SPACIOUSNESS OF INTERIORS

Its meaning, measurement and relationship to some architectural variables

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To the memory of my brother Dr. Ilhan Imamoglu

V.I.

Biz ki İstanbul Şehriyiz

Yüce Türk Halkı

Malûm olsun çektiğimiz acılar

N.H.

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CONTENTS

SUMMARY

The research project explained in this thesis aimed to understand the meaning of spaciousness of interiors and to examine its relationship to some architectural variables. The project developed through four stages each of which is explained in a different part in this thesis: a) the pilot studies, b) the first group of experimental studies, c) spaciousness-scale construction, and d) the second group experimental studies utilizing the scales.

The pilot studies aimed to explore people's understanding of the construct of spaciousness by a series of open-ended questionnairs, rank-ordering of characteristics of spacious rooms and survey of newspaper advertisements on housing. These studies suggested that spaciousness was a construct with positive connotations, often used in daily life to describe and evaluate interiors and that it was closely related to the size, clutteredness and general atmosphere of rooms.

The first group of experiments consisted of five main studies seeking to explore the relationship between spaciousness evaluations of interiors and such variables as the furniture density, the function of the interior,

window size, window position and room proportion. In all these studies a global spaciousness measure was taken either by using a single 7-point spacious-cramped (or confined) scale or by having subjects equalize the feeling of spaciousness of a comparison model to that of a standard one. This first group of experiments mainly indicated that a) the relationship between spaciousness and furniture density (empty, furnished, overfurnished) suggested an inverted-U shaped function with an overfurnished interior being assessed as less spacious than both an empty and a furnished one; b) people desire to carry out "intimate-personal", "social" and "public" activities in interiors with different degrees of spaciousness from the least to the most, respectively; c) rooms with windows on the short walls, were perceived as being more spacious than the ones with windows on the long sides; d) when located on the short sides, the larger the windows the more spacious the interiors were perceived; e) oblong rooms were perceived as being more spacious with continuous windows, whereas square-like rooms with smaller windows (3-bay); and that f) the room proportion did not seem to be related to the spaciousness evaluations.

Since these experiments obtained only global measures of spaciousness, their findings gave a general understanding of the effects of the variables studied. At this point, the need was felt to develop a more sophisticated scale which might not only help us understand the construct of spaciousness better but also could give more detailed measures of spaciousness. To reach this objective, an original pool of 151 bipolar adjectives were reduced to 19 by passing through five laborious stages consisting of a) selection of items appropraite to describe the spaciousness of interiors; b) selection of a sample of slides representing spacious and not spacious interiors; c) evaluation of spacious and not spacious slides with the retained items; d) factor analysis of spaciousness and not-spaciousness data; e) selection of the final set of items by using alpha reliability coefficient for spaciousness and crampedness scales. The spaciousness scale was comprised of three factors, namely, appeal, planning and space freedom, whereas the crampedness scale was made up of the four factors of planning, physical size, clutteredness and appeal.

The last group of experimental studies consisted of eight studies each of which utilized the newly developed spaciousness and crampedness scales. The first one examined the type of presentation (the medium) of an interior by comparing the spaciousness-crampedness evalulations of a full-size room, its 1/10 scale model and its colored slide. The results indicated that the evaluations of a full-size room and that of their models did not differ, whereas that of the slides differed from both. In the light of this finding the final group of experiments used full-size rooms or models interchangeably and examined the effects of organization, furniture density, room proportion, window size, window position, curtain position, time of the day, user, non-user differences and activity-room type. These studies mainly indicated that a) the more organized a room, the more spacious it appeared to be; b) an overfurnished interior was perceived as being less spacious than both the empty and the furnished ones, the main spaciousness factor responsible for this relationship being space freedom; c) interiors with either 3-bay or continuous windows on the long sides received higher evaluations on the space freedom component of spaciousness than the ones with windows on the short sides; however, when windows were located on the long sides, interiors having 3-bay windows received lower values on the planning factor, while those having continuous windows received lower ones on the appeal factor; d) when the windows were located on the short walls, the interiors with continuous windows were perceived as being more spacious than those with smaller windows; e) a square shaped interior received a higher value than the root-2 model on the space freedom factor; when compared to a root-3 model, it received higher values on both planning and space freedom factors of spaciousness; f) spaciousness evaluation of a room did not vary whether it was seen during the day or night-time; or with open or closed curtains;, g) the users of a room perceived the interior as being less spacious, in comparison to those who did not know it; and h) interiors for social and public activities required more spacious interiors than those for personal-intimate ones.

Finally, the thesis will be concluded by a general discussion of the main findings and their implications for architecture as well as for further research.

PART ONE

INTRODUCTION

INTRODUCTION

1.1 REVIEW OF PAST WORK

With advancing technology and population growth modern man had been compelled to pay increasing attention to his relationship to the built environment. One of the most striking features of our time is the progressive concentration of a large human population in compact cities. It is mainly this rapid urbanization that has caused an incredible growth in scale and complexity of buildings. Parallelling to this phenomenon is a desire and attempt to continually improve standards of physical and social well being, whilst pressing general economic constraints have demanded more economical and functional building designs; functional, not only in terms of primary human needs like heating, lighting, noise control, but also in terms of social well being and psychological satisfaction.

In this complicated picture, the role of an architect becomes very difficult; not only must he be able to follow technological progress in various fields (structure, construction, materials), cope with rapid social change, try to understand new institutions in the society; but also he must be able to find a satisfactory answer to the psychological well being of the future inhabitants of his buildings. He is not only a coordinator and the leader of a team of administrators, consultants, engineers, but also the artist. His buildings must be rational, efficient, economical, if not flexible and adaptable; spaces he creates must be comfortable, pleasing, stimulating, inspiring, and satisfactory. But how can he cope with all these intricate problems, especially with the most complicated and long ignored psychological one, the well being of the building users? Is his intuitive understanding of human nature adequate and his own observations sufficient for him to create good working and living situations in his buildings?

Although it is in an early stage, in the last few decades in various diciplines quite a number of attempts have been made to understand the interrelationship between man and his built environment which directly or indirectly may answer some of the problems that the architect has. The earlier studies which were isolated, using an empirical ad hoc approach, mainly dealt with the quantitative aspects, the minimum essentials of the buildings; standards of lighting, heating, noise control, ventilation, etc. The later studies on the other hand were more comprehensive dealing with more variables in actual environments, and hence more relevant to architecture: they attempted to find answers to spatial qualities and interpersonal distances in terms of the contemporary human requirements. (See Craik 1970, Kameron 1973, Ittelson 1973, Kuller 1973[a]; Langdon 1973, Canter 1974, Canter and Lee 1974 for a detailed account of the field).

In an earlier comprehensive discussion Craik (1968) outlined the range of research paradigms that are applicable to the study of physical environment and listed alternatives for each of four different research elements (observers, displays, nature and format of judgements, and validation criteria). As observers, he suggested special competence groups (e.g. architects, 'space' managers), special user groups (e.g. students, the elderly), and groups formed on the basis of personality measures. As displays, he considered the use of varying modes of direct experiences (looking at, living in) as well as a number of simulation techniques. He also reviewed the major psychological assessment devices, such as adjective check lists, ratings, Q sorts and also considered validation criteria. With these and some other guidelines, studies of perception of complex environments have been undertaken in a wide variety of settings; interiors, exteriors of buildings, architectural forms, cities, highways, etc. The present project concentrates on interiors.

Room - space

The room is perhaps the basic unit of architectural design. It is the enclosure for activities in a building (living, working), the main reason for the building. The success of the interior is largely responsible for the success of the architectural design. The room is designed to fulfil the needs of an environment for man. It is experienced not only in visual terms but also in thermal, tactile, acoustic and olfactory terms. Man is not an onlooker, he experiences this space as a whole, he lives in it. The scale and proportions, the textures, colour and use of material on various surfaces; the natural and artificial lighting; furniture; acoustic properties of the room;..... all these are interwoven to give a total experience of the space.

Clamp (1973), a psychologist writes: "For both the architect and psychologist, space encloses people; distance between individuals regulates intimacy, dominance and communication, and the types of activity that can be carried on.... for the artist, space seems to acquire mystic properties in its own right".

An architect, Engel (1964) describes the space in a different way:

> "Space in building, then, is an intrinsic medium through which the art of architecture asserts itself. Whereas other art forms express themselves by occupying and enriching human space, architecture is the art that, in fact, creates that space". ....."Space .... is increasingly determined by man's psychological requirements. Thus, spatial evaluation in architecture more distinctly marks the progress of civilization than does the change in architectural technique or form". "Just as architecture has changed in its form and expression throughout history so too has it changed in its concept of space. While architectural form and expression was subject to abrupt breaks and sudden discontinuity, owing to technical discoveries, socio-political revolutions, or philosophical changes, space in building had experienced a steady and continuous evolution throughout architectural history. Indeed, space is the very element that links architecture of different epochs and different cultures and preserves continuity of architecture from the past to the present" (p.233).

Another architect, this time a researcher in architectural psychology, Peled (1974) writes:

"That modern places, institutions, homes, are difficult or debilitating to live in has become by now a common, almost a banal statement. The inability to provide for, express and enrich life, is so evident and abundant around us, that it has become part of the media folklore.

...the poverty of design can be traced down to one central phenomenon; a loss of insight into the meaning of space, of the spatiality of human experience.

Too much architecture is related to, as observed. Analytic constructs of structure, system analysis, service system, as well as formal constructs (spaces and objects as encountered and appreciated rather than lived), layouts, are being given a geometrical aesthetics of their own, disconnected from the reality they are supposed to generate. The tempo/spatial zone is objectified in every way. The direct in-the work relations are ignored, or as has been the fashion lately, experience is short circuited back to the experiencing being, the sensory is being separated from the wholeness of experience and provided in a "pure" form....

We have become tourists in our own homes. The direct experience revealed to the laymen (and to the designer in his laymen's persona) has become irrelevant...
While slogans of social relevance, indeed social messianism, are part of architecture since the beginning of the century and have become more so in the last decade, it was rarely backed by a real insight into the spatiality of social encounter. Usually it results in an attempt to create plastic, objectified symobols of community of "togetherness" through buildings as objects and places, which emphasise unity" (p.1-2)

Spaciousness

Spaciousness is a widely used term in everyday life and architecture to describe and evaluate spaces. It is a derivative of space, and Murray's dictionary (1919) defines it as "1. The state or quality of being wide, spacious or commodious; extensiveness of area or dimensions; roominess. Spacious (adj.) of dwellings, rooms, etc.: Having or affording ample space or room; large, roomy, commodious" (Vol.IX, part 1). The Random House Dictionary (1967) on the other hand gives for spacious: "1. Containing much space, as a house, room, court, street, etc,; amply large. Syn. 1. roomy, capacious, wide. Ant. 1. small, cramped". The nearest word for spaciousness in the author's language, Turkish, is "ferahlık". It is of Arabic origin "ferah" meaning happiness, gayness, pleasing thing. In Turkish today it literally means "the sensation of being open". It is closely related to the quality and amount of space as well as the openness of the interior (fenestration, view). The antonym of "ferahlık" carries a strong meaning - difficult to stand, unbearable, unlivable. In the Arabic language "Ra'habah" is the nearest to spaciousness and means welcoming, welcoming and greeting with its soul and heart. In French "spaciousité", in German "geraumigkeit", in Japanese "kaihokan" or "basho no ooi" are the nearest terms and relate to roominess and width of an interior.

Literature survey in arts and social sciences shows that spaciosness is often used. Gilbert (1949) cited a passage from Binyon about a room designed by Inigo Jones:

> "It was not a very large room, but it seemed spacious, partly because of its loftiness, partly because it was empty of furniture, though panalled in wood throughout. It is strange how suddenly one can change

> one's mental climate.... Those simple yet stately proportions, that austerity of ornament that disdain of the trivial which yet communicates no sense of emptiness but rather of latent richness" (p.1).

Mercer (1971) reported comments by some architecture students: "Windows relive feelings of confinement.... provide a feeling of spaciousness" (p.53). Sanoff (1972) writes: "The clearstorey windows located at the peak of the two-storey living-dining area suggest a more apparent spaciousness as well as a major cross-ventilation source" (p.119).

In environmental psychology, in studies employing semantic differential technique, a space dimension, spaciousness or enclosedness is frequently reported; it consists of adjectives like spacious, roomy, free space, open, airy. (Kashmar 1965, 1970; Canter 1969; Honikman 1970; Hersberger 1970, 1972; Seaton and Collins 1972; Acking and Kuller 1972; Markus et al 1972; Kuller 1973b). This space factor either appeared independently (as in the cases of Kashmar, Collins, Honikman, Markus et al, Acking and Kuller, Kuller) or confounded with evaluative factors.

The use of the word spacious is not only confined to description and evaluation of spaces but also for advertisment. A notable amount of house advertisements in newspapers and estate agencies employ this word generously. In general, spaciousness seems to be strongly related to room and window size and carries a positive affective connotation.

Past studies

The bulk of experimental investigation of space perception in psychology have been largely confined to the study of perceived size, distance and form of small objects (Gibson, 1950; Kilpatrick, 1961; Forgus, 1966; Vernon, 1970, 1971). Some researchers in the fields of architecture and perceptual psychology have recently directed their attention to some of the more complex dimensions that determine our responses to the large scale architectural enviroment. Past studies related to architectural space and spaciousness can roughly be grouped into two: 1) Studies related to the perception of interiors in general and 2) Studies directly or indirectly related to spaciousness. The first of these will be briefly reported, the latter will be reviewed in detail.

Studies related to the perception of interiors in general:

1) Maslow and Mintz (1956) investigated the psychological effects of exposure to "beautiful" and "ugly" rooms.

Their subjects rated negative photographs of faces on two dimensions, fatigue-energy and displeasure-well being presented in each of three rooms; beautiful, ugly and average. In the beautiful room, the faces were rated as more well being and energetic. As a continuation of this, Maslow (1956) further studied the behaviour of two people who administered the previous experiment - the 'examiners', and showed that the examiners usually finished testing more quickly in the ugly room as compared to the beautiful one. He also observed that the examiners in the ugly room had reactions such as monotony, fatigue, headache, sleep, discontent, irritability, hostility, and avoidence of the room; while in the beautiful room they felt comfort, pleasure, desire to continue their activity.

K.H. Lee (1974) conducted a comprehensive housing survey in a new town, once in winter, once in summer time and studied the interaction between the types of heating and space usage, people's seating habits and attitudes. His empirical observations, measurements and descriptive evaluations in 195 households indicated that inadequate heating gave way to more intensive use of the living room, less effective use of the space, and more consistent parental seating in the living room.

Peled (1974) formulated three theoretical postulates:

"1. That the spatial and non-spatial are inter-related aspects of experience. That people, objects and places are experienced as entities, in their wholeness....

2. That objects and places are experienced in direct in-the-world relations as the bodies of metaphoric beings.

3. That underlying the experience of people, objects and places, there is a common dimensionality" (1974, summary).

He interviwed 14 passengers at length about their experience in air terminals and was able to show his point that a common dimensionality underlies the experience of both spatial and non-spatial aspects of a situation.

Lau (1970) studied gloom and pleasantness, artificial lighting quality in study-bedrooms. He found that models were satisfactory means to study artificial lighting.

Kashmar (1965, 1970) developed a semantic scale for the description of the interiors. Her 66 bipolar scales differentiated between three rooms, but were stable over time in the same room.

Canter and Wools (1970) developed techniques for appraising buildings. They used three semantic differential scales: one concerning how inspiring a room (building) was; another, its harmony; and the third, its friendliness. These scales were applied to music practice-rooms, study-bedrooms, secretarial offices and houses. The scales were able to discriminate between the stimuli as well as between seating arrangement.

Using slides of interior (drawing rooms) and exterior spaces and repeating the experiments in the real environment, Kuller (1972) obtained a semantic model for describing perceived environment, applicable to both interiors and exteriors. It could be used not only for comparison between environments but also for rating the environments against an inner frame of reference (single judgements). A jury of three experienced researchers selected variables that would best represent his 8 factors. The first factor, pleasantness, was presented by 8 variables, each of the remaining 7 factors by four (complexity, unity, enclosedness, potency, social status, affection, originality). He gave an account of semantic rating in general and pointed out to the advantages of using a standard test. Such a test would enable us not only to make better comparisons between different studies, improve communication between researchers, but also could be used as a practical tool by architects, planners, behavioral scientists in designing environments, education and environmental theraphy.

2) Studies directly or indirectly related to spaciousness are mainly two types; a) studies concerned with exterior spaces, and b) studies concerned with interiors.

a) Studies concerned with exterior spaces:

A series of investigations by Garling have suggested the hypothesis that the perceived openness-enclosure of an architectural space is a function of its physical size. In his initial investigation Garling (1969a) found that observers (Os), instructed to use a ratio scaling procedure, could reliably judge the degree of openness-enclosure of out-of-door spaces. Garling (1969b) also found that openness-enclosure ratings, obtained from both colour photographs and in situ viewing, were highly correlated with judgements of the physical size of the spaces. To acount for this correlation, Garling observed that Os may have confused openness with largeness and enclosure with smallness in making their ratings. That is, Garling proposed that

Os may have rated size rather than enclosure as instructed. In his later studies (1970a, 1970b) he dealt with perceived size and dept of external spaces by using colour photographs, detailed, un-detailed drawings and actual spaces. He employed binocular and monocular viewing with the magnitude estimation method and concluded that perceived size of space depended on perceived depth.

Spreiregen (cited in Hayward and Franklin, 1974) suggested that the perceived openness-enclosure of an architectural (exterior) space was mediated by the ratio of boundary wall height to wall distance of the boundary from the observer.

