OBJECTIVE INDICATORS TO PREDICT PLEASANTNESS OF LIVING ROOM

by

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Major Professor

TABLE OF CONTENTS

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LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Man had discovered the beginning of wisdom - he had created a roof that was more than a shelter - it was a home - his home. He had felt the need to be creative, to experience some kind of environmental mastery (St. Marie, 1973). Erich-fromm (1963) describes it as the need to feel the creator, to transcend the passive role of being created, to express individuality.

During its life span to date, the human factors discipline has largely been connected with the design of equipment, facilities and environments as related to work activities. However, the basic approach of human factors is equally applicable to a wide spectrum of other areas - to the design of all other man-made features of our total life space, toward the possible improvement of the overall quality of human life. The quality of life is in large part, our involvement with broad and ill-defined spectrum of various features or aspects of our total living environment.

An important ingredient in the living environments of people consists of the various buildings they use - homes, offices, factories, public buildings, schools, churches, etc. In this regard, there is an increasing awareness on the part of architects and others of the impingement of architectural design on the behavior and reactions and attitudes of people.

The design and arrangement of buildings and related facilities and of furniture and other items within them define the physical space within which people live and they can have a very distinct effect on people's behavior, comfort, emotions, and other subjective reactions. The concepts of personal space, territoriality, and defensible space all represent reasonable human values that should be respected, and that therefore should be provided for in architectural design and in the arrangement of physical facilities and features within the living space of individuals.

The role of home as an environment for human growth is a significant one. It has the potential to support human life in a meaningful way, influencing the development and behavior of individuals and families and their quality of life. Some aspects of architectural design and arrangement of living space do in fact influence the extent to which the personal space of individuals can be preserved, and it is a challenge to some of the traditional concepts about planning the interior of homes. Psychologists are now finding that a monotonous environment, which deprives the senses of stimulation, can be harmful to mental health (Marie, 1973). The brain needs sensory intake and stimulation for optimum development just as the body needs food for growth.

The living room today fulfills many functions. It must be planned for many activities formerly associated with the parlor, salon, drawing room or library. The family uses it as a common

meeting place and in it they receive friends in either a formal or an informal manner. It is used for reading, game-playing, lounging, home-study, music and television, conversation, working, bookkeeping and other purposes. It must be flexible both for parents and children; arranged for father to interview business acquaintances, mother to receive club guests, daughter to romance and the young people to roll back the rug and rollick to the latest rock-dance rythms (Ward, 1968).

The main objective of this study is to discover the nature of people's subjective reactions to a space, in particular aesthetic pleasantness and to develop a set of objective indicators to predict the pleasantness of living rooms. Aesthetic pleasantness is a multi-dimensional criterion and has a very wide meaning. The Semantic Differential Technique will be used to solve this problem.

The Semantic Differential Technique is the most widely used technique in the study of subjective responses to architectural stimuli. The method was developed by Osgood et al. (1957) and used widely as a technique in behavioral and environmental research.

Semantic Differential Technique

The Semantic Differential as a technique is essentially a combination of controlled association and scaling procedures. The subject is provided with a concept to be differentiated and a set of bipolar adjectival scales against which he has to

indicate, for each item (pairing of a concept with a scale), the direction of his association and its intensity on a seven-step scale. The crux of the method lies in selecting the sample of descriptive polar terms. Ideally, the sample should be as representative as possible of all the ways in which meaningful judgments can vary, and yet be small enough in size to be efficient in practice.

The notion of using polar objectives to define the termini of semantic dimensions grew out of research on synesthesia with Theodore Karwoski and Henry Odbert (1934) at Dartmouth College. Synesthesia is defined by Warren (1963) in his Dictionary of Psychology as "a phenomenon characterizing the experiences of certain individuals, in which certain sensations belonging to one sense or mode attach to certain sensations of another group and appear regularly whenever a stimulii of the latter type occurs". The series of researches by Karwoski, Odbert, and their associates, however, related synesthesia to thinking and language in general. The regular photistic visualizers varied among themselves as to the modes of translation between sound and vision and as to the vividness of their experiences, and their difference from the general population seemed to be one of degree rather than kind. Whereas fast, exciting music might be pictured by the synesthete as sharply etched, bright red forms, his less imaginative brethren would merely agree that words like "red hot", "bright", and "fiery", as verbal metaphors, adequately described the music. A slow

melancholic selection might be visualized as heavy, slow-moving "blobs" of somber hue and be described verbally as "heavy", "blue", and "dark". The relation of this phenomenon to ordinary metaphor is evident. A happy man is said to feel "high", a sad man "low"; the pianist travels "up" and "down" the scale from treble to bass; souls travel "up" to the good place and "down" to the bad place; hope is "white" and despair is "black".

Interrelationships among color mood and musical experiences were studied more analytically be Odbert, Karwoski, and Eckerson (1942). Subjects first listened to ten short excerpts from classical selections and indicated their dominant moods by checking sets of adjectives. On a second hearing they gave the names of colors that seemed appropriate to the music. The colors were found to follow the moods created by the music. Delius' On Hearing the First Cuckoo in Spring was judged leisurely in mood and predominantly green in color. A portion of Wagner's Rienzi Overture was judged exciting or vigourous in mood and predominantly red in color. When another group of subjects were merely shown the mood adjectives and asked to select appropriate colors, even more consistent relations appeared.

It seems clear from these studies that the imagery found in synesthesia is intimately tied up with language metaphor, and that both represent semantic relations. Karwoski, Odbert, and Osgood (1942) summarized this work with the statement that

the process of metaphor in language as well as in color-music synthesia can be described as the parallel alignment of two or more dimensions of experience, definable verbally by pairs of polar adjectives with translations occuring between equivalent portions of the continua.

A semantic space can be defined as a region of some unknown dimensionality and euclidian in character. Each semantic scale defined by a pair of polar adjectives is assumed to represent a straight line function that passes through the origin of this space, and a sample of such scales then represents a multidimensional space. The larger or more representative the sample, the better defined is the space as a whole. To define the semantic space with maximum efficiency, one would want to determine 'that minimum number of orthogonal dimensions or axes' which would exhaust the dimensionality of the space. In practice, one is satisfied with as many such independent dimensions as can be identified and measured reliably. The logical tool to uncover these dimensions is fact or analysis.

The essential operation of this measurement is the successive allocation of a concept to a series of descriptive scales defined by polar adjectives, these scales selected so as to be representative of the major dimensions along which meaningful processes vary. When a subject judges a concept against a series of scales, e.g.,

FATHER

Happy	1	2	3	4	5	6	7
Hard	1	2	3	4	5	6	7
Slow	1	2	3	4	5	6	7

each judgment represents a selection among a set of given alternatives and serves to localize the concept as a point in the semantic space. The larger the number of scales and the more representative the selection of these scales are, the more validly does this point in the space represent the meaning of the concept. By semantic differentation, then, is meant as the allocation of a concept to a point in the multidimensional semantic space by selection from among a set of given scaled semantic alternatives.

