults toward illumination characteristics in a social setting. The attitudes were determined by presenting three different lighting conditions to older adults, obtaining their attitudes, and then measuring the lighting conditions for their illumination characteristics.

The study was undertaken with the following objectives: 1) to determine what the attitudes of older adults are toward illumination characteristics in a social setting; 2) to determine which lighting characteristics are preferred for this setting by the participants of the study; and 3) to propose design recommendations for the lighting in the setting studied.

The rationale for this study is based on the man-environment relationship. The man-environment relationship is seen as a general theory concerning the determinates of human behavior. Competence/Environmental Press is a part of man-environment relations, but is specifically concerned with the competency of the person in relation to the environment. These theories support the assumption of this thesis; that people have different visual needs as they become older in order to carry on their normal activities in an environmental setting.

Attitude scales composed of statements were developed to attain the attitudes of the respondents. The statements were aimed at the environment in the dimension of space evaluation, complexity, and clarity. These items were submitted for each of the three lighting conditions to a group of respondents between the ages of 60 and 90. A biographical questionnaire accompanied the attitude scales.

Clarity was the only environmental category that showed a significant difference between the three lighting conditions. The attitudes

were determined to be most favorable toward the same lighting condition that the respondents preferred. This condition, which was a combination of sunlight and incandescent light, was then analyzed for illumination characteristics.

The conclusions were: 1) the illumination level preferred was high, 2) the brightness ratio preferred was medium, 3) the color temperature preferred was a combination of white light and warm colored light, and 4) the room contrast ratio preferred was of a medium to high contrast. From these conclusions design recommendations for the setting were made. These included increasing the illumination level in the room, changing the color of the light from yellow to white, and filtering the sunlight to reduce glare.