Starting from Garling's findings and Spreiregen's suggestions Hayward and Franklin (1974) hypothesized that perceived openness-enclosure is determined by the boundary wall height (H) to distance of the observer from the facing wall (D), H/D ratio andindependent of size of space. They used simple perspective drawings (1/1, 0.5/1, 0.33/1, 0.25/1 H/D) of out-of-doors architectural spaces of 10X10, 20X20 and 40X40 feet in size as stimuli under strict laboratory conditons (monocular vision, restricted head movements, dark room, etc). Their results supported their hypothesis;

i. varying values of H/D ratio produced systematic differences in ratings of openness-enclosure, as the value of H/D increased, perceived enclosure also increased;

ii. the main effect of size of space was not significant and size (area, volume) of space made no difference in how open or enclosed a space appeared. A 100 sq. ft. space and a 1600 sq.ft. space yielded almost identical impressions of enclosure, providing their boundry wall size-distance proportions remained equal;

iii. the interaction between the size and H/D ratio was significant.

Although this study mainly dealt with simple graphical stimuli and exterior spaces; the sizes of volumes utilized are very similar to interiors and so its findings can, perhaps, be applicable to interiors to a degree.

Sorensen and Floderus (1971) dealt with the various intensities of enclosed (or as they called 'restricted') space and their evaluations in an urban setting. By using semantic differential technique and employing 14 photographs of different urban spaces, although not very clear cut, they found a 0.72 correlation between the degree of enclosure and evaluation index. Thus, their subjects evaluated enclosed urban spaces more favourably.

Brodin (1973) started from the hypothesis that people rate an outdoor environment with an enclosed character more positively than an outdoor one with open character, and that the evaluations are influenced by type of environment. Ratings of perspective drawings and real situations indicated that evaluations for different environments were different, but the first part of her hypothesis was not a general rule.

Markus *et al*'s (1972) comprehensive survey of 427 houses on six sites in Scotland indicated that overall satisfaction was a function of amount of grass around the house, distance between houses, garden size and open space. The sky factor correlated highly with general satisfaction as did the amount of buildings in the view - this latter in the negative form - that is, the more buildings in the view the lower overall satisfaction.

b) Studies concerned with interiors:

Dalkvist and Garling (1971) studied the visually perceived or sensed 'restricted' space as a function of two variables; wall or screen arrangements and lighting. The number of 80x80 cm. screens was varied between 0 - 4 - 8 and 12, combined with four brightness levels of about 1, 10, 100 and 1000 lux measured at the floor.

Eleven subjects were asked to judge how restricted the space appeared, by marking a position along a 10 cm. straight line, the two ends defined as "completely restricted - not enclosed space at all". The results indicated that apparent restricted space increased directly with number of screens. On the other hand, the relationship between the apparent restriction of space and brightness level was not so simple: Although there was an increase in the restrictedness of space by increases in brightness (from 1 to 10 and 10 to 100 lux), this trend changed in the opposite way for the highest brightness level (1000 lux) and, regardless of the number of screens, the space was judged to be less restricted.

Although they used few subjects and worked with small screens under laboratory conditions, Dalkvist and Garling's both findings are valuable for the present project. The results may imply that; i. the more solid surfaces you have around the space, the more restricted it looks, and ii. low brightness levels make the space look restricted, however this later statement has a very limited implication for their experiment did not cover the usual brightness range (100 to 1000 lux) of architectural spaces in detail.

Kuller citing Ames's work (Kilpatrick 1961) which implies that light surfaces seem either larger or closer than dark surfaces, hypotesized that rooms with light surfaces would seem larger and/or more spacious (cited in Kuller 1972, p.100). Among other things, he studied the relationship between openness (spaciousness) of a room and lightness of its surfaces by the help of colour slides of drawings. (See also Acking and Kuller 1972). The results indicated a high positive correlation between these variables ($r=0.76$, $p < .01$). He further checked his findings by repeating the experiment in three full-size rooms and clearly varified the earlier results.

In another experiment (cited in Kuller 1972) Kuller studied room size. He chose three rooms, 6, 12, and 24 sq.m. in floor area, and asked each of his subjects to rate one room in terms of a) semantic scale and b) length and width of the room. He summarized the results of the semantic method in the following way:

> "As expected, the three rooms have been judged significantly different. This shows the existance of an inner frame of reference with which the individual can compare volumes of rooms in absolute ratings" (Kuller 1972, p.101).

The three rooms were also rated significantly different with respect to length and width, and both of the (a and b) ratings produced very similar results, as regards total curves. However, there were great error variances for the individuals in both semantic and length-width ratings. Kuller calculated the product-moment correlation coefficients between the two rating methods (to figure out whether the individuals who had given a high semantic rating had also given a great length-width, etc.) for each of the three rooms. All correlations were very low and did not significantly differ from zero. Kuller writes:

> "Thus, it seems as if the way in which an individual makes use of the semantic scale is independent of the way in which he indicates length and width for one and the same room. The interpretation of this result is very intricate. The most far-reaching conclusion would be that individual variations in perceived size are independent of variations in perceived length and width. The most probable conclusion is, however, that both rating methods give a random, and between them independent, deviation from the perception" (p.101).

Mercer (1971) outlined his work on measuring the extra space which, he thinks, a window imparts to a room, in an article titled "On measuring the effect of a window". He chose three rooms with the same celing height; two of these were identical in size and measured 8ft 7ins X 11ft 9ins X 7ft 10 ins. Both of these rooms had a 5ft X 3ins X 3ft 6 ins window, in one of the rooms the window was blocked by white painted hardboard. The third room, on the other hand was 6.2 times the volume of the former ones, and its window was also occluded. He asked his 52 subjects (30 psychology, 22 architecture students) to make six size estimations in three rooms: two body dimensions, the size of their head and width of shoulders; two imagined lengths of one foot and one foot six inches; and finally two real lengths of 32.2 and 43.0 cm.

The results indicated that three of the six estimates (lengths around 25 cm) were significantly bigger in the large room, as compared to the small one. He also compared the estimations in two small rooms, one with a window, one without, and found that two of the estimations were greater in the windowed room as compared to the windowless one. Mercer writes:

"By plotting mean estimation against room volume and fitting the estimates from the windowed room on the resulting graphs, the apparent or phenomenological volume (PV) of SW (small room with window) was found. The extra space (ES) due to the window is then given by: PV - real volume (RV) i.e., PV - RV = ES." He continues: "It would appear that the PV and thus the ES varies with what the person is concenred about. When the subject is concerned with his own body size that is, with something related to himself, the effect of the window is greatest. When he is concerned with imagined length the window effect is not as marked, and when he is concerned with size for which there is a visible comparison the window has no effect at all. In other words, the window affects most the person's perception of himself - it makes him 'feel' bigger, as manifest in his increased body boundary."

In estimations of 1ft imagined length there was a significant occupational effect. In all six estimations architecture students were more accurate than the psychology students.

Information given by Mercer in the published article is unclear, if not confusing, especially on the comparison of the two small rooms. In addition to that, as he himself admits, the way he calculated the PV (phenomenological volume) is highly debatable. More important than these, how relevant can estimations of lengths and body dimensions be for the perception of interiors? What is the implication of perceiving oneself bigger in the large room?

Holmberg et al (1967) investigated the effect of the ratio between depth and width on the perception of volume content of rectangular rooms. Four experiments were carried out, one with 1/10 scale models, one with 1/5, and two with full-scale mock up rooms.

In one of the two latter experiments subjects viewed the rooms from an open door, in the other, they were allowed to walk around in the room. For the full-scale experiments six rooms were built in a laboratory. The height of the rooms, 2.5 m., and the area (25 sq.m) was kept constant, but the relation between depth and width was changed: 1.0, 1.5, 2.0, 2.5, 3.0, and 3.5. These proportions were kept the same for 1/10 and 1/5 scale models as well. The magnitude estimation method was used. The square room, called 'the standard' was given 100 points for its volume and each of the 60 subjects was asked to assign a value to each of the comparison rooms (according to his subjective impression of its volume as compared to the standard).

The results indicated that the proportions of the rooms had a clear effect on volume perception; the more oblong a room, the more spacious it looked. The results also showed a good correspondance between small-scale and full-scale models concerning the proportion and volume estimation, when the subjects were stationary. When the subjects were allowed to walk around the full-scale rooms, however, they were less affected by the proportions. "The reason for this might be that the distance to the walls from the observer is critical for volume perception", they continue: "If the distance to the wall is a relevant factor in the perception of volume content, then one might predict that if stationary subjects perceive a room from a door in one of the long walls, they will perceive the room as smaller than if they view it from a door in one of the short walls".

Although Homberg et al used empty models and mock-up rooms, and did not simulate a real life situation, their study is of a considerable value for any kind of space perception.

Jeanpierre's research (1968) was related mainly to i. distance perception, ii. ceiling height and iii. room proportion in mock-up rooms.

i. One of the walls of a 7.00m long, 2.88m wide and 2.12m high room could be moved by the help of an electrical device. Each of the 36 subjects was asked to bring the opposite wall to a reference point, of either 2.50, 3.00, 3.50 or 4.00m, which was randomly changed each time by the experimenter. The results indicated that when the wall was closer than 4.00m to the subjects, there was a significant tendency to locate the panel further away. Jeanpierre varified the results of this study by verbal estimations of subjects in another and concluded that "There is an obvious sensitivity in man when his immediate environment diminishes" and "Estimation of space within the dimensions of a house (room) is a complex phenomenon. It uses some elements of perception but it is something else, something beyond the perception" (p.65).*

ii. In his second experiment Jeanpierre studied two room sizes: 1) 3.00m deep, 4.00m wide and 2) 5.00m deep, 6.00m wide; the celing height could be varied between 2.00 and 2.90m. Each of the 100 subjects had to adjust the ceiling height for 12 times;

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*Translations from French was made by Mr. J.F. Allain, Department of Modern Languages.

6 sitting down, 6 standing up position; to choose the best ceiling - room relation. The results indicated that there was no relationship between height of the subjects and the ceiling adjustments. But room size and position of the subject were significant; adjusted ceiling heights in the large room were greater than those in the smaller room and adjustements made in the standing up position were higher than those for sitting down. (Mean adjustments in 12sq.m. room were 2.540 and 2.473m while in 30sq.m. room 2.709 and 2.646m, for standing up and sitting down positions, respectively.

iii. In his last series of experiments Jeanpierre attempted to find the most satisfactory proportion in an enclosed space. By three different approaches he manipulated all three dimensions of his mock-up room; ceiling height within the range of 2.00 to 3.00m, side wall in 1.50 to 4.00m and the opposite wall in 1.00 to 5.50m. In this study his 8 subjects could move around the experimental room, and made their judgements on a 5-point "greatly satisfied-not satisfied at all" scale. Although this study was carried out in winter and the experimental room was not heated, the findings indicated that 2.50m ceiling height and square or square like rectangular rooms were judged to be the most favourable ones. Jeanpierre also noted that "People react much more acutely to unpleasant space than a pleasant one" (p.112).

Though very comprehensive and valuable, Jeanpierre used only mock-up interiors in his research. As he himself mentioned; a) there were some shortcomings in his experimental technique of the last group of studies (irregularities in model room, cold surroundings, small number of subjects, etc.) and in general, b) it is necessary to varify his findings in real rooms with windows, furniture, etc.

The title of Inui and Miyata's work (1973) is the same as in the present project: Spaciousness in interiors. They tackled the problem from a lighting point of view and aimed at finding a new criteria or an index -spaciousness- for window design. "Man feels enclosed in a small windowless room, but he feels in the open when he is on a balcony which commands a bright prospect". Inui and Miyata further explains:

> "Spaciousness would have a minimum value in a situation deprived of every bit of visual information; in a completely dark room the value would be zero. The maximum value would be found in a place which

commands an unobstructed hemisphere of sky, e.g. a boundless desert or sea. As human experience is finite and the unobstructed sky is perceived as finite hemisphere, the maximum value will be a finite one. The spaciousness of interiors will usually fall between these two extremes.

Spaciousness should be evaluated on a unipolar scale, beginning at zero and having a certain magnitude for each interior... the unipolar scale of spaciousness in the present study does not contain a sense of pleasantness, and is regarded as a pure magnitude scale of spaciousness".

Inui and Miyata employed three types of interior models: 1/20, 1/10 and 1/5 scale models; the width of the interiors were variable, the heights (3.00m) and depths (8.00m) fixed. An adjustable window was set in one wall, starting from a sill of 1.00m. The models were designed to represent a simplified version of an office with some scale furniture. They manipulated sky luminance (using an artificial sky) in three steps, the average horizontal illuminance on the working plane in seven steps and the window width in eight steps, by using magnitude estimation with a standard model. The value of 100 was assigned to the spaciousness of the standard model and each of the

10 subjects was asked to give a spaciousness value to each of the 474 combinations of the above variables as compared to the standard. The results indicated that the spaciousness of different sky luminances was a function of interior illuminance, room size and window size. The effect of room shape as a variable was not significant in estimation of spaciousness. As for the scale of the models; there is no differences between the results obtained from 1/20, 1/10 and 1/5 scale conditions. Inui and Miyata checked the results derived from the scale model experiments with 43 real rooms and varified the earlier findings.

As in the earlier studies of environmental psychology, Inui and Miyata abstracted the lighting from the general context of the interiors. They had a great desire to come to a clear-cut conclusion and to find a spaciousness formula; this reflected in their experimental design: Only 10 subjects were used to examine hundreds of combinations of a 3X7X8 factorial design; experiments were carried out in laboratory conditions, under an artificial sky; the furniture was used as they express "to add realism" to the models; as a whole, it is more of a lighting study rather than a spaciousness. The final "spaciousness formula" and agreement between the results of the scale models and real room conditions do not look very convincing either perhaps too good to be true. Another point is that, spaciousness may be quite a different construct in Japanese culture and might be abstracted from its evaluative dimension, which may not be the case of the British or European cultures.

1.2 PILOT STUDIES

Three pilot studies were carried out to explore people's constructs of spaciousness - how people understand and in fact do they understand the construct, what variables are mentioned as being related to it, what significance, if any, is being attached to the construct, etc. - by using open-ended questionaires, card sorting and surveying the building advertisements in newspapers. In these studies an effort has been made to get the opinions of other people besides the university students by including secretaries, janitors and nursery school teachers.

1.2.1 Open-ended questionaire

In order to gain insight and to understand how people describe and evaluate a spacious room, an open-ended question was given to a number of subjects. Each subject was given a sheet of A4 size paper with a printed sentence at the top: "My conception of a spacious room is: "and requested to write down his (her) opinion.

Three groups of subjects were used:

i. Thirty-six undergraduate architecture students, 32 male, 4 female,

ii. twenty-four postgraduate students, secretaries and janitors in the Department of Architecture and Building Science, University of Strathclyde, 22 male, 10 female.

iii. ten nursery school teachers in a new town in Scotland, all females.

The first group of subjects responded the questionnaire in a group session in a classroom, others individually.

On the basis of the frequency counts of the mentioned characteristics in subjects' responses, the following main variables were derived:

a) Activity in the room,

b) shape, dimensions and size of the room,

c) materials used,

d) furniture used,

e) light - natural, artificial - and view,

f) colours,

g) other sensory stimuli - sound level, smell - and,

h) general atmosphere of the room

The common characteristics of a spacious room mentioned by all three groups were; being uncluttered and large, having free circulation area; good natural lighting; high ceiling and a free, open, light atmosphere. Table 1, in Appendix I gives a detailed account of responses for each group. Undergraduate architecture students were more concerned about the lighting characteristics (28 out of 36), room proportion and shape (13/36); postgraduate and secretarial group, about furniture layout and other functional aspects of the interior; nursery school teachers, about room size (7/10), colour (10/10, white or light colours) and material (7/10 wall to wall carpeting).

1.2.2 Card-sorting - Rank order of characteristics of spaciousness of a room

A number of characteristics of a room were chosen from Markus et al (1972), Wools (1971) and Honikman (1970) and written on separate cards, each expressing a possible element of spaciousness according to the author. Each subject was asked to sort them into four groups; extremely important, quite important, slightly important, unimportant for a room to be spacious.

Twenty-two volunteer undergraduate architecture students were used as subjects.

Each of the characteristics of the first grouping - extremely important - was assigned a value of 4, quite important 3, slightly important 2, and unimportant 1. The responses of each of the 22 subjects was recorded, tabulated and the total as well as the mean assigned values for each characteristics were found (see Table 2, in Appendix I). As can be seen in Table 2, in Appendix I, being uncrowded, roomy, well ventilated, orderly, pleasant, having large windows, lots of daylight were considered important for a room to be spacious. The least important properties, on the other hand, were being expensive, new, ornate, complex, modern.

1.2.3 Survey of newspapers

One English, one Scottish newspaper were examined for a period of 7 days. All the advertisements for accommodation were checked and the usage of the word "spacious" was recorded. It was found out that 11.08% of English and 9.57% of Scottish newspaper advertisements used the word spacious (see Table 3, in Appendix I). It was mainly used with evaluative words and phrases like, attractive, charming, lovely, well-planned, or with words of some descriptive nature like, large, bright, with a good view, etc.

Although the percentages of the advertisements using spaciousness are not very high, one can, in the way it is used, speculate that it is an important, desirable, economical construct for describing (and perhaps, selling) the interiors.

1.3 THE PROBLEM

As has been shown, spaciousness inferring the interior space is an important construct, which may help our understanding of and reaction to interiors as a whole. It seems, therefore, that a spaciousness study not only may be interesting and enlighting on its own account but may also have far reaching implications for our understanding of other aspects of space (e.g. windows, furniture, etc.).

Broadly speaking, the review of the relevant research indicated that, with the exception of Inui and Miyata's work, there seems to be no direct attempt to understand spaciousness per se. Studies in relation to space have been undertaken by investigators who were either interested mainly in lighting or size of the space. Hence, an arbitrary separation is observed among the investigators who associate themselves with one or the other area. The particular position advocated here is that in undertaking a study of interior space, not only these two areas, but also various aspects of space; room proportion, position of a window, organization and amount of furniture should also be studied. And if possible, this study must examine the <u>interactions</u> between these architectural variables within a functional context. A study like this may enable us to answer to some of the theoretical as well as practical problems.