The semantic differential is a highly generalizable technique of measurement which must be adapted to the requirement of each research problem to which it is applied. There are no standard concepts and no standard scales, rather, the concepts and scales used in a particular study depend upon the purposes of the research. A method is objective to the extent that the operations of measurement and means of arriving at conclusions can be made explicit and reproducible. The semantic differential yields quantitative data which are verifiable, in the sense that other investigators can apply the same sets of scales to equivalent subjects and essentially obtain the same result. The means of arriving at results, from the collection of checkmarks on scales to the location of concept points on the

semantic space, are completely objective. The individual judge's data dealt with in semantic measurement are essentially subjective and all that is done is to objectify expressions of these subjective states.

One of the most important requirements of the semantic approach is representative sampling. Then the purpose of using factor analysis is to discover the "natural" dimensionality of the semantic space, the system of factors which together account for the variance in meaningful judgments. It is important that the sample be as free from bias as possible. The factor analysis method results in a matrix of coordinates (loadings) for each variable on a set of dimensions (factors) which are othogonal to each other. Each dimension coincides with a variable chosen as pivot. The higher the loading of a variable on a dimension, the more closely related is that variable with the dimension.

Semantic Differential and Designed Spaces

The most substantial research in the area of architectural design, using this approach of study, has been accomplished by Vielhauer (1965), Canter (1968), Craik (1968), Collins (1969), Briltell (1969), and Hershberger (1972). These studies were mostly of exteriors of buildings. Most of these studies were reviewed by Collins and Seaton (1972). There was noteworthy agreement between all of the above researchers on the first dimension or factor, which was labelled as "aesthetic evaluation".

This factor had substantial loadings of such scales like pleasant, cheerful, colorful, comfortable, sparkling, bright, impressive, elegant, gay, etc. A second factor, which was labelled as "physical organization" was also found to be common among all the researchers. It had substantial loadings of such scales like neat, orderly, tidy, organized, clean, etc.. A third, space factor was evident for four of the researchers with loadings of such scales like roomy, large, wide, flexible, spacious, open, etc.. A friendliness factor was evident for four researchers and carried loadings of such scales like beautiful, attractive, soft, friendly, welcome, happy, joyful, etc.. A potency factor was also evident for three researchers with loadings of such scales like rough, course, rugged, strong, etc.. Five strong dimensions of architectural meaning are now well established, namely, 1) aesthetic evaluation, 2) physical organization, 3) space or size, 4) friendliness, and 5) potency.

Most of these studies have used representations rather than the actual environment models, slides and drawings have been used as representations of actual environments. For time, money, efficiency, and ease of analysis, investigations and evaluation of human responses to environmental arrays have often used representations of the environment rather than the actual environment. Howard et al. (1972) compared the people's responses to real and represented environments. Three groups of subjects were asked to evaluate four different rooms on twenty-

eight semantic scales. The first group visited each of the four rooms and evaluated them. The second group evaluated color slides of these four rooms and the third group evaluated black-white slides of these rooms. Through, there was striking similarity between the two slide conditions, the affective responses elicited by group 1 (actual environment) was not significantly different from the other two groups. When a researcher uses representation to study human responses, he selects and reproduces those properties of the environment that he believes are salient in eliciting some particular aspect of the user behavior. The advantages of using representations of the actual environments are considerable if it can be made sure that the conclusions generalize to the real environment.

Objective Indicators

Architects, if they are to serve mankind well, must improve their abilities to predict accurately and consistently, how people will comprehend and use the buildings which they design, before they are even constructed. The semantic differential appears to offer possibilities in this regard. Specifically, the architect must obtain reliable and valid information about the relationships between the formal properties and attributes of what he designs and the thoughts, feelings, attitude, and behaviors which they tend to evoke. To design new environments which will maximally benefit the occupants or users, the architect must know which aspects or attributes of the

physical environment cause which thoughts, feelings, attitudes, or behaviors as a minimum. The semantic differential technique is general enough to apply to many environments and respondent groups with a degree of accuracy capable of useful interpretation.

The crux of all these studies, however, is in predicting pleasantness from the objective indicators. The semantic scaling devices should give the interior designer or architect valid information which he does not have presently or cannot readily obtain by traditional observation and interviewing methods. The factors or objective indicators analyzed, enables him to predict better how people will comprehend and use his buildings before they are even constructed. Specifically, what the architect obtains from these objective indicators is reliable and valid information about the relationships between the formal properties and attributes of what he designes and the thoughts, feelings, attitudes and behaviors which they tend to evoke. In other words, these objective indicators offer some kind of guidelines to the architect in his architectural design.

A study of lighting quality was made by Hopkinson and Watson (1970) using the semantic-factoring approach. They provided the lighting designer with a set of physical parameters or indicators, which if optimized will ensure that the resulting lighting design has that quality he desires.

An office study was made by Bennett (1975) and Chitlangia (1975), in which they developed a set of objective indicators

to predict the pleasantness of office rooms. They used the semantic differential to study people's subjective reactions to office rooms. Color slides of 30 different office rooms shown to a group of 30 judges, who evaluated them on a series of 14 semantic scales. Also physical measurements and observations were made on those 30 different office rooms. They had 43 variables which included the measurements, observations and the 14 semantic scales. Factor analysis was used to extract independent factors from the data. They reported twelve factors to predict the pleasantness of office rooms.

The first factor reported was an 'evaluation factor' which was also evident in previous studies. This factor carried substantial loadings of subjective judgment scales like pleasant, colorful, neat, textured, interesting, contemporary, friendly, organized and bright and indicated more wall area, barrier (between the occupant and visitor) and drapes. The second factor was a'size and crowding' factor indicating more volume, more wall area, more window area and the crowding seen from loadings of more furniture floor area, and a greater number of furniture pieces. The third one was a 'bright and new' factor with loadings of more window area and recently redecorated offices. The fourth factor reported was a 'crowding'factor with loadings of more furniture floor area and a high furniture to floor area. Also more built-ins and more window area carried substantial loadings indicating a crowding effect. The fifth

factor was a 'decorative' factor indicating a good wall treatment and wall reflectance makes the office look better. Also picture and supplementary light carried substantial loadings.

The sixth factor reported was a 'furnishing' factor indicating that a traditional furniture style is favoured. The seventh factor was 'occupant's choice' indicating that the occupant prefers to have plants and barrier between him and the visitor. The eighth factor did not seem to explain much. The ninth factor reported was 'occupants judgment of pleasantness'. The occupant judged an office to be pleasant which has more or larger windows, good wall reflectance and has a barrier between the occupant and the visitor. The tenth factor reported was a 'brightness' factor indicating that an office room with more or larger windows and a good wall reflectance is very bright and lighted. The eleventh factor reported was a 'neat and organized' factor which was also evident in previous studies. This factor carried loadings of such scales like light, neat, organized, private, and simple. The twelth factor was a 'color' factor indicating the colors yellow, green or a combination of these two makes the office look more friendly as opposed to the colors red, blue, purple or their combinations.

Thus twelve factors were reported to predict the pleasantness of office rooms. The present study is a similar type of study, involving living rooms.

PROBLEM

The primary objective of this study is to discover the nature of people's subjective reactions to a space, in particular the aesthetic pleasantness and to develop a set of objective indicators to predict the pleasantness of living rooms. In other words, to develop a set of objective indicators which will enable an architect or interior designer to predict better how people will comprehend and use his buildings, before they are even constructed. Specifically, what the architect obtains from these objective indicators is reliable and valid information about the relationships between the formal properties and attributes of what he designs and the thoughts, feelings, attitudes and behaviors they tend to evoke.

METHOD

In this study, color slides of thirty living rooms of thirty different homes were shown to twenty-one subjects who evaluated them on 15 semantic scales. Also, physical measurements and observations were taken. There are thirty-seven variables in this study, comprising of, the physical measurement, observations and the fourteen semantic scales for a particular living room. The data generated, is a 37 x 30 matrix, shown in Appendix 1. The data was factor analyzed, and seven independent factors or dimensions were extracted.

Tasks

From the 31,293 persons listed in the Manhattan, Kansas telephone directory, 140 persons were picked in a random sample. A letter, as shown in Figure 1, was sent, requesting permission to let the researcher take measurements, observations and a picture of the living room. Out of the 140 persons, only 120 could be reached and 33 persons agreed to participate in the study. Thirty living rooms were used in the study. A telephonic confirmation was made and a convenient appointment fixed for the visit. The researcher, accompanied by an assistant and a professional photographer, visited each of the 30 different homes, according to the scheduled appointments.

Various measurements, observations, and judgments were made as shown in Table 1. These physical measurements and observations are potential objective indicators in predicting the

KANSAS STATE UNIVERSITY
DEPARTMENT OF INDUSTRIAL ENGINEERING
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MANHATTAN, KANSAS 66506

March 10, 1976

To

I am a graduate student in the Department of Industrial Engineering at Kansas State University. I am doing research on the pleasantness of living rooms. For this, I need to take a color photo and make measurements of a variety of living rooms. This will later be rated by judges. I would appreciate it if you would let me take a picture of your living room and also measure its dimensions. I will contact you by telephone in the next few days to arrange an appointment convenient to you, if you would like to participate in the study.

Thank you very much.

Sincerely yours,

S. Krishna

Figure 1. Letter

Table 1. List of Measurements, Observations and Judgments.

Measurements	
Length	ft.
Breadth	ft.
Ceiling Height	ft.
Illumination Level	fc.
Wall Reflectance	--
Floor Area	$ft.^2$
Window Area	$ft.^2$
Furniture Floor Area	$ft.^2$

Observations	
Drapes	Yes/No
Pictures	Nos.
Art Objects	Nos.
Plants	Nos.
Furniture Style	Traditional/Contemporary/Modern
Recreational Facilities	TV _____ Stereo _____ Piano_____ etc. (Nos.)
Carpet: Wall to Wall	More than half / Less than half / None

Table 1. (continued)

Research: Visitors' Judgments								
V. dirty	1	2	3	4	5	6	7	V. clean
V. un-pleasant	1	2	3	4	5	6	7	V. pleasant
Unneat	1	2	3	4	5	6	7	V. neat
V. bad	1	2	3	4	5	6	7	V. good

pleasantness of the living room. A form, as shown in Figure 2, was used to elicit the judgments of the occupant. A color photopraph, using the existing light was also taken. Individual judgments by the 3 research visitors were made on cleanliness, pleasantness, neatness and the condition of the room.

Judgment Procedure

The color slides were presented to judges according to the order of the visit. The 21 judges recorded their judgments on the 15 semantic scales. The list of semantic scales are as shown in Table 2. Each judge was provided with a booklet containing 30 such sheets to record his judgments. The scale used is a seven-point scale defining the extremities of an adjective, describing the display. For example,

terribly organized	1	2	3	4	5	6	7	Excellently organized

the 1 to 7 scale is defined as:

1. terribly organized
2. very poorly organized
3. poorly organized
4. fairly well organized
5. well organized
6. very well organized
7. excellently organized.

Variables

There are 37 variables in this living room study.

OCCUPANTS' FORM

Identification No.

Address:

i) Number of family members _____

ii) The year the house was built _____

iii) The year you moved here _____

iv) How many years ago was the living room re-decorated? _____

v) Your judgment of pleasantness

1	2	3	4	5	6	Very pleasant 7

Thank you very much for participating in this study.

Figure 2. Occupant's Form

Table 2. List of Semantic Scales.

				average				
unpleasant	1	2	3	4	5	6	7	pleasant
tidy	1	2	3	4	5	6	7	untidy
open	1	2	3	4	5	6	7	closed
private	1	2	3	4	5	6	7	public
traditional	1	2	3	4	5	6	7	contemporary
crowded	1	2	3	4	5	6	7	spacious
cheerful	1	2	3	4	5	6	7	sad
bright	1	2	3	4	5	6	7	dull
drab	1	2	3	4	5	6	7	colorful
uninteresting	1	2	3	4	5	6	7	interesting
complex	1	2	3	4	5	6	7	simple
friendly	1	2	3	4	5	6	7	unfriendly
orderly	1	2	3	4	5	6	7	messy
distant	1	2	3	4	5	6	7	intimate
plain	1	2	3	4	5	6	7	textured

These consist of the physical measurements and observations which constitute the objective measures and the 15 semantic scales as the subjective measures. The list of variables is as shown in Table 3. The dimensions of the room were first measured and the following were calculated from them, namely, floor area, volume, and window area. The number of furniture pieces were counted and furniture floor area was calculated from them. The illumination level was measured at the center of the room. A count was taken on the number of pictures, art objects and the recreational facilities like television, piano, stereo, etc. The wall reflectance was calculated from the wall luminance. The following information was gotten from the occupant, namely, age of house, years since redecorated and the occupant's judgment of pleasantness. The furniture style was catagorized as traditional, contemporary, and modern. Carpeting was classified as none, less than half, more than half and wall to wall. The researchers on-the-spot judgments on the cleanliness, pleasantness, condition and neatness were combined as an overall researchers judgment. A preliminary analysis was made on the data. It was found that the scales tidy-untidy and orderly-messy were highly correlated and as a result these variables were combined by taking their means and reduced to a tidy-orderly scale. In another correlation analysis between the 21 judges for the pleasant-unpleasant scale, it was found that seven deviated much from the mean. It was decided to eliminate the data of these seven judges from the overall

TABLE 3. List of Variables in the Study.