Spaciousness seems to be closely related to size of interiors.

What is the difference between these two words? Do their connotative meanings differ at all? If so, what is the relationship between the size and spaciousness of a room? We can measure the size of an interior with simple, objective means; can we do the same for the spaciousness? Does every large room look spacious, or vice versa?

Jeanpierre showed that square-like rooms are seen as more satisfactory. Since spaciosness is highly associated with satisfaction, can there be a relation between room proportion and spaciousness assessments? If so, will our results confirm Jeanpierre's findings? Or is it the other way around and the oblong rooms are seen more spacious - as Holmberg et al showed?

It seems that another aspect of spaciousness is its relatedness to windows. If so, is it the natural light we get from the window or other stimuli that counts? For example do interiors with windows look less spacious during the night? Is there a clear relationship between window size and spaciousness as Inui and Miyata showed? If so, what is the role of window position and room proportion? Does spaciousness of a room change with the changes in the amount of light, like Inui and Miyata suggested, or is it of some permenant nature and depend more on 'unchangeable' aspects like room proportion, window size, etc?

Pilot studies suggested that spacious rooms should not be cluttered with furniture, if so what is the relationship between spaciousness and furniture density? Does organization of furniture have an effect on spaciousness assessment of an interior? Spaciousness is considered as a desirable quality in general. Is it desirable in every situation? Do people want to carry out all kinds of activities in spacious interiors, if they are given the opportunity? Or do they make differentiations?

The present project will try to answer to some of these questions. Spaciousness at this stage is conceived in rather loose terms, as a general feeling deriving mainly from perception of interior spaces. It is hoped that, as the present research progresses, not only an empirical definition of spaciousness but also its relationship to some architectural variables will be achieved.

PART TWO

EXPERIMENTAL STUDIES I

II.1 THE EFFECT OF FURNITURE DENSITY ON THE SUBJECTIVE EVALUATION OF SPACIOUSNESS AND ESTIMATION OF SIZE OF ROOMS*.

The experiments to be reported in this section investigated the effect of furniture density on evaluations of spaciousness and size estimations of full-size rooms. Although data for spaciousness and size were collected at the same time within the same experimental setting, they will be presented separately for the sake of clarity.

Earlier experiments

a) Spaciousness. As has been discussed in the literature survey, studies related to spaciousness can be grouped as those focusing on exterior spaces and those on interior spaces. Included among the former are Hesselgren's (1971), Garling's (1971) and Sorenson & Floderus' (1971) investigations, all of which have dealt with "closed-open space" in a manner similar to that of 'spaciousness' in the present experiments.

To the author's knowledge, a direct study of spaciousness in interiors has so far been undertaken only by Inui(1971). Using a uni-polar scale, Inui's experiments have mainly studied spaciousness in relation to sky luminance,

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* A report of this study was presented at the Second International Architectural Psychology Conference in Lund, Sweden, June 1973 and published in Architectural Psychology, R. Kuller (Ed.), 1973.

horizontal illuminance, room size and window width using various scale models.

Studies dealing with exterior spaces bear no direct relation to the present experiments and those of Inui have not considered the effect of furniture.

b) Size. As with spaciousness, a literature survey in relation to the study of size judgements has indicated that most of the investigations in this field bear no direct relation to the object of the present experiment. Being mainly carried out from a general psychological standpoint, these studies on "space perception" and "size judgments" have dealt with illusions, how human being perceive the third dimension, which cues aid in this process, the relationship between size and distance etc. (Gibson, 1950; Dember 1961; Vernon, 1970, 1971; Epstein, 1963; Epstein *et al*., 1961; and Luckiesh, 1965). Perhaps the only group of studies that seem to be related to the present experiment are those dealing with "divided" or "filled" space. The well known Oppel-Kundt illusion (cited Piaget, 1969) shows that a divided line is over-estimated in comparison to an undivided line of equal length. Luria, *et al*. (1967) have shown that "filled space" produces an impression of greater distance. In their study, the relative distance of comparison and standard targets was estimated when there was a rod from observer's chin rest to the standard and when the rod was absent. It has been found that the apparent distance of the standard was greater when the rod was present. These studies imply that a divided space seems to appear larger.

An important problem for the architect is to determine the degree to which these abstract findings can be generalized to the subjective size estimations of living spaces where multiple cues like proximal size, interposition and shading of elements, brightness, texture gradients of surfaces, etc., all are experienced in a rather complex order. In other words, is the architect justified in interpreting this as an indication that the more elements a space contains the larger it appears?

A seemingly related study is Holmberg, et al's (1967) experiment about perception of volume. However, they have only investigated the relationship between proportions and volume estimations of 1/10, 1/5 and full-size empty models, without considering the effect of furniture, but have suggested it as an important variable.

The effect of furniture layout in living spaces has in the past only been studied in relation to inter-personal relationships (Lipman, 1968; Sommer, 1969; Joiner, 1970); and the assessment of friendliness of rooms (Wools, 1970). These studies do not bear a direct relevance to the present experiments either.

The review of the past studies concerning size judgments in general seems to imply a direct relationship between size estimations and the number of items in a particular space. However, personal experience of the present author with various empty and furnished interior spaces suggests an inverse relationship. Therefore, the relationship between size estimation and furniture density needs to be determined empirically. For this purpose, a completely randomized experimental design with three experimental conditions of empty, furnished, overfurnished was devised. Moreover, since this experiment constitutes a part of a larger project on the study of spaciousness, an important aim is to explore the general relationship between spaciousness evaluation and furniture density of rooms.

Thus, the aims of the two related experiments can be stated as follows:

(i) to determine the effect of furniture density on the spaciousness evaluation of rooms;

(ii) to determine the influence of furniture density on the size estimation of rooms; and

(iii) indirectly, to study the relationship between size estimations and spaciousness evaluations.

METHOD

Subjects

Ninety volunteer, male architecture students (with a mean age of 20.6 years) of the University of Strathclyde were used as subjects. There were thirty subjects in each of the three conditions of the experiments.

Stimuli

Two adjacent office rooms divided by a permanent partition were used as stimuli. The main reason for using these rooms as stimuli was that both of them could be observed at the same time, thus eliminating the effect of the memory factor in the results; moreover, being adjacent, the natural lighting was similar as well as many other physical factors, such as: building materials, colour of surfaces, artificial lighting and general character of the rooms. One of the rooms was used as the standard and the other as a comparison room; the floor area of the two rooms were 11.95 and 9.82 square meters, respectively. The standard room was furnished as an office, with two desks, two low cabinets, one ordinary, two arm and two typist's chairs, one coffee table, a 2x3m. cream coloured, plain carpet and some permanent book shelves on one of the walls. The furniture of the standard room was kept constant, whereas, that of the comparison room was manipulated as,

(a) empty, (b) furnished, with a desk, an ordinary, a typist's and an armchair, a duplicating machine, a coffee table and a 1.85 x 2.80 cream coloured, plain carpet and a few books on the permanent shelves, (c) overfurnished, with another desk, another typist's, and armchair, three paintings and some more books in addition to the furniture stated in the previous condition. For the furniture layout of the standard room and that of the comparison room in the three experimental conditions, see Figure 2.1.

Procedure

The experiments were administered to each subject individually; that is, each subject assessed both spaciousness and size, the order of which was counterbalanced within each experimental group. Thus, half the subjects in each of the three experimental condidions first responded to spaciousness, then to size, whereas, the other half responded first to size, then to spaciousness.

The spaciousness evaluations were obtained by using a seven-point 'spacious-cramped' scale. Each subject first evaluated the standard room, then the comparison room on two separate "spacious-cramped" scales. For the size judgments, magnitude estimation technique was used, whereby, the size of the standard room was stated to be 10 units and each subject was asked to judge that of the comparison room as compared to the standard. For the size judgments, subjects were asked to stand in front of the partition

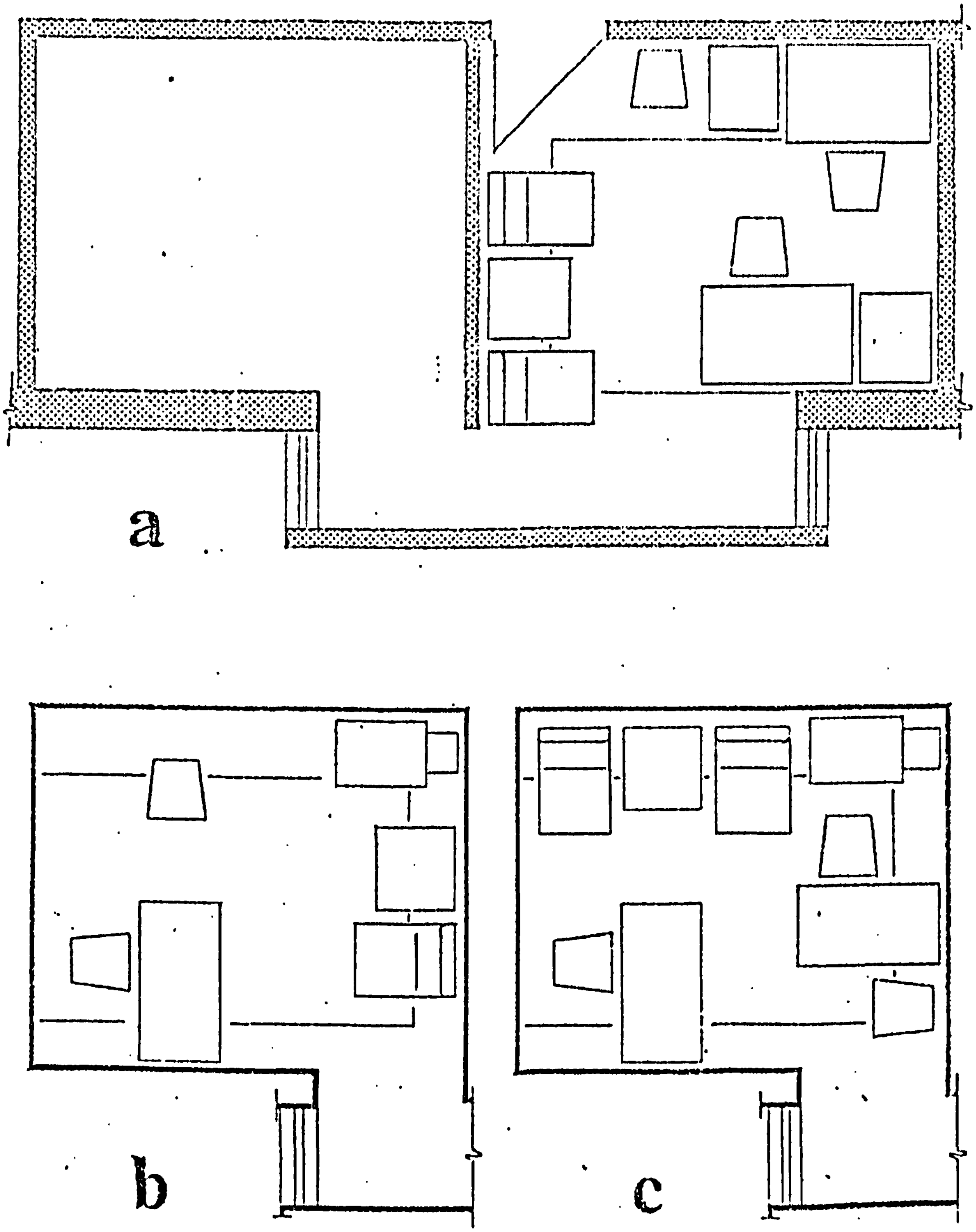

FIGURE 2.1. The arrangement of furniture in the standard room and in the three conditions of the comparison room, (a) empty, (b) furnished, (c) overfurnished.

separating the two rooms, so that he could observe both rooms equally well.

RESULTS

A) Spaciousness. Subjects' responses on the "cramped-spacious" scale were converted into numerical scores of 1 to 7, respectively. The mean scores of the thirty subjects in each of the three conditions of the experiment are shown in Figure 2.2.

As is seen in Figure 2.2, the mean scores for the empty, furnished, overfurnished conditions of the comparison room are 3.73, 4.20, 2.66, respectively, and those of the standard room are 4.46, 4.20, 4.70, respectively. The differences between the three spaciousness evaluations for the three conditions of the comparison room were analyzed by analysis of variance for factorial designs, the results of which have been summarized in Table 2.1.

TABLE 2.1. Summary table for analysis of variance for spaciousness evaluation of the comparison room with furniture density and sequence as two factors.

Source	SS	df	ms	F	P
Total	216.40	89	-	-	-
Furniture density	37.00	2	18.50	8.94	$p<.001$
Sequence	.04	1	04	.02	n.s.
F. density x Seq.	5.49	2	2.74	1.32	n.s.
Error	173.87	84	2.07	-	-

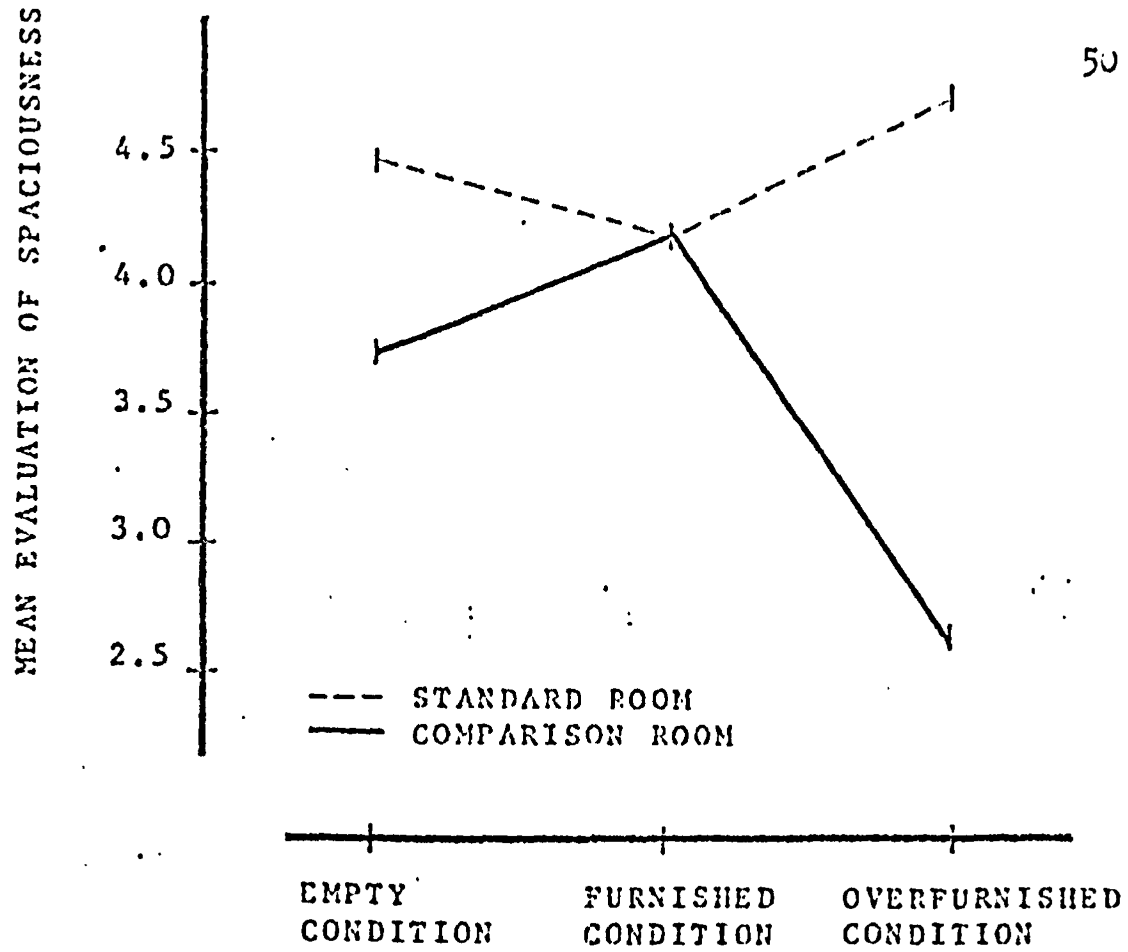

FIGURE 2.2. Mean spaciousness evaluations of the 30 subjects in each of the three experimental conditions of empty, furnished and overfurnished.

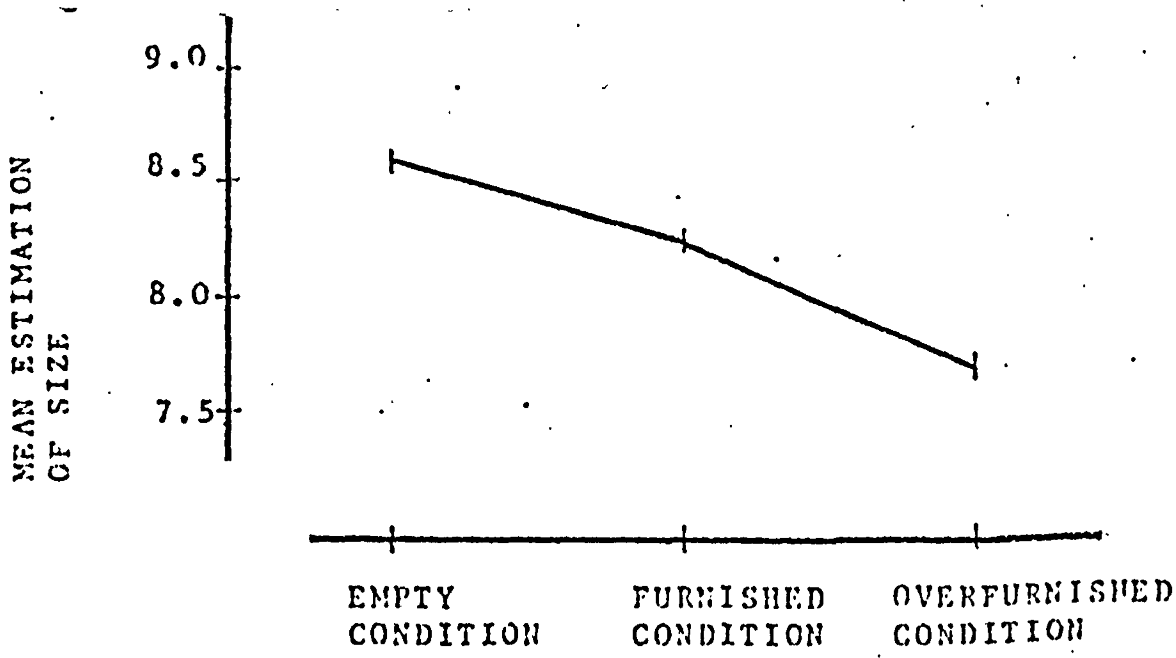

FIGURE 2.3. Mean size estimations of the thirty subjects in each of the three experimental conditions of empty, furnished and overfurnished.

As is shown in Table 2.1, the sequence effect, that is, evaluating the comparison room on the basis of spaciousness first or second, and the interaction effect of sequence with treatment were not significant. However, the overall treatment effect has been found to be highly significant. t - tests for the individual treatment means revealed that the difference between the mean spaciousness evaluations of furnished and overfurnished conditions were highly significant ($p < .001$), as well as, the difference between empty and overfurnished conditions ($p < .01$). However, the difference between empty and furnished conditions was not significant.

To check whether or not any uncontrolled factors were contaminating the results, the differences between the mean spaciousness evaluations of the standard room by the thirty subjects in each of the three experimental groups were also analyzed by an F - test; however, since the standard room was kept constant all through, the differences were not significant - a result which was expected.

B) Size. Since the size of the standard room was stated to be constant (10 units), the results are confined to the mean size estimations of the comparison room by the thirty subjects in each of the three experimental conditions of empty, furnished, overfurnished. These mean scores are represented in Figure 2.3.

As can be seen in Figure 2.3, the mean size judgments are 8.58, 8.26, 7.68 for empty, furnished and over-furnished conditions, respectively. The differences between these means of the three experimental conditions were analyzed again by analysis of variance for factorial designs. Table 2.2 summarizes the results of this analysis.

TABLE 2.2. Summary table for the analysis of variance for size judgments of the comparison room, with furniture density and sequence as two factors.

Source	SS	df	ms	F	P
Total	153.66	89	-	-	-
Furniture density	12.49	2	6.25	3.74	$p<.05$
Sequence	.10	1	.10	.06	n.s.
F. density x Seq.	.97	2	.49	.29	n.s.
Error	140.10	84	1.67	-	-

Table 2.2. shows that again the sequence and the interaction effects were not significant, whereas, the treatment effect was significant ($p<.05$). However, t - tests for differences between individual means have revealed that the differences between empty versus furnished and furnished versus overfurnished conditions were not significant, but that of empty versus overfurnished conditions was significant ($p<.01$).

DISCUSSION

A) Spaciousness. The results suggest the relationship between empty, furnished, overfurnished conditions and their spaciousness evaluations to be of an inverted - U shape. That is, both an empty room and an overfurnished one is assessed to be less spacious than a furnished one. Although the differences between the empty and furnished conditions were not significant, the general trend seems to indicate that some degree of furnishing has a positive effect on spaciousness assessment. Incidentally, it is interesting to point out that for the furnished condition the mean spaciousness evaluations of both the standard and the comparison rooms coincided. That is to say, comparison room which is about 20% smaller, was assessed to be just as spacious as the standard room. It seems that there is an optimal level for the furniture density; when this density is exceeded, additional items start playing a negative role on people's feelings of spaciousness. This finding is in agreement with the results of the pilot studies, which have indicated that for quite a number of subjects' conceptions, spaciousness is closely related to being "uncluttered".

B) Size. The results for the size estimations have shown that there is an inverse relationship between the mean perceived size and furniture density. That is, the empty room is assessed as the largest and the overfurnished as the smallest. This finding is in agreement with the expectations of the present author, and shows that the rather abstract findings about "filled" or "divided space" cannot be readily generalized to full size rooms, where there is an interplay of various factors.

An incidental finding is that for the furnished condition the size estimations of these architecture students were pretty close to the actual ratio of the size of the comparison to standard room. On the other hand, in the empty condition, they have slightly overestimated and in the overfurnished case, slightly underestimated the size of the comparison room.

These experiments, as well as Inui's findings and the pilot studies carried out by the present author, have confirmed the finding that spaciousness is a readily understood concept and have suggested that spaciousness of a room is related to but different from its assessed size. Spaciousness seems to be more sensitive than size to changes in furniture density.

In evaluating the findings of these experiments, it should be kept in mind that these results were obtained from a specific population, namely, male architecture students whose judgments were made in a specific setting, to a specific type and number of items of furniture, arranged in a specific way. Further experimentation is needed in this field to specify the degree to which these findings can be generalized to the population in general, to settings other than office rooms, and to different layouts. Moreover, future studies should aim to clarify the shape of the curve representing the relationship between spaciousness and furniture density by considering more than three levels.

II.2. DESIRABLE DEGREE OF SPACIOUSNESS FOR DIFFERENT KINDS OF ACTIVITIES.

II.2.1. THE INITIAL EXPERIMENT.

In general one can say that each space is designed for a certain function or a set of functions. In other words, there is a differentiation of spaces and activities associated with them. Since spaciousness is a derivative of space, it cannot be studied without considering the function or purpose of a particular space. One can compare the spaciousness of two classrooms; but it is not meaningful to compare the spaciousness of a classroom with a kitchen or the spaciousness of a car with a livingroom. In other words one can only speak about spaciousness within a functional context.

Spaciousness is generally accepted as a desirable quality. Inui (1971) showed that it is closely related to satisfaction, Canter (1972) has found satisfaction in a children's hospital to be highly associated with spaciousness of the wards. Pilot studies carried out by the present author have also indicated that it is generally a desirable quality.

Since spaciousness is assumed to be inseparable from the space and consequently from the function of the space, it is important to study directly the relationship between function and spaciousness. Thus, this study aims to clarify whether maximum spaciousness is desirable regardless of the function of the space, or whether the degree of spaciousness desirable for a specific space is closely related to the activities that will take place in it.

Being stimulated by Hediger's (1955, 1964) and Hall's (1966) categorizations of relationships and distances in animal and human life, an attempt has been made to categorize empirically a range of activities into three groups: personal-intimate, social and public. It is hypothesized that for 'personal-intimate' activities people prefer to be in confined spaces. For the performance of the 'social' activities they choose rather spacious environments and for the 'public' activities they prefer the most spacious environments.

METHOD

The selection procedure for the activities.

A list of 35 activities were administered to a group of ten judges to be classified into three groups; namely, 'personal-intimate', 'social', and 'public'. The judges were instructed that the 'personal-intimate' grouping referred to those activities which involved only themselves and/or someone with whom they had very close relationships; such as a lover, a mother, a very close friend, etc. With such people they would tolerate more physical contact and might engage in intimate, ego-involved activities. The 'social' grouping, on the other hand, would include the activities which usually involved more than two persons with whom they had more distant relationships and would tend to talk about more general, neutral topics. These relationships might involve friends in general, teachers, etc. Finally the 'public' grouping referred to those activities that they would engage in with people whom they either knew very little or did not know at all. See Appendix II A for the list of 35 activities and the introduction given to the judges. The judges' categorizations were given numerical values of 'one' for 'personal-intimate', 'two' for 'social' and 'three' for 'public' activities. (See Appendix II B). From the original 35 activities, fifteen were selected. The two main criteria for selecting these activities were; a) a high degree of agreement among the judges, b) an equal representation of each category. The mean values of the five activities representing the 'personal-intimate' grouping was 1.02, that of 'social' was 1.96, and that of 'public' was 2.80. Thus, the difference between these three means was highly significant ($p<001$).

Subjects

Thirty six second-year architecture students (32 male, 4 female) of the University of Strathclyde served as subjects. The age range was between 18-24 with a mean of 19.5.

Stimuli.

The fifteen activities selected, were mimeographed in two random orders, one being the reverse of the other. Each activity had its own seven-point 'spacious-confined' scale.

Procedure.

The activity scale was administered to all the subjects at the same time in a classroom. Half the subjects were given the first random order and the other half the reverse order. The subjects were instructed to forget about the specific places in which they have carried on these activities but to concentrate on the spaciousness of the kind of place which would be most desirable for each activity. After a brief instruction to the usage of seven-point scales, they were asked to check the appropriate degree of speciousness.

(Appendix II.B illustrates the form used in this experiment.)

RESULTS

The scales were given the numerical values of 1-7 (confined-spacious). Figure 2.4 shows the mean of the 36 subjects' evaluations of the desirable degree of speciousness for each of the fifteen activities.

As can be seen in Figure 2.4., the degree of spaciousness desirable for personal-intimate, social and public activities have formed distinct clusters.

The mean values of the five activities representing

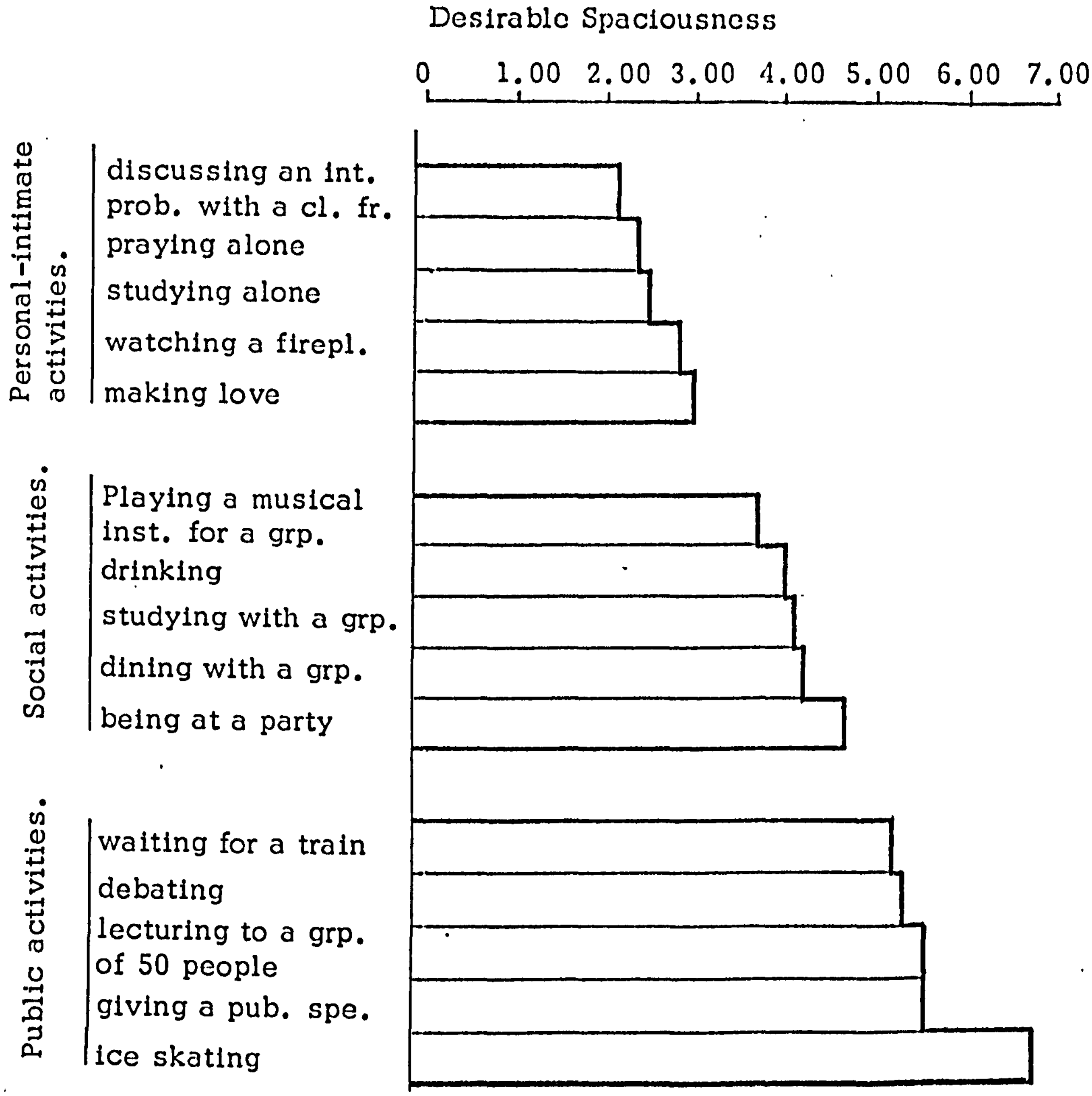

FIGURE 2.4. Mean spaciousness evaluations of the 36 subjects for each of the fifteen activities.

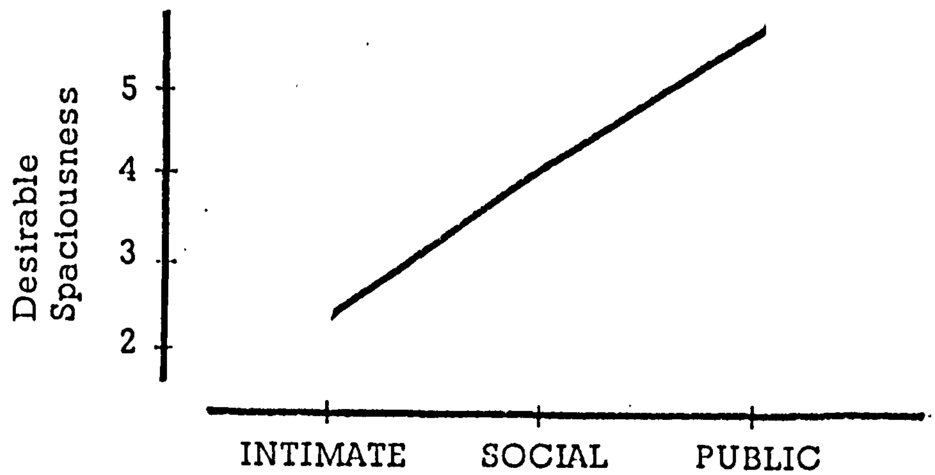

FIGURE 2.5. Mean spaciousness evaluations of the 36 subjects for each of the three categories of personal-intimate, social and public.

each of the three categories are shown in Figure 2.5.

As is seen in Figure 2.5., the mean of the 36 subjects' evaluations of the desirable spaciousness value for the personal-intimate grouping is 2.45; for the social grouping 4.08; and for the public grouping 5.58. The significance of the overall difference between the three means were analyzed by an F-test for repeated measures experimental design, as has been summarized in Table 2.3.

TABLE 2.3. Summary table for analysis of variance of the repeated measures of the desirable spaciousness for personal-intimate, social and public activities.

Source	SS	df	ms	F	p
Total	256.47	107	-	-	
subjects	36.31	35	-	-	
Treatments	176.20	2	88.10	142.09	$p<.001$
Error	43.96	70	.62	-	

As is shown in Table 2.3., the overall differences between the three means for personal-intimate, social and public activities are highly significant. Multiple comparisons between the three means have indicated that all three means are significantly different from one another ($p < .001$).

DISCUSSION

The results have strongly supported the hypothesis that for some kind of activities people prefer rather confined spaces, whereas, for others the desirable degree of spaciousness increases. Personal-intimate activities (praying, studying, making love, etc.) require confined spaces. In these activities there is a personal involvement or an intimate involvement with somebody in a space; therefore, the activities themselves are very important and require person's full concentration. For that reason the individual needs privacy, seclusion and to be himself. This desire for confinement was discussed by a number of authors (Sandstrom, 1972; Sommer, 1969; Jonge, 1968; Hall, 1966) and explained by physiological, cultural and psychological reasons. J.W. Black (1950) has shown that the size and reverberation time of a room affects reading rates; people read more slowly in larger rooms where the reverberation time is longer than in smaller rooms. Hall (1966) has cited various instances of how people from different cultures experience space; for example, the same space perceived as crowded by the Americans, may be quite spacious for the Latin Americans. Sandstrom (1972) emphasized the psychological aspect of space and attempted to link the good, friendly and unpleasant, unfriendly memories with the experienced space of childhood; good and friendly memories being associated with soft, poetic, while the unpleasant and unfriendly ones being linked to spaces which are either larger and more desolate or stringently pressing.

The second category of activities (social) require rather spacious environments. This category has a social content and usually includes more than two people who know each other reasonably well and are involved in non-personal activities or engaged in topics of conversation (drinking, dining with a group of friends, being at a party, etc.). The roles they play are rather formal in character and the existence, pressure of social norms and rules are felt. Society is there and the individuals have to be more careful and considerate of others.

The last grouping of activities, public, requires the most spacious environments. They are well outside the personal and group involvement, and include a number of people who don't know each other. Participants act in certain prescribed ways and treat each other as strangers (e.g., waiting for a train, debating, giving a public speech, etc.). The roles they play are formal and predetermined by each society or culture. Any breakage of rules brings its heavy penalty to individuals.

One objection that may be raised in relation to the present findings is that when the number of people taking part in an activity increases, it necessarily requires a larger space. The validity of this objection was studies later in a related experiment. At this point, it can be pointed out that this objection poses a problem only for the public activities which in general need larger spaces, due to the number of people involved. However, it is difficult to explain by the same argument, why people prefer less spacious spaces for intimate activities which could equally well be carried out in more spacious and larger spaces.

Thus, the present experiment has clearly indicated that for personal-intimate activities people prefer confined, or less spacious spaces, which may be related to a need for seclusion, for freedom from the environmental pressures or to be able to concentrate fully on the problem or the other party involved in the intimate activity and what not. One cannot help but share Goodman's (1973) comment that "any human activity is rich with cause and shape; with tendency of the organism and adjustment to the environment", and this study is only a part of the beginning for further understanding of human nature and its environment.