Variable Number	Variable Name
Objective Indicators	
1	Floor area
2	Volume
3	Window area
4	Furniture floor area
5	# of furniture pieces
6	Carpet
7	Pictures
8	Plants
9	Illumination level
10	Wall reflectance
11	Age of building
12	Years before redecorated
13	Occupant's judgment of pleasantness
14	Furniture style
15	Recreational facilities
16	Art objects
17	Slide luminance
18	Length
19	Breadth

Table 3. (continued)

Variable Number	Variable Name
20	Height
21	Width to length
22	Furniture area to floor area
Judgments	
23	Unpleasant-pleasant
24	Open-closed
25	Private-public
26	Traditional-contemporary
27	Crowded-spacious
28	Cheerful-sad
29	Bright-dull
30	Drab-colorful
31	Uninteresting-interesting
32	Complex-simple
33	Friendly-unfriendly
34	Distant-intimate
35	Plain-textured
36	Overall judgment of researchers
37	Tidy-orderly

data, to achieve better results. In another preliminary analysis, it was found that there was a high correlation between the judgments of the three research visitors on the four scales used, and hence it was decided to combine the judgments of the three research visitors on these four scales. This was labelled as "overall researchers judgment".

Judges

As noted, out of the 21 judges who participated in the study, the data of fourteen judges was used. Most of the judges were housewives. Each judge was provided with a booklet containing 30 sheets, each sheet having the 15 semantic scales. Instructions, as shown in Figure 3 were given to the judges. The mean of the fourteen judges, for a particular scale of a particular living room was taken as the datum.

Instructions

On the following pages are a number of pairs of words separated by numbers, for example:

unimpressive 1 2 3 4 5 6 7 impressive

(average)

You will be shown a series of slides of living rooms. When the first slide is shown, write down its identification in the upper right-hand corner of the page where it says "Identification _____", for example, "14". Now look at the slide. Based strictly on what you personally feel about the particular office from the slide, judge it on each scale (pair of words). For example, if you thought it was average in impressiveness, circle the "4". If you thought it was extremely unimpressive, circle the "1", and so on. Judge on every scale for the first living room. Then when the next slide is presented, write down its identification on the next page and judge it on every scale. There are 30 living rooms in all.

Thank you very much for being a subject for this study.

Figure 3. Instructions

RESULTS

The raw data constitute a 37 x 30 matrix shown in Appendix 1. The floor area ranged from 90 to 475 sq. feet. The window area ranged from 6 to 120 sq. feet. The illumination level ranged from 25 to 100 fc. On the following pleasantness scale:

1 terrible
2 very poor
3 poor
4 fair
5 good
6 very good
7 excellent

Occupants gave their living rooms an above average rating of "good" with only one "very poor" and ten "excellent". This agreed with the research visitors' overall judgment. Other judgments were tightly packed in the middle categories.

The intercorrelations among the 37 variables are shown in Table 4. A principal components factor analysis was carried out on the matrix intercorrelations using the BMD03M factor analysis computer program (1965). The resulting factor matrix, after orthogonal rotation, is shown in Table 5. In the rotated factor matrix, a loading of 0.35 has been shown. These seven factors have been labelled according to the combination of variables they comprise.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
1	1.00																																				
2	0.95	1.00																																			
3	0.56	0.73	1.00																																		
4	0.44	0.64	0.75	1.00																																	
5	0.23	0.26	0.17	0.52	1.00																																
6	0.12	0.10	0.08	0.04	0.18	1.00																															
7	0.28	0.19	0.14	0.05	0.19	0.08	1.00																														
8	0.11	0.07	0.16	0.02	0.28	0.17	0.01	1.00																													
9	0.38	0.53	0.67	0.77	0.49	0.03	0.07	0.11	1.00																												
10	0.19	0.27	0.28	0.20	0.13	0.43	0.14	0.05	0.25	1.00																											
11	0.23	0.14	0.09	0.12	0.11	0.18	0.37	0.15	0.16	0.12	1.00																										
12	0.13	0.05	0.19	0.13	0.00	0.05	0.12	0.19	0.30	0.06	0.07	1.00																									
13	0.25	0.24	0.25	0.15	0.37	0.16	0.04	0.17	0.17	0.41	0.29	0.01	1.00																								
14	0.15	0.17	0.01	0.06	0.26	0.34	0.20	0.21	0.19	0.31	0.12	0.20	0.11	1.00																							
15	0.40	0.41	0.23	0.02	0.03	0.13	0.17	0.30	0.13	0.32	0.35	0.07	0.31	0.22	1.00																						
16	0.58	0.57	0.28	0.39	0.23	0.07	0.25	0.27	0.33	0.13	0.05	0.05	0.01	0.12	0.12	1.00																					
17	0.10	0.02	0.02	0.03	0.10	0.04	0.45	0.01	0.07	0.34	0.01	0.03	0.18	0.07	0.11	0.06	1.00																				
18	0.79	0.77	0.36	0.36	0.28	0.08	0.42	0.10	0.38	0.18	0.33	0.10	0.34	0.24	0.48	0.42	0.13	1.00																			
19	0.70	0.73	0.56	0.49	0.31	0.04	0.09	0.19	0.28	0.22	0.03	0.09	0.36	0.12	0.27	0.38	0.11	0.48	1.00																		
20	0.47	0.51	0.33	0.23	0.38	0.23	0.30	0.24	0.19	0.27	0.12	0.04	0.17	0.33	0.22	0.25	0.13	0.59	0.40	1.00																	
21	0.23	0.20	0.07	0.00	0.01	0.00	0.24	0.29	0.19	0.01	0.27	0.14	0.03	0.16	0.19	0.18	0.23	0.63	0.31	0.28	1.00																
22	0.10	0.12	0.46	0.51	0.50	0.01	0.17	0.08	0.60	0.04	0.13	0.32	0.03	0.08	0.20	0.10	0.00	0.07	0.10	0.01	0.14	1.00															
23	0.48	0.46	0.24	0.25	0.20	0.02	0.32	0.15	0.19	0.24	0.17	0.06	0.29	0.23	0.14	0.31	0.17	0.51	0.30	0.32	0.21	0.09	1.00														
24	0.20	0.32	0.59	0.32	0.02	0.11	0.25	0.34	0.40	0.18	0.09	0.45	0.39	0.13	0.05	0.01	0.23	0.14	0.42	0.15	0.19	0.20	0.13	1.00													
25	0.14	0.23	0.39	0.27	0.03	0.38	0.15	0.37	0.36	0.03	0.19	0.42	0.07	0.19	0.07	0.10	0.24	0.05	0.38	0.20	0.23	0.17	0.26	0.56	1.00												
26	0.23	0.17	0.04	0.06	0.37	0.16	0.53	0.16	0.10	0.12	0.18	0.02	0.03	0.33	0.07	0.24	0.28	0.26	0.16	0.49	0.12	0.02	0.10	0.08	0.09	1.00											
27	0.15	0.21	0.34	0.05	0.17	0.09	0.22	0.14	0.11	0.17	0.06	0.43	0.26	0.01	0.11	0.08	0.34	0.14	0.32	0.17	0.11	0.04	0.05	0.77	0.44	0.01	1.00										
28	0.42	0.43	0.23	0.21	0.31	0.08	0.21	0.16	0.20	0.32	0.15	0.23	0.40	0.08	0.23	0.15	0.01	0.41	0.37	0.21	0.08	0.03	0.76	0.18	0.15	0.09	0.09	1.00									
29	0.21	0.27	0.26	0.14	0.14	0.00	0.17	0.10	0.12	0.25	0.06	0.24	0.42	0.37	0.30	0.12	0.23	0.23	0.35	0.12	0.03	0.03	0.15	0.44	0.18	0.31	0.18	0.59	1.00								
30	0.40	0.35	0.04	0.02	0.19	0.03	0.21	0.06	0.01	0.37	0.02	0.32	0.39	0.02	0.30	0.07	0.01	0.48	0.30	0.27	0.19	0.25	0.70	0.01	0.18	0.17	0.08	0.84	0.52	1.00							
31	0.51	0.49	0.24	0.26	0.38	0.01	0.37	0.21	0.26	0.19	0.13	0.21	0.29	0.06	0.21	0.32	0.23	0.51	0.34	0.32	0.18	0.01	0.89	0.02	0.20	0.12	0.21	0.85	0.24	0.77	1.00						
32	0.39	0.32	0.01	0.18	0.38	0.06	0.46	0.05	0.09	0.05	0.03	0.43	0.12	0.01	0.16	0.18	0.27	0.33	0.27	0.09	0.03	0.05	0.61	0.30	0.34	0.10	0.51	0.70	0.19	0.67	0.82	1.00					
33	0.25	0.18	0.10	0.02	0.29	0.04	0.45	0.10	0.03	0.01	0.16	0.40	0.06	0.15	0.01	0.23	0.38	0.23	0.01	0.11	0.16	0.09	0.73	0.35	0.52	0.19	0.50	0.69	0.02	0.62	0.84	0.81	1.00				
34	0.03	0.01	0.19	0.01	0.21	0.29	0.42	0.04	0.01	0.08	0.06	0.41	0.07	0.04	0.04	0.12	0.35	0.08	0.18	0.00	0.21	0.01	0.50	0.55	0.62	0.15	0.70	0.52	0.08	0.39	0.63	0.76	0.83	1.00			
35	0.49	0.45	0.14	0.15	0.27	0.05	0.33	0.16	0.13	0.31	0.01	0.18	0.29	0.16	0.15	0.30	0.15	0.50	0.35	0.35	0.18	0.12	0.87	0.04	0.21	0.05	0.13	0.83	0.21	0.82	0.89	0.74	0.78	0.60	1.00		
36	0.46	0.45	0.40	0.35	0.32	0.12	0.01	0.27	0.41	0.22	0.14	0.26	0.44	0.15	0.09	0.33	0.04	0.38	0.48	0.32	0.01	0.12	0.55	0.49	0.19	0.26	0.39	0.26	0.11	0.20	0.36	0.12	0.09	0.10	0.40	1.00	
37	0.29	0.28	0.28	0.12	0.17	0.08	0.12	0.26	0.21	0.17	0.02	0.37	0.47	0.04	0.08	0.18	0.04	0.34	0.32	0.41	0.12	0.01	0.27	0.52	0.24	0.29	0.66	0.01	0.05	0.05	0.04	0.36	0.19	0.44	0.11	0.70	1.00