II.2.2 THE EXPERIMENT CONTROLLING THE NUMBER OF PEOPLE INVOLVED IN THE ACTIVITIES

The experimental study reported in the previous section on "the desirable degree of spaciousness for different kinds of activities" has shown that personal-intimate activities require rather confined spaces, social activities require rather spacious and public activities require the most spacious spaces. One important point that needs to be clarified here is whether or to what degree this relationship is being determined by the number of people involved in each activity, because these activities involve an increasing number of people by definition; for personal-intimate activities the number of people involved is few, for social activities it increases and for public activities this number reaches still a higher level.

Actually, from a practical point of view, the important thing is to realize this relationship between the kind of activities and spaciousness, as our experimental work has clearly shown. However, a theoretical problem that one needs to tackle here is to specify what factors really bring about this relationship between activities and spaciousness. In other words, is this relationship determined mainly by the number of people involved in the activities, or the relationship between participants or by the nature of the activities themselves which may be related to some psychological factors such as, a need for seclusion, for privacy, for dominating, owning or defending one's territory in the case of personal-intimate activities, in contrast to exposing oneself to new people, new events and experiences in the case of public activities? Therefore, another experiment using the same procedure but this time controlling the number of people involved in the activities was carried out.

One problem that could be foreseen here was related to choosing a group of activities with an equal number of people to represent each of the three groupings of personal-intimate, social, and public, because it might not be possible to keep the number constant and still be able to represent each grouping. A related issue that came out here was whether the 'roles' or the 'activities' should be manipulated; in other words, should we try to find some activities that represented the three groupings irrespective of the actor's relation (or role) to the other party (PRAYING, be it with a friend, or someone you do not know, DINING, be it with a lover, a distant friend or someone you do not know, DISCUSSING, DEBATING, etc.) or should we keep the activities the same but manipulate the actor's relation or role to the other party (eating with a LOVER, eating with a COLLEAGUE, and eating with SOMEONE YOU DO NOT KNOW), or both? Thus it was decided that the best solution would be to give the judges as comprehensive a list as was possible representing both of the above mentioned possibilities and find out empirically how they would sort them out.

METHOD

The selection procedure for the activities:

A list of 28 activities was administered to 22 judges individually, again to be classified into three groups, namely "personal-intimate", "social", and "public". The judges were instructed as was in the previous study (II.2.I.). Appendix II.C illustrates the instructions together with the activity list given to 22 male judges.

The judges' categorizations were again given numerical values of 'one' for "personal-intimate", 'two' for "social", and 'three' for "public" activities. From the original 28 activities fifteen were selected. The two main criteria for selecting these activities were; a) a high degree of agreement among the judges, and b) an equal representation of each category. The mean values of the five activities representing the "personal-intimate" grouping was 1.23, that of "social" was 2.03, and that of "public" was 2.74.

Table 1 in Appendix II classifies the selected activities with respect to the number of people involved. As can be seen in Table 1, Appendix II, the selected 5 activities in three activity groups included equal numbers of people with only two exceptional cases: i) Personal-intimate and social groupings had one activitiy involving one person other than the actor ('Dining with a lover' -intimate, 'Dining with a businessman to make a deal' - social) but the public activity instead, included "a few" (Playing a musical instrument for a few people you don't know); and ii) social and public grouping had one activity involving "a bunch of ..." people, while in the personal-intimate group "your family" represented this number (bunch). Other than these two cases, each of the three activity groups classified by the judges, had the very same number of people (a few, a dozen, eight to ten). Another aspect questioned earlier -whether the activities or the relationship (roles) between people was the decisive factor in determining the three groupings was cleared up: 22 judges gave more emphasis to roles rather than the activities themselves. In other words, an activity (e.g., reading, discussing) was categorized in all three groups of personal-intimate, social, and public, according to the actor's relation to the other people; thus one activity was not always considered personal-intimate or social or public.

Subjects

Thirty eight undergraduate architecture students, 34 male, 4 female, were used as subjects. The mean age was 19.66 years, the range being between 18-22.

Stimuli

The fifteen selected activities and a buffer one, were mimeographed in two random orders, one being the reverse of the other. Each activity had its own seven-point spacious-confined scale. One of the two lists of activities used in the experiment is given in Appendix III.D. The instruction page was the same as in the previous experiment (see Appendix II.B).

Procedure

The experiment was administered to all subjects at the same time in a classroom. Half the subjects were given the first random order and the other half the reverse order. After a brief instruction to the usage of seven-point scales, they were asked to check the appropriate degree of spaciousness which would be most desirable for each activity.

RESULTS AND DISCUSSION

The scales were given the numerical values of 1 - 7 (confined-spacious). Figure 2.6 shows the mean of the 38 subjects' evaluations of the fifteen activities. The mean of the five activities representing each of the three categories, on the other hand, are shown in Figure 2.7.

As can be seen in Figure 2.7, the mean of the 38 subjects' evaluations of the desirable spaciousness value for the 'personal-intimate' grouping was 2.87; for the 'social' grouping 4.01; and for the 'public' grouping 4.86. The data was analysed by one-way analysis of variance with repeated measures. Table 2.4 summerises the results of this analysis.

TABLE 2.4 SUMMARY TABLE FOR ONE-WAY (ACTIVITY: PERSONAL-INTIMATE, SOCIAL, PUBLIC) ANALYSIS OF VARIANCE WITH REPEATED MEASURES

Source	SS	df	ms	F	p
Subjects	979.69	37	26.48	-	-
Treatments	1882.44	2	941.22	107.45	$p<.001$
Error	648.23	74	8.76	-	-
TOTAL	3510.36	113	-	-	-

As is seen in Table 2.4, the overall differences between the three means for personal-intimate, social, and

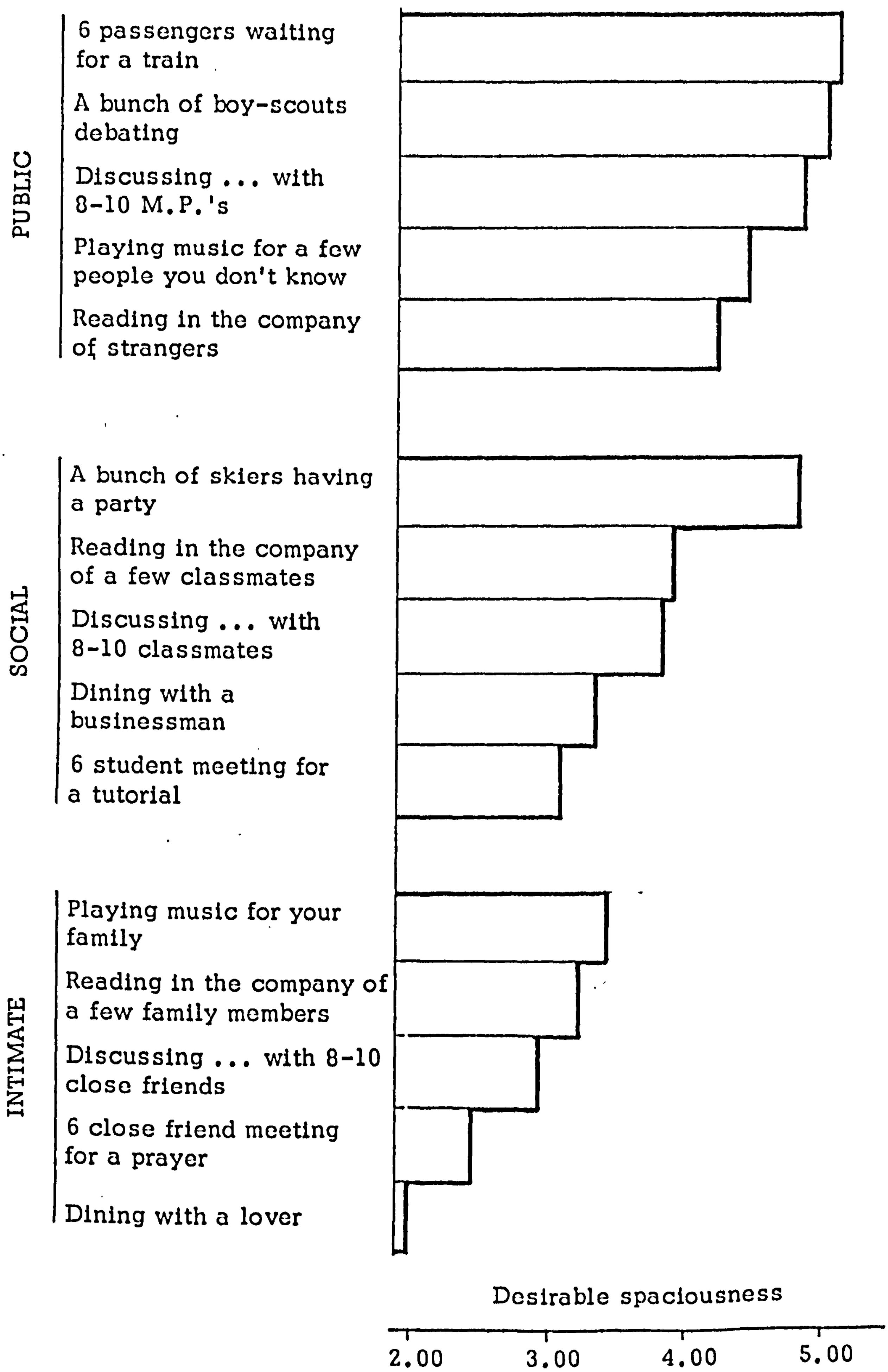

FIGURE 2. 6. The mean evaluations of 15 activities by 38 subjects.

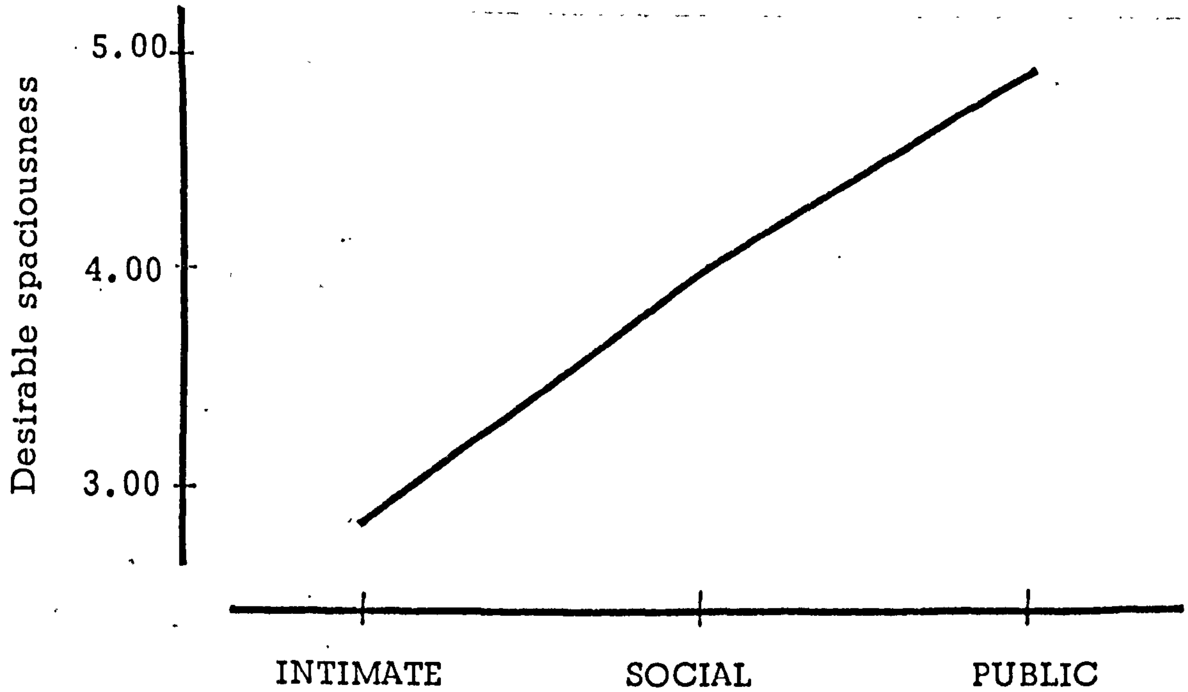

FIGURE 2.7. The mean values of the 5 activities representing each of the 'personal-intimate', 'social', and 'public' categories.

public activities were highly significant. Separate t-tests analyses applied for three types of activities also indicated that the differences between all three groupings were significant at $p<.001$ level.

The results clarified the question asked about the role of the number of people in deciding the appropriate degree of spaciousness for three types of activities: even when the number of people is kept constant in 'personal-intimate', 'social', and 'public' activities, people still want to carry out these activities in interiors with significantly different levels of spaciousness. In other words, not the number of people, but the relationship between the people seems to be the decisive factor in this issue. People desire to carry out public activities in the most spacious interiors; they prefer spacious rooms for social ones; and they think that less spacious interiors will be more proper for the personal-intimate activities, even if the number of people involved is the same.

II.3 THE EFFECT OF ROOM PROPORTION, WINDOW SIZE, WINDOW POSITION

11.3.1 THE EFFECT OF WINDOW SIZE, ROOM PROPORTION AND WINDOW POSITION ON SPACIOUSNESS EVALUATIONS OF ROOMS*

The review of the relevant literature and the pilot studies reported in Part 1, indicated that spaciousness was closely related to windows. In order to gain some insight in this field, four pilot studies were carried out in real rooms. Due to their exploratory nature, these studies are presented in Appendix II.

The literature on windows and window designs are extensive, among which Markus' (1967), Ne'eman & Hopkinson's (1970), Collingro & Roessler's (1972) are the most closely related ones to the present experiments. Markus emphasised the importance of window as a visual link with the outside world and considered the maximum information as the primary function of the window. Ne'eman & Hopkinson's studies on 1/12 scale models

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* A report of this study was presented at the International CIE Symposium on "Windows and their functions in architectural design" in Istanbul, Turkey, October 1973 with Professor T.A. Markus and published in the Proceedings of the Conference.

introduced the idea of "critical minimum acceptable window size". They stated that a scale model was a valid analogue for studying vision and light in buildings. They also found that the selected minimum acceptable window size was dependent neither on the level of daylight penetrating through the window nor on internal artificial illumination. They stated that "the subjective appraisal cannot be related directly and simply to any single dimensional parameter" and explained the assessment of minimum acceptable window width according to three different shapes of the room. Hence their results reveal a close relationship between the minimum window width and room proportion. Contrary to Ne'eman & Hopkinson's study Collingro & Roessler have found the artificial lighting and window width to be significantly related to communication with outside. Their Ss felt less enclosed and restrained when the amount of artificial light increased in the model, and also when the width of the window increased.

Working with various scale models under an artificial sky, Inui & Miyata found that spaciousness for different sky luminances was a function of interior illuminance, room size and window size. They mentioned that the scales of models didn't affect the spaciousness estimation and they didn't find any significant difference between various shapes (proportions) of models.

Jeanpierre (1968) on the other hand, working with full-size mock-up interiors, found out that people in general preferred square or square-like rectangular rooms to other room shapes.

Another highly relevant investigation to the present one is Holmberg et. al.'s (1967) study on the perception of volume content of rectangular rooms. They used 1/10, 1/5 and full-scale empty rooms with 1.5, 2.0, 2.5, 3.0, 3.5 depth to width floor ratios and found a linear relation between these ratios and perception of volume (content); "the more oblong a room, the more spacious it looks". (However, they didn't consider the effect of furniture, didn't deal with windows and the proportions they used were exaggerated.) They suggested that the distance of the wall from the observer might be responsible for the linear relationship obtained between room ratios and perception of volume. Their results show a good correspondence between 1/10, 1/5 and full-scale models concerning the proportion and volume estimation when the Ss were stationary. Lau (1970), dealing with subjective assessment of artificial lighting quality, also concluded that models were satisfactory means to study artificial lighting.

On the basis of these studies which are directly or indirectly related to spaciousness, we can conclude that;

a) Models are satisfactory means to study the visual aspects of spaces,

b) Spaciousness may be directly related to window size,

c) The effect of window position on spaciousness seem indeterminate, and finally,

d) There are doubts about the influence of sky luminance on choosing a preferred window width.

In order to find out the effect of window size, room shape and window position on spaciousness a completely randomised 2 x 2 x 2 factorial design was devised, with two levels of window size (three-bay and continuous), two levels of room shape (square root two by one, and square root three by one floor proportions) and two levels of window position (window on short wall and window on long wall). Figure 2.8 shows the eight combinations of these three experimental variables. Hence the main aims of the experiment were:

1) To study the effect of window size on spaciousness, (variable A)

2) To study the effect of room shape on spaciousness, (variable B)

3) To study the effect of window location on spaciousness (variable C) and

4) To study the interaction between these three variables.

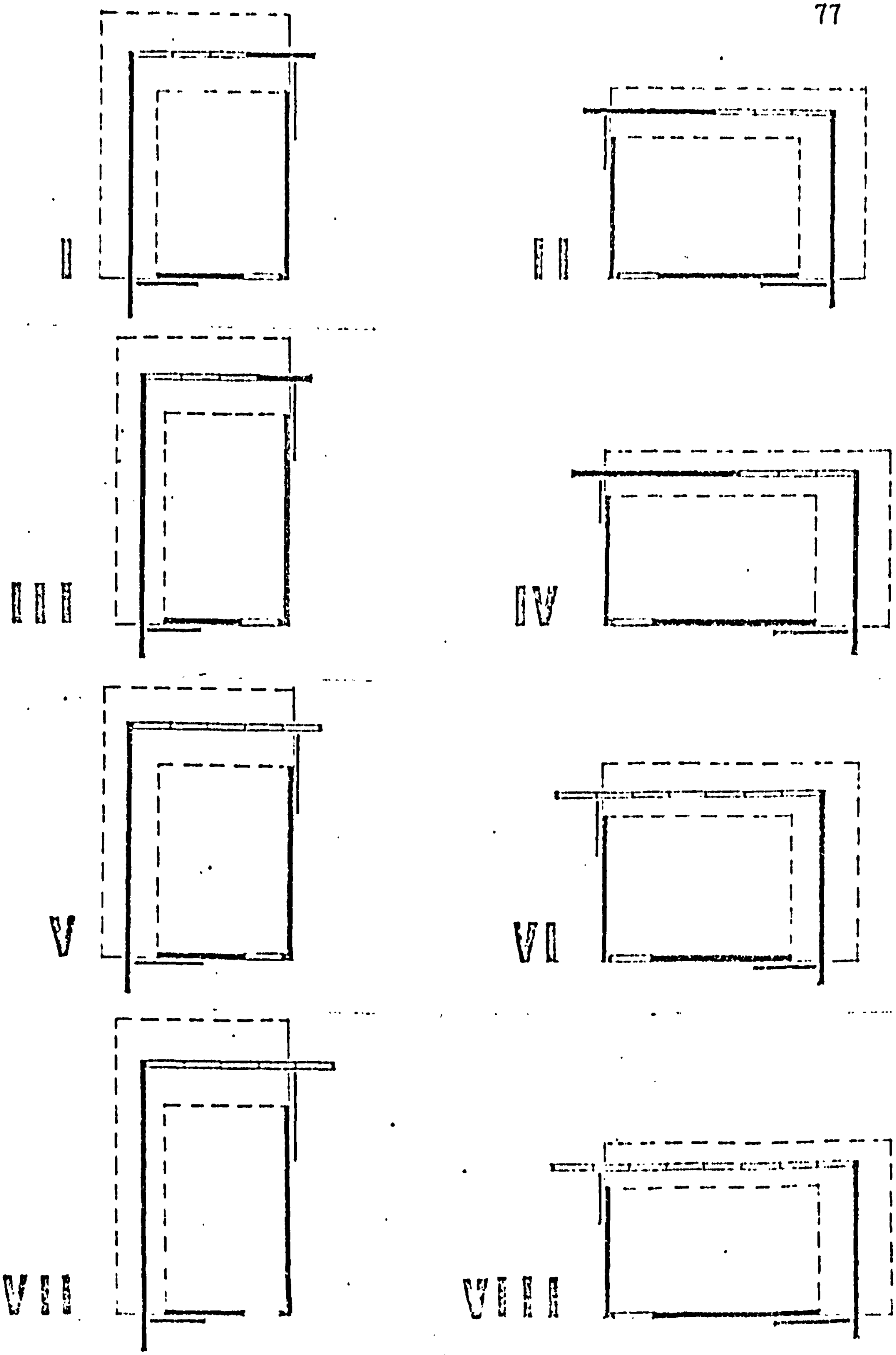


Figure 2.8. 1/10 plans of adjustable models, conditions I to VIII. Dotted lines indicate the smallest and the largest areas, whereas the "equal areas" are shown by solid, dark lines.

METHOD

Subjects

One hundred and twenty volunteer, male students, staff members and technicians of the University of Strathclyde were used as subjects. The mean age was 31.40 years. There were fifteen subjects in each of the eight conditions of the experiment.

Stimuli

1) A square conference room,
2) A 1/10 model of this conference room which will be referred to as the standard model,
3) Two 1/10 scale adjustable models:
   a. square root two by one
   b. square root three by one proportioned model, both with similar architectural character to the standard model.

1) A square conference room was selected for use as a standard; a basic room to be compared with differently proportioned rooms. The floor area was about 36 square meters, ceiling height 2.70 m. It had a five-bay continuous window with a 0.95 m. sill height. (See Figure 2.9). The room was located at the fourth floor of one of the University buildings and had a view to the west, on to other University buildings and Glasgow cityscape. Due to its

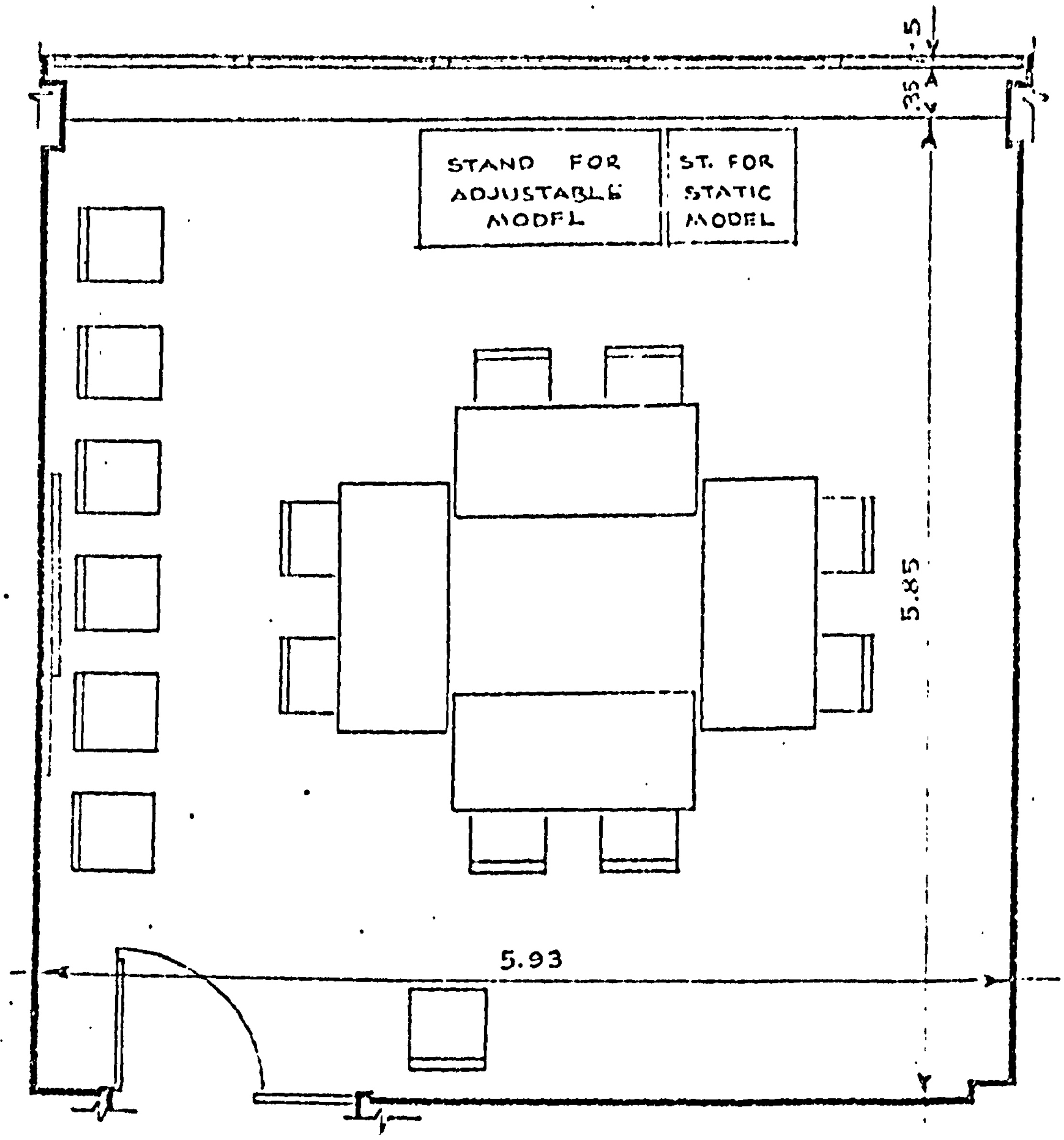


FIGURE 2.9. 1/50 plan of the conference room.

continuous window, the room had adequate natural lighting and did not require any electric lighting during the experimental days in summer. The room had a wall-to-wall dark-brown carpet, white (BS 2660 range, BS 9-102 white) ceiling tiles and warm white (BS 2660 range; BS 4-046 parchment) painted walls; four 1.52x.71m. brown tables, fifteen aluminium tubular, upholstered, charcoal chairs. As can be seen in Figure 2.9, the tables were placed in the middle of the room, and a row of chairs on the south side.

2) The 1/10 model of the conference room was constructed and furnished with 1/10 scale furniture. As true a representation of the actual room as is possible was aimed at. A viewing aperture located at a height representing standing eye level was set on the East wall, opposite to the window, at the door position of the real room. By looking into the model through the aperture the observer was simulating standing at the rear end of the room, entering through the door and looking at the room, facing the window. (See Figure 2.10).

3) Two adjustable, 1/10 scale models were designed; one with square root two by one, the other with square root three by one floor proportions. The size of each model could be changed by means of a handle, but

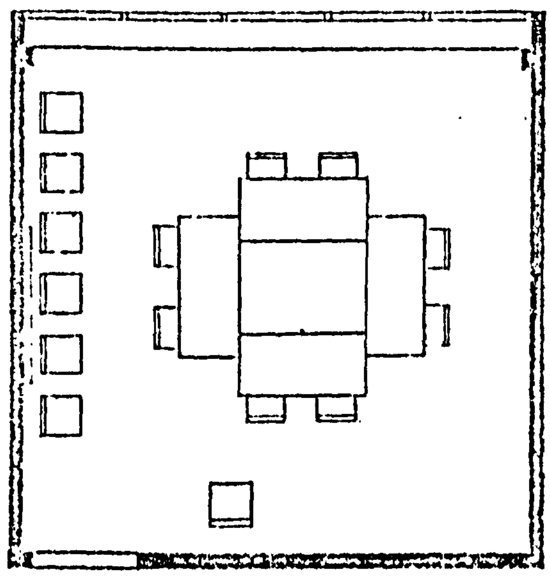


FIGURE 2.10. 1/10 plan of the standard model (1/10 model of the conference room).

the proportion and ceiling height of each was kept constant. Two walls and the floor (base) of each adjustable model were fixed, while the remaining two walls were moveable on the diagonal of the basic rectangle, so that the proportion always remained the same. It was possible to change the two moveable walls for eight of the experimental conditions. The adjustable models were designed in such a way that all of the eight experimental conditions would have similar architectural atmosphere - using the same materials, colouring of surfaces, ceiling height, dimensions of window bays, furniture layout, etc. - except for the room proportions, placement of the window (on short or long wall) and the number of window bays. The fixed walls had two viewing apertures, according to the experimental setting, one of them was blocked while the other one used for looking into the model.

The furniture arrangement was such that for the I, III, V and VII conditions the row of chairs was placed to the North side of the room, giving a mirror image of the layout in the standard model; while in other conditions the arrangement in principle was similar to the one in the standard model and consequently to the actual room. (See Figures 2.11 and 2.12.) The smallest possible area in both of the adjustable models was equivalent to about

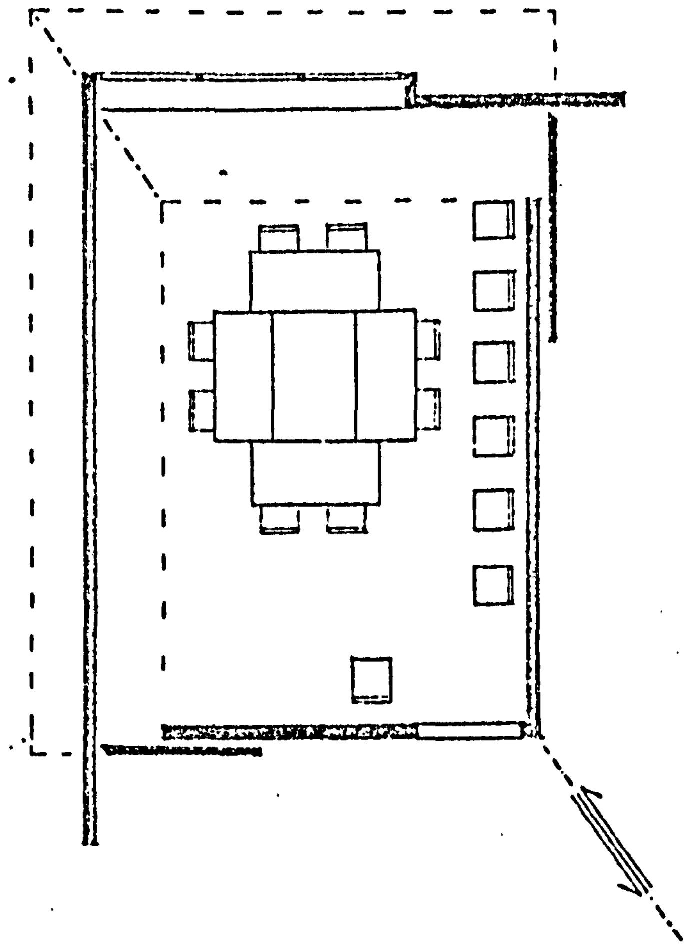


FIGURE 2.11. 1/10 plan of adjustable model in condition I; three-bay window, root two proportion, window on short wall.

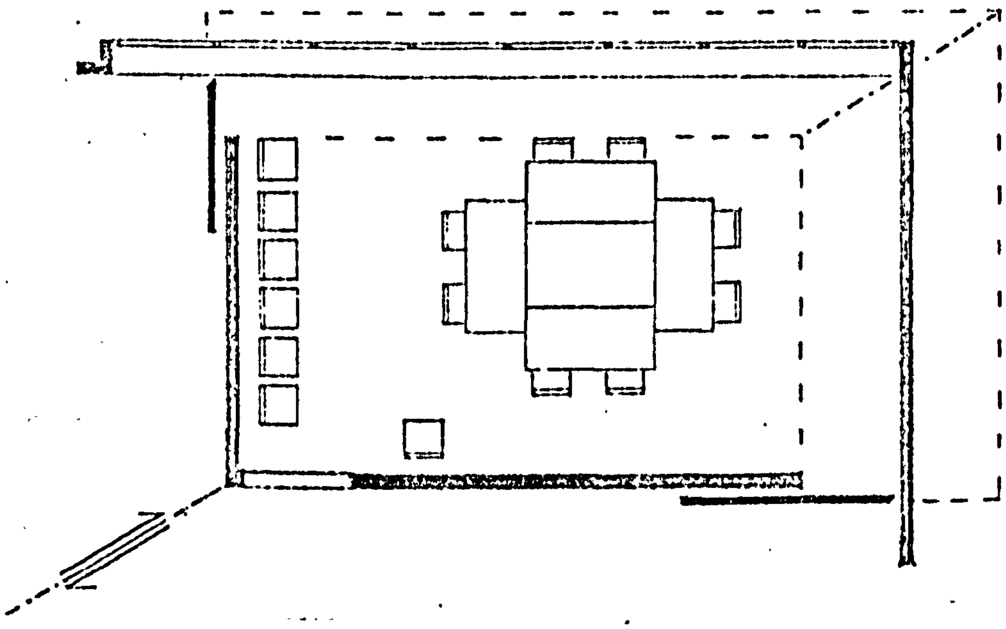


FIGURE 2.12. 1/10 plan of adjustable model in condition VIII; continuous window, root three proportion, window on long wall.

25 square meters and the largest to 47 square meters, thus $\pm$ 30% of the area of standard model could be achieved.

The rationale for choosing the stimuli

Choice of rectangles: To avoid the arbitrary selection of room dimensions, basic root rectangles were employed; square, square root two by one, and square root three by one. The relationship between a square and these rectangles is that the diagonal of a square yields square root two length, and the diagonal of square root two by one rectangle yields square root three length. The numerical values of root two and root three are 1.414 and 1.732 respectively. In architectural context these two proportions can be considered quite common.

Windows starting from the corner of the room: Ne'eman & Hopkinson as well as Inui & Miyata used symmetrical window positions. In the present study the windows start from one end of one of the walls. The reasons for this are;

1) Since the models are adjustable it would have been very difficult to have symmetrical windows on a flexible wall without cumbersome devices,
2) To enable the Ss to adjust the model size without changing
    a. window position with respect to the room and

consequently,

b. the general character of the window wall,

3) To be able to have a continuous window, starting from one end and enlarging or diminishing with the will of the Ss,

4) An increasing number of buildings are being designed with these characteristics.

Sky luminance and artificial lighting not considered:

1) The authors at this stage, wanted to learn about the effects of natural lighting on spaciousness,

2) The models used here as stimuli are simpler, easier to deal with, enabling one to work with them in any place,

3) Since the models are adjustable it would have been very difficult to maintain the similar electric lighting pattern and quantity in the models,

4) The selected experimental room had a continuous window, had adequate daylight and did not need any electric lighting during the experiments,

5) Experiments were carried out in summer between 9.00 - 17.00 hours, in mainly cloudy conditions; sky luminance could be considered more or less constant.

View: Due to their positioning in the room, the models had the same view as the real room. Thus the information content of the windows was roughly constant. The room used for the experiments was far away from any other occupied building and therefore there was no problem of visual privacy.

Procedure

For each of the eight experimental conditions, two models, the standard model and one of the adjustable models, were placed side by side, in front of the windows of the conference room, so that they could be compared easily and would have more or less the same view and the lighting conditions as the actual room.

The experiment was administered to each subject individually. After a short introduction each subject was first asked to compare the spaciousness of the real room with its 1/10 model (standard model). Then the experimenter demonstrated how to adjust the rectangular model and left the model in "equal area" position and asked the subject to adjust it so that both of the models (rectangular and the standard) would look equal in spaciousness. When the subject adjusted the model and expressed that he was satisfied with his judgement he was thanked and left the room, then the experimenter measured and recorded the subject's assessed size.

In architectural psychology literature there are a number of investigations with scale models, giving the subjects the opportunity of changing one of the variables (Jeanpierre, 1968; Hill, 1968; Ne'eman & Hopkinson, 1970; Inui & Miyata, 1973; Keighley 1973). In the present study the subjects were enabled to adjust and choose any size they felt satisfactory. They could practice and make their decisions within the limits of the experiment, where there were no limiting sizes or steps of different sizes.