TABLE 4. INTERCORRELATIONS BETWEEN VARIABLES

TABLE 5

FACTOR MATRIX

1		2		3	
Evaluation		Newness		Size and Crowding	
Floor area	0.39	Years since redecorated (recently decorated)	-0.56	Volume	0.48
Length	0.37			Window area	0.68
Pleasant	0.88	Occupant's judgment	0.43	Furniture floor area	0.94
Private	0.36	Open	0.67	No. of furniture pieces	0.49
Cheerful	0.88	Spacious	0.78	Illumination level	0.83
Colorful	0.85	Simple	0.41	Furniture to floor area	0.86
Interesting	0.92	Distant (vs intimate)	0.48		
Complex	0.82	Researchers judgment	0.72		
Friendly	0.86	Tidy-orderly	0.91		
Intimate	0.67				
Textured	0.93				
Researchers judgment	0.35				

TABLE 5

FACTOR MATRIX (cont.)

4		5		6	
Traditional Decorative		Contemporary		Modern	
Pictures	0.65	Floor area	0.42	Number of furniture pieces (fewer pieces)	-0.43
Wall reflectance	0.39	Volume	0.42		-0.43
Art objects	0.47	Plants	-0.56	Carpet	0.74
Slide luminance	-0.58	Age of building (newer homes)	-0.58	Wall reflectance	0.57
Height	0.39	Number of recreational facilities	0.68	Furniture style (more modern)	0.77
Traditional	0.78	Length	0.71	Height (low ceiling)	-0.45
Bright	0.54	Width to length (narrow rooms)	-0.70		

TABLE 5

FACTOR MATRIX (cont.)

7	
Size	
Floor area	0.55
Volume	0.54
Window area	0.40
Furniture style (more traditional)	-0.37
Breadth	0.71
Plants	0.38
Open	0.41
Public	0.65
Bright (not dull)	0.46
Distant (not intimate)	0.36

DISCUSSION

Factors

Factors with loadings over 0.35, after orthogonal rotation, are recorded in Table 5. The following factors were extracted.

Evaluation factor. In this factor, nine of the 15 subjective judgments carried substantial loadings. Previous researchers in this area have always found this factor in their studies. In previous studies, this factor was loaded with scales like cheerful, sparkling, colorful, bright, pleasant, etc. In the office study, this factor carried loadings of pleasant, cheerful, bright, etc. and objective measures like more wall area, presence of a barrier (between the occupant and the visitor), and drapes. In this research, this factor carried loadings of nine of the fourteen scales, including pleasant, cheerful, private, colorful, interesting, comples, friendly, intimate, textured and the physical measures indicating more floor area and length. It essentially indicates that a large, long room is aesthetically pleasant and elicits the above reactions. This is also evident from the correlations of floor area and length with pleasantness (0.48, 0.51). Also, these two objective measures are substantially correlated with room cheerfulness and interest (0.42, 0.51; 0.41, 0.51). Another interesting aspect in this factor is that the research visitors judgment carried only a moderate loading and the occupant's judgment none.

Newness factor. This factor carried substantial loadings of subjective scales - simple, open, spacious, distant and a favourable evaluation of recently decorated homes. It also carried substantial loadings of the research visitor and occupant's judgment of the living room, this being on-the-spot evaluation. Also, it carried a high loading of tidy-orderly judgment. A recently decorated room or a room in good shape elicits the reactions reported in this factor. In contrast to the previous factor, this factor carried loadings of both the occupant's judgment and the research visitor's judgment. This essentially indicates that recently decorated rooms were in good condition and elicited favourable responses from both the occupant and the research visitors.

Size and Crowding. This factor carried substantial loadings of volume, window area, furniture floor area, number of furniture pieces, illumination level and the ratio of furniture to floor area. This indicates a large room with a high ceiling, well lighted and having big windows. Greater number of furniture pieces and more furniture floor area are also indicated. A crowding effect is also seen as evident from the substantial loading of furniture to floor area. More window area is associated with more lighting as evident from the substantial correlation (0.67) it has with illumination level. More volume indicates a long, wide room with a high ceiling.

This factor was also noted in the office study and carried substantial loadings of floor area, window area, volume and wall

area indicating a large, wide room. It also carried loadings of furniture floor area, number of furniture pieces indicating the crowding effect. This seems to agree with the factor of this research. Since there is no subjective judgment associated with this factor, it seems that this factor has little impact on the subjective reactions.

Traditional Decorative factor. This factor carried substantial loadings of pictures, wall reflectance, art objects, height and subjective judgments of traditional and brightness. Pictures tend to make the room more traditional as evident from the correlation (0.51) between them. A high ceiling, presumably indicative of house age, is also evident. It also tends to make the room more traditional as evident from the correlation (0.49) between the two. A light wall surface is indicated from the substantial loading of wall reflectance. These objective measures makes the room look bright and traditional. This factor was also reported in the office study and carried loadings of wall reflectance, pictures, supplementary light and was labelled as a decorative factor.

Contemporary factor. This factor carried substantial loadings of floor area, volume, fewer plants, recently built homes, number of recreational facilities, room length and a negative loading of width to length. It indicates a large, long room with a few plants in it. A substantial loading of recreational facilities indicates the presence of television, piano, stereo, etc. in the room. A substantial loading of length and

a negative loading of width to length indicate a long, narrow room. This factor did not carry any subjective reactions. A few homes, out of the 30 studied, might have had these characteristics and features and hence formed an independent group.

Modern factor. This factor carried substantial loadings of fewer furniture pieces, carpeting, wall reflectance, a modern furniture style and a low ceiling height. All these objective measures indicate a living room with fewer furniture pieces, wall-to-wall carpeting, a light wall surface, modern furniture style and a low ceiling height. Again, there are no subjective judgments associated with this factor and hence it does not have any aesthetic impact. It can be said that a few homes out of the 30 studied had these characteristics and features and hence formed an independent group.

Size factor. This factor carried substantial loadings of floor area, volume, window area, plants, traditional furniture style and the subjective judgments, open, public, bright and distant. This indicates a big, wide room having large windows and many plants, with a traditional furniture style. These objective measures make the room look open, public, bright and distant. This factor was evident in most of the previous researches. Vielhauer (1965), Craik (1968), Collins (1969), Brittell (1969) and Hershberger (1972) reported this factor with loadings of scales like big, huge, broad, roomy, high, etc. In the office study, this factor was partially evident as 'size and crowding'. It carried substantial loadings of floor area,

volume, window area, indicating a large, wide room with a high ceiling. This seems to agree with the factor of this study.

These seven factors seemed to be the most interpretable set. As more factors were extracted, they became more specific and less interpretable.

Though an attampt has been made to relate these factors to previous studies, one can find there is no substantial relation. Most of the previous researches did not involve any objective measures, as variables, except the office study where both the objective measures and subjective judgments were used as variables.

Cluster Analysis

Three clusters were chosen for discussion, namely, a size cluster, lighting cluster and the subjective judgments cluster. The first two clusters essentially consist of the size and illumination variables.

Table 6 shows the intercorrelations of the size cluster variables. It is comprised of floor area, volume, length, breadth, and height. The floor area, length, breadth and height are substantially correlated with volume. Hence volume can be considered as a representative size variable.

Table 7 shows the intercorrelations of the lighting variables. This cluster consists of lighting variables like illumination level, wall reflectance, slide luminance, brightness

TABLE 6. SIZE CLUSTER

Variable Name	Floor Area	Volume	Length	Breadth	Height
Floor Area	1.00				
Volume	0.95	1.00			
Length	0.79	0.77	1.00		
Breadth	0.70	0.73	0.48	1.00	
Height	0.47	0.51	0.59	0.40	1.00

TABLE 7

LIGHTING CLUSTER

Variables	Illumination Level	Wall Reflectance	Slide Luminance	Brightness	Window Area
Illumination Level	1.00				
Wall Reflectance	$\bar{0}$.25	1.00			
Slide Luminance	$\bar{0}$.07	$\bar{0}$.34	1.00		
Brightness	$\bar{0}$.12	0.25	$\bar{0}$.23	1.00	
Window Area	0.67	$\bar{0}$.28	0.02	$\bar{0}$.26	1.00

judgment and window area. More window area indicates a well lighted room. There seems to be no relation between the other variables. Slide luminance and bright-dull judgment were taken from the slides whereas wall reflectance and illumination level were measured in the living room. It is clear from these relations that the slides have not truly represented the real lighting measures of the living rooms. This is evident, mainly, from the poor correlation between wall reflectance and slide luminance.

Table 8 shows the intercorrelations between the subjective judgments. A pleasant room is also interesting, cheerful, and textured as evident from the correlations of three variables with pleasantness (0.76, 0.89, 0.87). A spacious room is also open and distant. There seems to be a poor correlation between the overall researchers judgment and other subjective judgments. This again indicates that certain subtle features of the living room are not truly reproduced in the color slide.

Limitations

There are certain limitations of this study. This study was on 30 living rooms with 37 variables and objective data of fourteen judges. In the opinion of some researchers, there should be five times the number of judges and three times the number of stimuli (rooms) as there are variables. So, for 37 variables, there should be at least 185 judges and 111 stimuli or living rooms. Since this could not be achieved, this can be

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TABLE 8

CORRELATIONS BETWEEN SUBJECTIVE JUDGMENTS

Variable	Unpleasant-Pleasant	Open-Closed	Private-Public	Traditional-Contemporary	Crowded-Spacious	Cheerful-Sad	Bright-Dull	Drab-Colorful	Uninteresting-Interesting	Complex-Simple	Friendly-Unfriendly	Distant-Intimate	Plain-Textured	Overall Researcher's Judgment	Tidy-Orderly
Unpleasant-Pleasant	1.00														
Open-Closed	δ.13	1.00													
Private-Public	δ.26	δ.56	1.00												
Traditional-Contemporary	δ.10	δ.08	0.09	1.00											
Crowded-Spacious	0.05	δ.77	0.44	0.01	1.00										
Cheerful-Sad	δ.76	0.18	0.15	δ.09	0.09	1.00									
Bright-Dull	δ.15	0.44	δ.18	δ.31	δ.18	0.59	1.00								
Drab-Colorful	0.70	0.01	δ.18	0.17	δ.08	δ.84	δ.52	1.00							
Uninteresting-Interesting	0.89	δ.02	δ.20	δ.12	δ.21	0.85	0.24	0.77	1.00						
Complex-Simple	δ.61	δ.30	0.34	0.10	0.51	0.70	δ.19	δ.67	δ.82	1.00					
Friendly-Unfriendly	δ.73	δ.35	0.52	0.19	0.50	0.69	0.02	δ.62	δ.84	0.81	1.00				
Distant-Intimate	0.50	0.55	δ.62	δ.15	δ.70	δ.52	0.08	0.79	0.63	δ.76	δ.83	1.00			
Plain-Textured	0.87	0.04	δ.21	δ.05	δ.13	δ.83	0.21	δ.82	0.89	δ.74	δ.78	0.60	1.00		
Overall Researchers' Judgment	0.55	δ.49	0.19	δ.26	0.39	δ.26	δ.11	0.20	0.36	δ.12	δ.09	δ.10	0.40	1.00	
Tidy-Orderly	δ.27	.0.52	δ.24	0.29	δ.66	0.01	0.05	0.05	0.04	δ.36	δ.19	0.44	δ.11	δ.70	1.00