Although many authors mentioned the possibility of using scale models in visual tasks, the present author also wanted to check the validity of 1/10 scale models with regards to spaciousness. First of all subjects were taken into the experimental room, they were asked to compare its spaciousness with its 1/10 model (standard model), then the _S_s were asked to compare the rectangular model with the standard model. This procedure was thought to help the _S_s to follow a smooth mental judgement; step by step starting with the consideration of the spaciousness of an actual room, continuing with the judgement of the 1/10 scale model of the same room and ending with the comparison of the same scale but two different shape models.

RESULTS

I. Comparison of spaciousness of the actual room with its 1/10 scale model: 35 of the 120 subjects assessed the standard model more spacious than the actual room, 20 of the Ss assessed the room more spacious than its model; while 65 Ss assessed the room and its 1/10 model equal in spaciousness. Thus 54% of the Ss saw no difference.

II. Spaciousness comparison of two models:
Subjects' assessment of rectangular adjustable models were measured, recorded and converted into volume. The mean assessed volumes for the 15 Ss in each of the eight conditions of the experiment are shown in Figure 2.13. It must be kept in mind that the smaller the volume of the adjustable model the more spacious it is judged to be. As is seen in Figure 2.13, in five conditions (I, II, V, VII, VIII) rectangular models were assessed more spacious than the standard model, while in the other three conditions (III, IV, VI) the standard model was assessed more spacious. The adjusted sizes of the rectangular models were very close to the size of the standard model; the mean of the largest adjusted one was 8.08m^3 or 8.25% larger than the standard model and the mean of the smallest adjusted one was

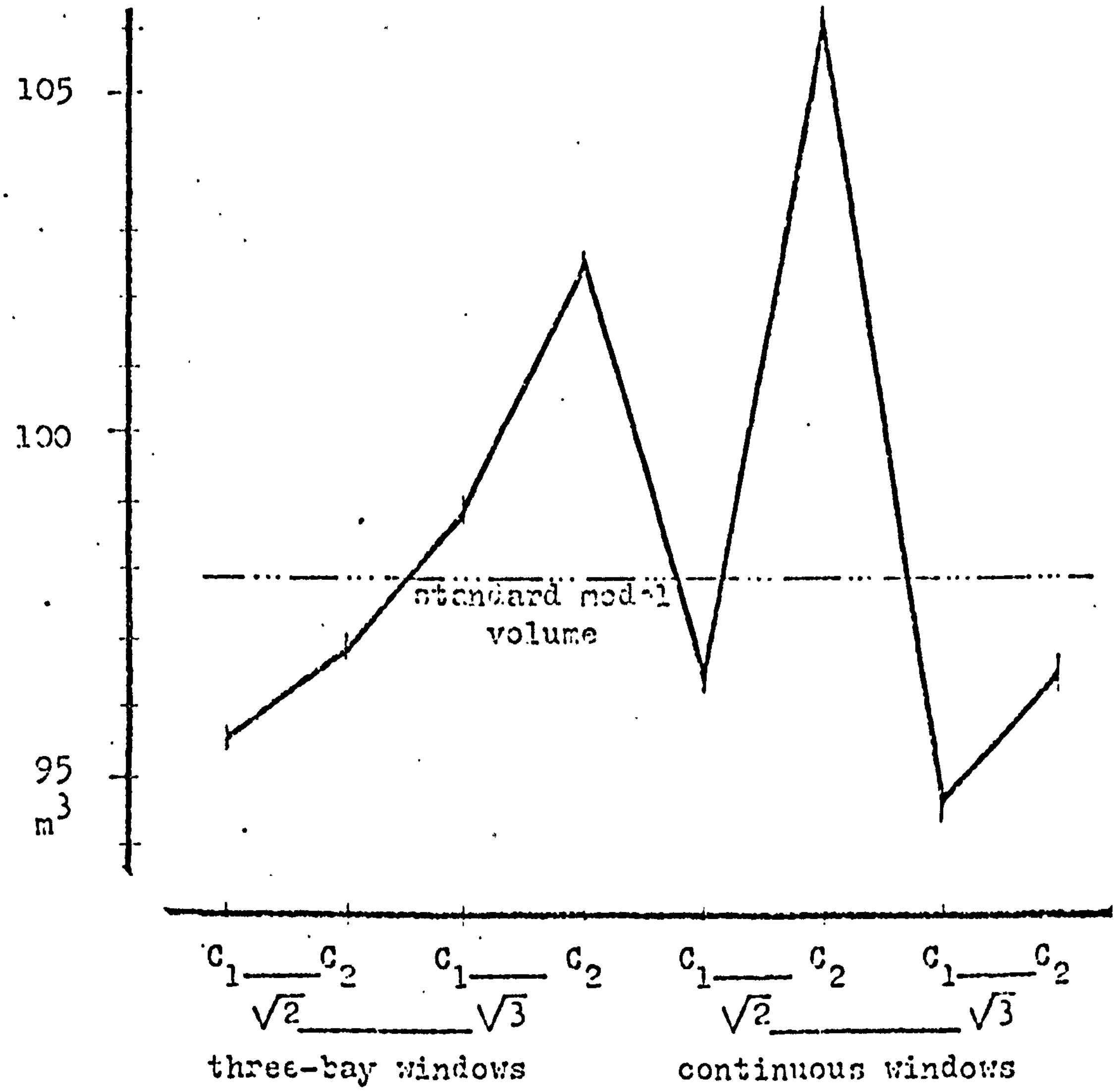


FIGURE 2.13. The mean adjusted volumes of rectangular models by 15 Ss in each of the eight conditions of the experiment.

$3.32m^3$ or 3.38% smaller than the standard. Thus the difference between the largest and the smallest was $11.40m^3$.

The differences between the eight spaciousness assessments for the eight conditions of the rectangular models were analyzed by analysis of variance for a 2 x 2 x 2 factorial experiment, the results of which are summarised in Table 2.5.

TABLE 2.5 SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR SPACIOUSNESS ASSESSMENTS OF THE RECTANGULAR MODELS WITH WINDOW SIZE, ROOM PROPORTION AND PLACEMENT OF WINDOW AS THREE VARIABLES

Source	SS	df	ms	F	p
A Window size	0.00	1	0.00	-	-
B Room proportion	14.47	1	14.47	0.18	-
C Window position	488.59	1	488.59	6.41	$p<.025$
A X B	749.20	1	749.20	9.83	$p<.005$
A X C	83.13	1	83.13	1.09	-
B X C	54.00	1	54.00	0.70	-
A X B X C	185.81	1	185.81	2.43	$p<.20$
Error	8530.20	112	76.16	-	-
Total	10105.40	119	-	-	-

Main Effects

As is seen in Table 2.5, the main effects of window size and room proportion are not significant whereas that of window position is significant ($p<.025$). That is, when the window is on a short wall, irrespective of the window size or proportion of the models, all the models were assessed to be more spacious than the models with the window on a long wall.

Interaction Effects

The interaction of window size with room proportion is highly significant ($p < .005$). In the three-bay window case, root two models were assessed (quite) spacious (adjusted mean volume being $96.24m^3$) while root three models were assessed (quite) cramped (adjusted mean volume $100.54m^3$). On the other hand, when the windows were continuous on one of the walls (larger window area) the situation was reversed, and the root two models were seen as least spacious ($101.24m^3$) while the root three models were evaluated as the most spacious (adjusted mean volume being $95.55m^3$). Figure 2.14 shows the A X B (window size X room proportion) interaction in graphical form. As can be seen in this Figure, in both of the window conditions the volume of the standard model is between the above mentioned values.

t - tests applied for simple effects of A X B interaction indicate that in three-bay and continuous window conditions the differences between root two and root three models are significant ($t = 2.006$; $df = 58$; $p < .025$ for three-bay windows and $t = 2.297$; $df = 58$; $p < .025$ for continuous windows).

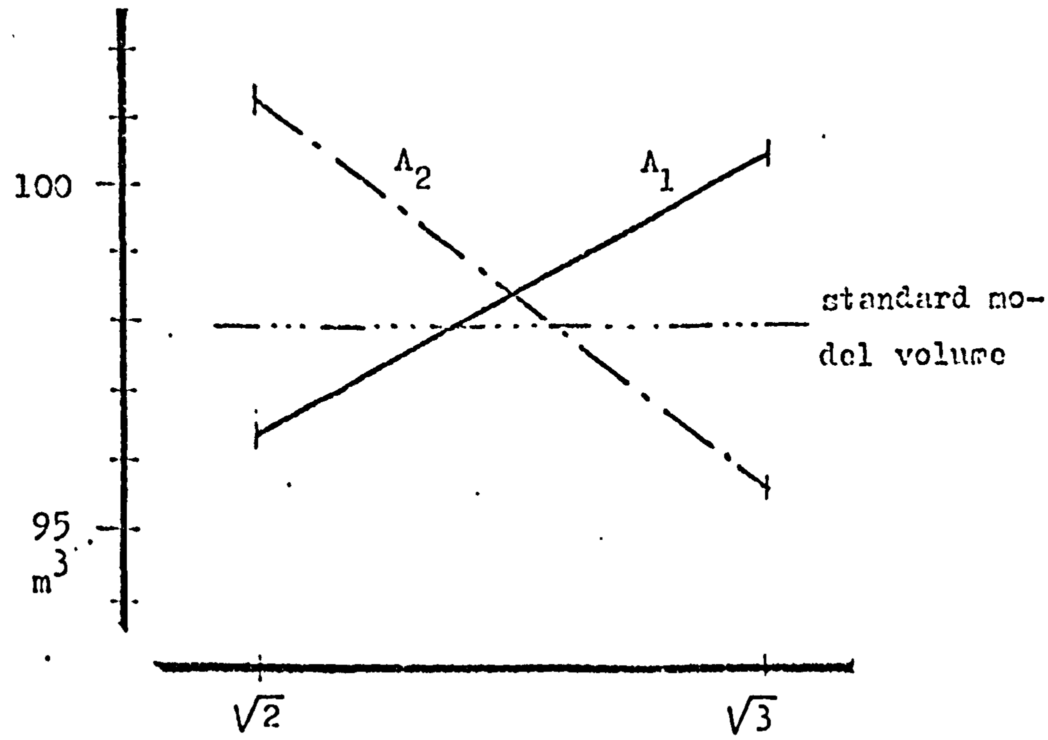


FIGURE 2.14. Window size (A) X room proportion (B) interaction effect.

t - tests applied for root two models show that the difference between three-bay windows and continuous windows is significant ($t = 1.926$; $df = 58$; $p < .05$). This difference in root three case is also significant ($t = 2.495$; $df = 58$; $p < .01$).

As can be seen in Table 2.5, the other interaction effects are not significant. Although the high-order interaction is approaching significance ($p < .20$).

DISCUSSION

I. The results of the present experiment verified that 1/10 detailed scale models can be used as a means to represent the interior spaces. More than 50% of subjects saw no difference between the spaciousness of the actual room and its model. About 30% assessed the model as being more spacious than the room. This may be due to the fact that during the experiment the models (both the standard and the comparison) that were placed on tables, occupied a certain volume.

II. The results indicate the main effects of window size and proportion of rooms to be insignificant. This finding may seem to be in conflict with the results of the past studies which have in general showed window size to be directly related to spaciousness (Collingro & Roessler, 1972, Inui & Miyata, 1973).

The highly significant interaction of window size with room proportion however, points out that the effect of window size on spaciousness is more complicated than past literature has shown. It seems that the effect of window size gains importance when it is considered within the proportion of the rooms. In square-like rooms smaller windows give greater feeling of spaciousness than continuous windows, on the other hand, in oblong rooms continuous windows give a greater feeling of spaciousness. In other words, the root two proportioned rooms can give more economical volumes with smaller windows and the root three proportioned rooms with larger windows. (See Figure 2.14).

One of the most important findings of this experiment is the strong relationship between spaciousness evaluation and window position; irrespective of the window size or proportion of the models, the rooms were seen as being more spacious when the windows were on the short wall. This, of course, is a comfort for architects and shows that a smaller external wall which is desirable for building economy also gives better spaciousness.

On the basis of the main findings, namely, the main effect of window position and the window size x room proportion interaction, square-like rooms will be expected to appear more spacious with a smaller (three-bay) window on the short wall, and oblong rooms to be evaluated as being more spacious when there is a continuous window on the short wall. Figure 2.13 shows that the comparison models bearing these characteristics were assessed as most spacious (conditions I and VII). The mean adjusted volume in the 1st condition is 95.63m^3 and in the VIIth 94m^3. It should be pointed out that the sizes of the windows in these two conditions are very close to each other; specifically 5.43m^2 in the 1st condition and 6.88m^2 in the VIIth. Hence, these findings seem to indicate the very interesting possibility of determining the most economical solution of desirable window size and spaciousness relationship.

In five experimental conditions the standard model was seen less spacious than the comparison ones, in the remaining three conditions it was assessed more spacious. But in all of the eight conditions the adjusted sizes of the comparison models were very close to the size of the standard model. (The range of the adjusted volumes for all of the 120 <u>Ss</u> had a minimum value of 84.21m^3 and a maximum of 124.59m^3 as compared with 97.93m^3 volume of the standard model.) This finding indicates that; either the <u>Ss</u>

do very careful and consistent judgements of spaciousness or, they associate the spaciousness very closely with physical volume or floor area.

One of the unexpected findings of this experiment is the inverse relationship between window size and spaciousness in root two proportioned models. One would expect that the root two model with continuous window on long wall (condition VI) would be assessed as one of the most spacious rooms. Contrary to this expectation this condition was evaluated as the least spacious. This finding seems to warrant some explanation: The sizes of the windows in the first four conditions was constant, $5.43m^2$, while in the last four it was variable $7.69m^2$, $11.39m^2$, $6.88m^2$ and $12.02m^2$ for the V., VI., VII. and VIII. conditions, respectively. The ratio of the window area to the floor area ranged from 14.33% in the IVth condition to 33.65% in the VIIIth. That is to say the window sizes were relatively large. (See Ne'eman & Hopkinson, 1970). Ss might have found this high "window area/floor area" ratio very unusual and had difficulty in making judgements, or spaciousness may be a concept that loses its meaning above a certain limit of window size; beyond a certain size of window, or amount of light, some other factors might be playing more important roles.

In generalising the findings of this experiment it should be kept in mind that these results were obtained from a specific population, whose judgements were made in a specific setting, to specific room proportions and window design, to a specific type, number and arrangement of furniture. Further experiments are underway as part of the general research project on spaciousness, to specify the degree to which these findings can be generalised to different layouts, different proportions and window designs.

II.3.2 THE RELATIONSHIP BETWEEN THREE LEVELS OF WINDOW SIZE, TWO LEVELS OF ROOM PROPORTION AND SPACIOUSNESS ASSESSMENT OF ROOMS

The previously reported experiment indicated that rooms with their windows on the short walls were assessed as being more spacious than the ones with windows on the long sides. Another finding of the previous study was that the window size effect did not reach significance. As was mentioned before, this finding was not in agreement either with the findings of Inui and Myata (1973) or with the findings of Collingro and Roessler (1972). Inui and Miyata had found a positive significant relationship between the window size and spaciousness, and Collingro and Roessler showed that when the width of the window was increased, people felt less enclosed and restrained.

The fact that the window size effect did not reach significance in the previous experiment might have been due to the relatively large size of three-bay windows. Particularly when the windows were located on the short sides of the models, the size of three-bay windows were very close to that of continuous ones (see the discussion part of Experiment II.3.1). Hence, perhaps the two levels used had not varied the size of windows sufficiently to study the main effect of this variable. To examine this possibility, the present experiment was devised. By keeping the window position constant on the short side, this experiment aimed to study the effects of three levels of window size (2-bay, 3-bay and continuous) and two levels of room proportion (root-two and root-three floor proportions) on spaciousness assessment of 1/10 scale models.

METHOD

Subjects

Thirty subjects of the two new conditions involving 2-bay windows were again male students, staff members and technicians of the University of Strathclyde. The data for the four conditions involving 3-bay and continuous windows were taken from the previously reported study. There were fifteen subjects in each of the six conditions of the present experiment. The overall mean age for all subjects was 28.15 years, the range of the mean ages for the six conditions being between 20.46 and 38.40 years.

Stimuli

The stimuli were the same as in the previous experiment except a new window size - 2-bay window - was introduced to the short sides of the root-two and root-three adjustable models.

Procedure

The procedure was the same as in the previous experiment (see Experiment II.3.1)

RESULTS

Subjects' assessments of rectangular adjustable models were measured, recorded and converted into volume as was done in the previous experiment. The mean assessed volumes for the fifteen subjects in each of the six conditions of the experiment can be seen in Table 2.6.

TABLE 2.6 THE MEAN ASSESSED VOLUMES OF THE FIFTEEN SUBJECTS IN EACH OF THE SIX CONDITIONS OF THE EXPERIMENT (m^3)

	2-bay window	3-bay window	continuous window
Root-two	103.96	95.63	96.48
Root-three	99.81	98.79	94.61
Mean	101.885	97.21	95.545

It must be kept in mind that the smaller the volume of the adjustable model, the more spacious it is judged to be. The data was analyzed by a two-way - 3(window size X 2(room proportion) - analysis of variance for completely randomised factorial designs. Table 2.7 summarizes the results of this analysis.

As can be seen in Table 2.7, the main effect of window size was significant ($p < .025$). That is when positioned on the short sides, the interiors having smaller windows

TABLE 2.7 SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR SPACIOUSNESS ASSESSMENTS OF THE ADJUSTABLE MODELS WITH WINDOW SIZE AND ROOM PROPORTION AS TWO VARIABLES

SOURCE	SS	DF	MS	F	p
A (window size)	648.6557	2	324.3278	3.9404	.025
B (room proportion)	20.3157	1	20.3157	.2468	-
AB	208.8844	2	104.4422	1.2689	-
Residual	6913.8983	84	82.3083		
TOTAL	7791.7543	89			

were perceived as being less spacious than those with continuous windows. Separate t-test analyses indicated that the difference between the spaciousness of rooms with 2-bay and continuous windows was significant ($t = 2.53$, $df = 58$, $p < .02$), whereas the difference between 2-bay and 3-bay windows was reaching significance ($t = 1.93$, $df = 58$, $p < .1$). There was no difference between the spaciousness assessments of rooms with 3-bay and continuous windows.