considered as a pilot study and can offer some guidelines for future large scale studies in this area. Also, the sample of living rooms studied is not representative of any definable population. One of the problems the researcher had was a poor response from certain sections of the community. Mainly, the affluent agreed to participate in the study and hence there is a certain amount of bias involved in the sample.

Objective Indicators

The main objective of this study was to discover the nature of people's subjective reactions to a space, in particular aesthetic pleasantness and to develop a set of objective indicators to predict pleasantness of living rooms. The following are the objective measures which might aid the interior designer in designing a living room. A long room with more floor area elicits many favourable reactions like pleasant, friendly, intimate, cheerful, etc. The presence of pictures and art objects make the room look bright and traditional. A light wall surface and a high ceiling also make the room look bright and traditional. A room with big windows and hence more window area make the room look open, bright, and public. A traditional furniture style elicits favourable reactions. Also presence of plants in the room make it look open, bright, etc.

While various details, plants, art objects, carpets do tend to beautify a living room, the compensatory models of factor and correlation analysis applied to all data are probably

inappropriate. Having art objects will not necessarily make a living room pleasant. Not having art objects does not guarantee lack of pleasantness. Having art objects is somewhat correlated with living room pleasantness. Pleasantness is a disjunctive condition. That is, a space can be pleasant if A, or if B, or if C or if A, B, C are present. This is the main implication of correlation analysis.

Though the objective indicators mentioned earlier do help the interior designer, some of them seem to be out of his field. For example, floor area as an objective indicator usually cannot be manipulated by the interior designer. Pictures and art objects in the room may depend on the likings of the occupant rather than the interior designer. This is one of the main limitations of these objective indicators for the designer.

Further Studies

1. A similar type of study done on a large-scale involving more number of living rooms, more objective measures and more judges.

2. Studies to determine objective indicators to predict pleasantness of other spaces such as public meeting places, study rooms, lecture halls, auditoriums.

3. A study to predict the reactions to surfaces like floor surfaces, wall surfaces, table surfaces, etc.

CONCLUSIONS

1. Seven factors or dimensions have been found to predict the pleasantness of living rooms.

2. A long room with more floor area elicits general, favourable reactions like pleasant, friendly, cheerful, intimate, etc.

3. The presence of pictures and art objects makes the living room look more traditional and bright. A light wall surface and a high ceiling also makes the room look more traditional and bright.

4. A traditional furniture style elicits favourable reactions.

5. A living room with big windows and plants makes it look open, bright and public.

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APPENDIX - 1

DATA MATRIX

LIST OF VARIABLES IN THE STUDY

Variable Number	Variable Name
Objective Indicators	
1	Floor area
2	Volume
3	Window Area
4	Furniture floor area
5	# of furniture pieces
6	Carpet
7	Pictures
8	Plants
9	Illumination level
10	Wall reflectance
11	Age of building
12	Years before redecorated
13	Occupant's judgment of pleasantness
14	Furniture style
15	Recreational facilities
16	Art objects
17	Slide luminance
18	Length
19	Breadth

LIST OF VARIABLES IN THE STUDY (continued)

Variable Number	Variable Name
20	Height
21	Width to length
22	Furniture area to floor area
Judgments	
23	Unpleasant-pleasant
24	Open-closed
25	Private-public
26	Traditional-contemporary
27	Crowded-spacious
28	Cheerful-sad
29	Bright-dull
30	Drab-colorful
31	Uninteresting-interesting
32	Complex-simple
33	Friendly-unfriendly
34	Distant-intimate
35	Plain-textured
36	Overall judgment of researchers
37	Tidy-orderly

LIVING ROOMS

VARIABLES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	204	405	255	405	247	204	418	120	325	216	210	192	204	90	184	475	285	285
2	2112	3045	2168	3424	1976	2032	3344	1395	2600	1728	1680	1536	2112	630	1472	4064	2280	2280
3	50	90	40	72	41	45	120	29	52	27	18	25	24	28	36	88	25	50
4	55	69	41	59	37	46	64	42	41	50	32	46	50	26	43	63	39	61
5	5	9	7	10	7	9	8	6	6	8	4	6	8	4	5	8	7	10
6	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.75	1.00	1.00	1.00	1.00	0.75	0.75
7	1	8	3	4	4	4	4	1	10	4	5	5	2	2	1	3	0	6
8	2	2	0	7	6	3	4	0	4	6	2	2	0	0	0	5	6	4
9	50	35	35	30	30	30	70	35	50	30	20	30	25	20	20	40	20	25
10	0.84	0.80	0.71	0.96	0.62	0.59	0.37	0.72	0.56	0.85	0.88	0.91	0.67	0.72	0.92	0.85	0.11	0.11
11	17	52	42	22	11	19	12	21	51	34	37	10	18	36	24	26	27	24
12	0.25	2.00	11.00	16.00	1.00	7.00	1.50	2.00	3.00	1.00	10.00	2.00	18.00	1.00	1.00	3.50	1.00	10.00
13	4	6	7	4	5	7	7	7	7	6	5	2	7	6	5	6	7	7
14	C	C	T	C	C	C	C	C	C	T	C	C	C	M	M	C	C	C
15	1.0	3	3	1	2	2	3	2	2	2	2	2	2	2	0	3	2	0
16	4	5	1	6	2	5	2	0	2	1	2	0	0	0	0	3	5	2
17	1.1	0.5	12.4	2.5	1.2	2.5	3.1	2.1	2.0	7.1	3.1	3.9	8.0	7.9	7.9	6.0	18.1	2.1
18	22	27	21	19	19	22	23	15	25	18	21	16	22	16	16	25	19	19
19	12	15	13	12	13	13	13	12	13	12	10	12	12	12	12	18	15	15
20	8	9	8	8	8	8	8	7	8	8	8	8	8	8	8	8	8	8
21	0.36	0.55	0.62	0.63	0.68	0.59	0.56	0.80	0.52	0.66	0.47	0.75	0.54	0.75	0.75	0.72	0.79	0.79
22	0.21	0.22	0.16	0.14	0.15	0.18	0.15	0.23	0.13	0.23	0.15	0.24	0.18	0.28	0.23	0.13	0.13	0.21
23	4.21	5.71	4.07	4.57	5.35	5.00	5.71	3.14	5.64	2.57	5.42	3.28	4.78	4.78	4.71	6.07	4.76	5.85
24	3.38	3.38	2.69	3.15	2.84	3.30	3.00	3.00	2.30	2.84	4.23	4.76	3.92	3.92	3.46	1.92	3.07	3.23
25	3.61	3.53	4.00	3.46	4.69	3.76	3.76	3.69	3.84	5.38	3.00	3.92	3.61	3.46	4.15	4.61	4.00	2.46
26	3.76	2.30	2.84	3.46	4.00	5.38	4.00	3.69	2.69	3.92	2.61	3.53	6.00	5.92	4.00	4.30	4.38	2.30
27	3.46	3.15	4.69	2.53	4.15	4.69	4.00	4.38	5.46	4.07	4.07	3.30	2.76	3.84	4.76	6.46	5.23	3.23
28	3.92	3.07	3.69	3.00	3.46	3.38	2.76	4.53	3.30	3.84	3.53	4.46	2.53	3.38	4.15	2.15	3.53	1.84
29	3.53	3.61	1.69	3.92	3.84	2.23	3.30	3.76	3.92	2.76	4.15	4.23	1.84	3.53	5.00	1.84	3.76	2.38
30	3.23	4.38	3.84	4.23	4.61	5.00	5.23	2.84	4.38	3.84	4.61	3.46	6.15	3.53	3.23	5.38	4.84	5.76
31	3.23	5.46	3.30	3.38	5.23	3.92	5.46	1.92	4.76	2.46	5.00	2.46	4.92	3.84	3.15	5.76	3.84	6.15
32	5.69	3.53	5.38	4.15	3.84	4.38	3.15	6.07	4.30	5.15	4.15	5.15	3.38	5.00	5.76	3.46	5.75	2.23
33	4.15	2.92	4.46	4.15	3.30	3.76	3.23	4.01	3.23	4.69	2.69	4.15	3.00	3.15	4.15	3.15	4.07	2.00
34	4.15	4.46	3.00	2.76	4.15	3.38	4.46	2.38	4.00	3.15	5.00	3.61	4.53	4.92	3.30	3.46	3.07	2.84
35	3.69	5.30	2.30	4.38	5.15	4.23	5.30	2.15	4.61	2.30	4.61	2.84	5.69	4.00	4.00	5.92	4.69	6.00
36	62	64	63	59	65	62	76	55	65	36	46	35	51	46	67	68	64	62
37	4.45	6.15	4.61	6.30	5.91	5.53	6.76	4.76	4.30	8.14	5.99	8.22	6.76	7.61	3.76	3.76	5.30	5.53

19	20	21	22	23	24	25	26	27	28	29	30
255	304	297	273	234	352	234	252	154	172	202	195
2040	2432	2673	2184	1872	4224	1872	2268	1078	1376	2016	1560
120	32	132	42	36	240	32	48	6	18	32	56
64	68	41	60	46	190	68	64	15	35	95	53
8	9	6	9	7	10	9	14	3	7	18	13
0.75	0.00	1.00	1.00	1.00	1.00	1.00	0.25	0.75	1.00	1.00	1.00
1	6	3	2	6	0	4	4	3	2	6	3
10	1	5	3	7	2	0	6	2	5	4	12
30	25	40	30	50	100	40	50	25	30	70	50
0.87	0.68	0.60	0.98	0.66	0.40	0.98	0.12	0.91	0.86	0.91	0.94
19	19	20	18	9	20	8	20	16	21	16	21
3.00	10.00	4.00	3.00	1.00	1.00	0.50	6.00	12.00	1.00	5.00	0.50
7	6	7	6	6	6	4	6	3	5	7	6
C	C	C	M	C	C	C	T	C	C	C	C
0	2	3	2	1	2	0	2	2	1	2	1
1	2	0	0	4	4	3	1	0	0	3	3
7.0	2.9	4.9	5.5	7.1	10.1	1.1	3.0	8.1	9.0	4.9	1.0
17	19	20	21	18	32	18	21	14	17	22	15
15	16	15	13	13	16	13	12	11	11	13	13
8	8	9	8	8	8	8	9	7	8	8	8
0.88	0.84	0.75	0.62	0.72	0.72	0.72	0.57	0.78	0.65	0.59	0.86
0.25	0.22	0.13	0.22	0.19	0.54	0.29	0.25	0.10	0.20	0.36	0.27
4.21	4.71	4.28	5.21	5.00	5.07	3.92	5.57	4.14	4.78	4.71	5.28
1.76	4.30	1.92	3.30	3.00	1.23	2.76	3.23	3.84	1.76	4.07	2.69
4.23	3.61	5.23	3.61	4.84	5.15	4.07	2.84	3.38	4.23	4.00	4.76
3.38	2.38	3.00	4.00	3.30	4.92	3.30	2.15	5.23	2.69	1.61	4.00
5.84	2.61	6.15	4.07	4.76	5.23	5.15	4.15	2.61	6.00	3.00	2.69
4.15	3.38	3.69	3.53	3.38	2.92	4.46	2.84	3.53	3.46	3.61	2.76
3.23	3.46	2.69	3.00	3.00	2.38	4.00	3.00	3.30	3.00	4.53	2.76
3.00	4.23	4.00	4.54	4.07	4.07	3.30	4.69	3.69	3.84	3.61	4.61
3.15	4.46	3.69	4.84	3.92	4.84	3.07	5.15	3.84	3.46	5.00	5.69
5.15	2.61	5.76	3.38	4.53	4.46	5.07	3.76	3.23	5.61	3.30	3.76
4.69	2.54	4.46	3.30	3.92	4.00	4.38	2.92	3.61	3.69	3.07	2.53
1.84	5.38	2.53	3.84	2.07	3.53	2.69	2.61	4.84	3.07	4.76	4.38
3.00	5.00	4.07	4.76	5.00	4.30	2.76	5.46	3.46	4.00	4.69	4.61
71	66	60	72	76	70	62	63	39	73	66	63
3.60	8.23	3.45	5.22	3.91	5.92	4.83	4.99	12.76	4.15	5.53	5.69

OBJECTIVE INDICATORS TO PREDICT PLEASANTNESS OF LIVING ROOM

by

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ABSTRACT

The main objective of this study was to discover the nature of people's subjective reactions to a space, in particular aesthetic pleasantness and to develop a set of objective indicators to predict pleasantness of living rooms.

Three research visitors visited 30 different homes, taking physical measurements, observations and color photograph of the living rooms. Color slides of these 30 living rooms were shown to fourteen judges who evaluated them on 15 semantic scales. The data was factor analysed and independent factors extracted.

Seven factors were extracted. A long room with more floor area elicits favourable reactions like pleasant, cheerful, etc. The presence of pictures, art objects, a light wall surface and a high ceiling makes the room look traditional and bright. A traditional furniture style elicits favourable reactions. A living room with large windows and plants make it look open, bright and public.