DISCUSSION

The results indicated the main effect of window size to be significant. Rooms with continuous windows were assessed as being significantly more spacious than the ones with the smaller 2-bay windows. The difference between the spaciousness of rooms with 3-bay and continuous windows was not significant, while that between 2-bay and 3-bay windows was approaching significance.

TABLE 2.8 WINDOW SIZES, FLOOR AREAS AND RATIOS OF WINDOW SIZES TO FLOOR AREAS OF THE SIX EXPERIMENTAL CONDITIONS (m^2)

		Window Size	Floor Area	Window/ Floor	Mean w./floor
2-bay window	root-2	3.62	38.50	9.40%	9.60%
	root-3	3.62	36.97	9.79%	
3-bay window	root-2	5.43	35.42	15.33%	15.09%
	root-3	5.43	36.59	14.24%	
contin. window	root-2	7.69	35.73	21.5%	20.58%
	root-3	6.88	35.04	19.63%	

The ratio between window size and average adjusted floor areas for the three types of windows were 9.60%, 15.09% and 20.58%, for 2-bay, 3-bay and continuous windows, respectively. Table 2.8 shows window sizes, floor areas and ratios of window sizes to floor areas of the three types of windows for both root-two and root-three models.

Results implied that the increase in the ratio of window/floor area from about 9.6% to 20.6% significantly increased the spaciousness of the interiors, while the increase from 9.6% to about 15.4% was almost significant. On the other hand, people did not see any difference between the spaciousness of interiors when the window/ floor area ratios increased from 15.1% to 20.6%. Thus on the basis of the present findings it can be concluded that when the windows are quite small (smaller than about 1/10 of the floor area) the rooms are perceived least spacious. Any increases in window size helps the interior to appear more spacious, consequently the most spacious condition is achieved by increasing the width of the window to the full width of the room (continuous window).

To recapitulate, the results of the two experiments related to window size, window position and room proportion showed that:

(a) The spaciousness assessment of a real room and that of its 1/10 scale model seem to be similar;

(b) rooms with their windows on the short sides are seen more spacious than those with their windows on the long sides;

(c) root-two models (square-like) are seen more spacious with 3-bay windows, whereas root-three (oblong) ones with continuous windows;

(d) when located on the short sides, interiors with small 2-bay windows are assessed as being less spacious than those with continuous windows.

PART THREE

SPACIOUSNESS SCALE CONSTRUCTION

SPACIOUSNESS SCALE CONSTRUCTION

III.1. STAGE 1 :THE SELECTION AND THE RATINGS OF DESCRIPTIVE ADJECTIVE PAIRS ON APPROPRIATENESS TO DESCRIBE THE SPACIOUSNESS OF A ROOM

As this project progressed, a continuous need was felt to understand better and clarify the meaning of spaciousness, as well as a need for a more discriminative tool to evaluate the interiors in terms of spaciousness. For this purpose an attempt was made to construct a spaciousness scale. It was hoped that this would serve two main functions; one being theoretical, the other more practical. On theoretical level, such a scale would further enlighten the main psychological components of spaciousness, thereby clarifying its denotative and connotative meanings and enhancing our understaning of the construct. On the practical level, the scale might enable one to rate or evaluate interiors with respect to spaciousness. It should be pointed out that this scale is considered specifically as a tool to be used for experimental purposes. For example by asking subjects to evaluate a number of interiors using this scale, we should be in a position to differentiate between those perceived as spacious and those that are not; hence by way of a systematic manipulation of the variables exposed in the interiors, it would be possible to collect a wide range of experimental data in a more economical way. It was hoped that such a tool might enable the investigator to obtain evaluations of spaciousness without mentioning the word'spaciousness', which may be specifically important in some investigations, like intergroup comparisons or cross-cultural studies.

METHOD

a) One hundred and twenty adjective pairs were selected from different sources (Vielhauer, 1965; Canter, 1969; Honikman, 1970; Wools, 1971) to be rated on their appropriateness to describe the spaciousness of a room. Nine of the 120 adjective pairs were duplicated to assess the internal consistency of the ratings. Thus, total list presented for rating consisted of 129 pairs of adjectives. (See Appendix III,A) The entire list was randomly printed on six pages and the order of the pages in the list was randomized.

Thirty six undergraduate architecture students (1972-73 second year), 32 males, 4 females, served as raters.

b) After further investigation of the related fileds and survey of the newly published literature 31 new bipolar adjective pairs were added to the list of 120 pairs, altogether reaching the number of 151 (Canter and Wools 1970; BPRU, 1972; Hersberger, 1972; Kuller, 1972 and 1973b). The reason for this addition of new pairs was to have as comprehensive a list as possible. In addition to the nine duplicated pairs, one of the new 31 bipolar adjectives was repeated to assess the internal consistency of the ratings. Thus, total list presented for rating consisted of 161 pairs of adjectives. The new pairs were randomly added to each of the six pages of the previous list (Appendix III).

Two groups of subjects served as raters ;

1. Forty two undergraduate and graduate architecture and psychology students, 32 male, 10 female,
2. Fifty seven office workers, 30 male, 27 female, in one of the large offices in Glasgow.

The questionaire was administered to each group in separate sessions.

Each adjective pair e.g. large-small, pleasant-unpleasant, was rated on its appropriateness to describe the spaciousness of a room. An eleven-point rating scale, ranging from a rating of one, "extremely inappropriate" to a rating of eleven, "extremely appropriate" was used. The reason why an 11-point scale was utilized is due to its more discriminative nature as compared to any scale with a smaller categorization. At this stage a need was felt to draw a clear borderline between the appropriate and inappropriate pairs. The subjects were also given the option of using question marks to designate any pair of words whose meaning was unclear.

RESULTS

To obtain a measure of internal consistency, correlation coefficients of the 10 duplicated pairs were computed. The analysis of data for the 10 repeated adjective pairs indicated that, the variables did not have a normal distribution. Hence, rank order correlation coefficients, both Spearman's rho and Kendall's tau were computed for each of the ten duplicated pairs by the help of the SPSS (1970) computer program. Since the Kendall's tau seems more appropriate for the present data (a large number of cases were classified into a relatively small number of categories) Table III.1.1. gives only these coefficients and their 'z' values for the whole subject sample (SPSS 1970, p.153, Siegel, 1956). The combined correlation for the total subject sample gave a mean 'z' value of 8.24, which is significant beyond the .00003 level. (Table 1 in Appendix III gives both the computed Spearman's rho and Kendall's tau values and their significane levels for three different subject groups, males, females and the total subject sample).

Means, standard deviations and the question marks were found for each of the 161 pairs of adjectives to obtain the central tendency of appropriateness values, the amount of subjects' agreement and clarity of meanings of the adjective pairs.

The criteria for deleting adjective pairs were stringent, To be eliminated, an adjective pair

(i) had a mean below 7.0, the first "appropriate" point on the 11-point scale, for either student or office worker groups;

(ii) had a standard deviation of 3.16 (variance of 11.00) or larger;

(iii) had 9 or more question marks.

TABLE III.1.1. COMPUTED TWO-TAILED KENDALL'S TAU CORRELATION COEFFICIENTS AND THEIR 'z' VALUES FOR EACH OF THE TEN REPEATED ADJECTIVE PAIRS (ALL GROUPS)

BIPOLAR ADJECTIVE	NO. OF RESPONSE	KENDALL'S TAU	SIGNIF.	z
restful-disturbing	133	.356	.001	6.08
pleasant-unpleasant	135	.541	.001	9.31
uncluttered-cluttered	134	.487	.001	8.35
empty-full	131	.524	.001	8.87
contemporary-traditional	134	.519	.001	8.90
distinctive-ordinary	134	.387	.001	6.63
graceful-clumsy	132	.455	.001	7.74
livable-unlivable	133	.449	.001	7.66
neat-messy	133	.526	.001	8.97
huge-tiny	95	.638	.001	9.15
MEAN				8.24

These criteria left 31 adjective pairs. Most of the pairs had small standard deviations, thus the criterion of a standard deviation of 3.16 or larger was a post hoc empirical decision, signifying wide variability among subjects' ratings. As a secondary check the medians and the interquartile ranges of the retained 31 adjective pairs were computed and it was found that the interquartile ranges were 5 or smaller and the medians were 7 or above. In other words, all the retained adjective pairs were rated within the appropriate range by at least 50% of the subjects and the dispersion of judgements were not high. (See Appendix III, Tables 2 and 3 for the ratings of the whole list and the retained 31 adjective pairs, respectively).

III.2. STAGE 2 : THE SELECTION AND EVALUATION OF INTERIOR SLIDES IN TERMS OF "SPACIOUSNESS"

METHOD

From a large pool of 35 mm. coloured slides, 36 slides of interiors (living rooms, offices, chapels, lounges, exhibition halls) were selected by the author who tried to choose an equal number of "spacious" and "not spacious" slides.

The order of selected 36 slides were randomized (Appendix III, Table 4) and projected on a 2 x 2 m. white screen. To minimize the order effect, first, all of the 36 slides were projected for a few seconds each, then each one was shown for approximately 20 seconds to be rated.

A four - point scale 'Very spacious - Spacious - Not spacious - Not spacious at all' was used to evaluate the spaciousness of each slide, (See Appendix III. B).

The subjects were;

1. Twenty five office workers, 18 male, 7 female, in a large office in Glasgow.

2. Thirty eight undergraduate architecture students (1973-74 second year), 34 male, 4 female.

Groups 1 and 2 rated the slides in separate sessions.

RESULTS

The mean rating for each slide was calculated for each group of subjects. Figure 3.1 shows the curves of the mean values for office workers and students. The examination of Figure 3.1 indicates a striking similarity between the ratings of two different subject groups. The Pearson product - moment correlation applied to the mean ratings of the slides by two groups of subjects gave an 'r' of .950, (n=36), which is significant beyond $p<.001$ level. The rank order of slides can be seen in Appendix III. Table 5 for each group and for the whole subject sample.

The five slides that were rated as the most spacious and the five that were rated as the least spacious by both subject groups were selected to be used in the third stage. Table 6 in Appendix III. gives the means and standard deviations of 7 most spacious and 8 least spacious interiors for comparison.

FIGURE 3.1 RATINGS OF 36 SLIDES BY TWO GROUPS OF SUBJECTS

III.3. STAGE 3 : RATINGS OF SELECTED SLIDES WITH THE FINAL LIST OF BIPOLAR ADJECTIVE PAIRS

1. Pilot study

A pilot study was carried out with 6 subjects in order to see the general reaction of the subjects to the stimuli, the procedure and to length of time spent. Ten 35 mm. coloured slides chosen in the second stage of the scale construction (5 most spacious, 5 least spacious interiors) were projected on a 2x2 m. white screen one by one, and the subjects were asked to rate them with the final list of 31 bipolar adjective pairs. See Appendix III. C, for one of the 10 identical lists used by each subject to evaluate each of the 10 interiors. The pilot experiment took 35 minutes altogether, and none of the subjects mentioned the length of time as unreasonable when the matter was discussed later on. Subjects thought that the experiment was interesting. One subject wanted the neutral line on 7-point scale to be emphasized in a clear way. The meanings of adjective pairs, like 'well scaled', 'well balanced' and 'static space' were questioned. (It was also mentioned that when the order of adjective pairs was kept constant for each subject, as in the study, subjects did not spend much energy or time to judge the slides one after another).

In the light of the pilot study, 6 different randomized lists of 31 bipolar adjectives were prepared, ten of the same list to be given to one subject, and the neutral line in 7-point scale was emphasized. See Appendix III.D, for the final form of questionaire to be used in the main study.

2. Main study

METHOD

Five most spacious and 5 least spacious (from now on called 'not spacious') slides of interiors selected in "stage two" were shown to three groups of subjects in three separate sessions;

1. Twenty one office workers, 10 male, 11 female,
2. Forty one first year architecture students (1973-74), 36 male, 5 female,
3. Twenty five third year architecture students (1973-74), 22 male, 3 female.

Each of the 87 subjects judged each of the 10 slides by 31 7-point adjective pairs selected in "stage one".

The order of the slides were random but this randomness was kept constant in all three sessions. The average time spent for the rating ranged between 25 and 35 minutes.

Subjects' evaluations on the 31 adjective pairs were converted into numerical scores of 1 to 7, (1 representing the undersirable end of the scale, e.g., small, cluttered, repelling, etc., and 7 referring to the desirable one, e.g., large, uncluttered, inviting, etc.), tabulated and punched into IBM computer cards. By using SPSS (1970) computer program, first an aritmetical mean value in each variable was calculated for each of the 10 interiors based on the judgements of 87 individuals. These mean values then constituted the basis for two correlation matrices, for the five most spacious and the five least spacious interiors. The correlation of each variable with all the other 30 variables were calculated in terms of Pearson Product-Moment correlation coefficient. Then the two separate groups of 465 correlation coefficients were tabulated and the application of the McQuitty's Elementary Linkage Analysis (1957, 1961, 1964) to each table gave way to meaningful clusters of adjective pairs for both spacious and not spacious interiors. Hence a further detailed analysis, factor analysis, of the data was undertaken. (Correlation matrices for spacious and not spacious interiors can be seen in Appendix III. Tables 7 and 8 respectively).

III.4 STAGE 4 : FACTOR ANALYSIS

As has been described in the third stage of spaciousness scale construction, five most spacious and five least spacious slides of interiors were shown to 87 subjects. Each subject judged each of the ten slides by 31 (7-point) bipolar adjectives. By using "Statistical Package for Social Science" computer program (SPSS, 1970), first an arithmetical mean value in each variable was calculated for each of the 10 interiors based on the judgements of 87 individuals. These mean values then constituted the basis for two correlation matrices, for the five most spacious and the five least spacious interiors. The correlation of each variable with all the other 30 variables were calculated in terms of Pearson Product-Moment correlation coefficient. Then the two separate groups of 465 correlations were subjected to a principal component analysis and rotated to orthogonal, simple structure by the Varimax method. The number of extracted factors in SPSS program was first determined by eigenvalues, whereby the factors that have eigenvalues greater than 1 were extracted (Rummel, 1970; SPSS, 1970; Harman, 1967).

RESULTS

Spacious interiors

The Varimax rotated solution for spacious rooms initially gave way to 6 factors, but the interpretation of these factors was very difficult. Therefore, fewer number of factors were rotated: 5, 4, 3, and 2 factors. Tables 9, 10, 11, 12, and 13 in Appendix III, give the Varimax rotation results for 6, 5, 4, 3, and 2 factors of 31 adjective pairs, respectively. Table 14, on the other hand, gives the eigenvalues, percentages of variance, and cumulative percentages for these analysis. Among these the 3-factor solution was considered the most meaningful one (Rummel, 1970). Table III.4.1 shows the adjective pairs that have factor loadings of .30 or greater for the spacious rooms, for the 3-factor solution. These three factors accounted for 47.7% of the total variance. Factor I accounted for 46% of common variance, Factor II for 27%, and Factor III for 27%.

The outcome of the subjective interpretation is reported in the following way: A variable is ascribed to a factor if it has the highest loading in this factor. The loading which is written in front of each variable indicates to what extent the variable correlates with the entire factor. The sign of the loading only shows the relation of the variable to other variables within the same factor.

FACTOR I - Appeal

Factor I obtained high loadings in the following variables:

repelling-inviting	.79
uncomfortable-comfortable	.76
disturbing-restful	.74
unimaginative-imaginative	.74
unimpressive-impressive	.72
harsh lighting-soft lighting	.69
unlivable-livable	.64
static space-dynamic space	.53
cozy-monumental	-.53
single purpose-multiple pur.	.51

The only negatively loaded adjective pair is cozy-monumental. As has been mentioned in the third stage of scale construction, ratings of 7-point bipolar adjective were recorded with the principle that the larger sizes (large, huge, monumental) were registered as "7". However, it seems that when the subjects used the pair of cozy-monumental to evaluate the interiors, they gave more emphasis to the emotional appeal rather than the implied size dimension. In other words, it is the "coziness" of a space that

TABLE III.4.1

VARIMAX ROTATED FACTOR LOADINGS - SPACIOUS ROOMS

Distibution of variables on different factors. All loadings which after rotation show loadings >.30 have been included.

Item No.	Adjective pair	I	II	III
7	Repelling-inviting	.79	.35	
25	Uncomfortable-comfortable	.76	.31	
22	Disturbing-restful	.74	.32	
17	Unimaginative-imaginative	.74		
31	Unimpressive-impressive	.72		
16	Harsh lighting-soft lighting	.69		
27	Unlivable-livable	.64		
13	Static space-dynamic space	.53		
1	Cozy-monumental	-.53		.39
15	Single purpose-multiple pur.	.51		
8	Disorganized-organized		.72	
21	Poorly organized-well organ.	.48	.64	
5	Non-functional-functional		.61	
4	Poorly scaled-well scaled	.45	.59	
9	Poorly balanced-well balanced	.57	.59	
26	Uncoordinated-coordinated	.35	.57	
14	Poorly planned-well planned	.53	.54	
20	Poor lighting-good lighting		.48	
3	Dark-light		.46	
23	Inadequate size-adequate size		.42	.37

TABLE (continued)

		I	II	III
2	Cramped-roomy			.67
10	Tiny-huge	-.30		.66
30	Small-large			.65
18	Restricted space-free space	.36		.61
11	Cluttered-uncluttered			.55
27	Crowded-uncrowded			.55
19	Closed-open			.53
28	Narrow-wide	.50		.52
12	Restricted-unrestricted	.45		.50
6	Full-empty			.46
24	Poor acoustics-good acoustics	.31		
Proportion of total variance in %		21.9	13.0	12.8
Proportion of common variance in %		46	27	27

goes with the positive and desirable attributes, like invitingness, comfort and restfulnes, not its "monumentalism"

The variables that were unrelated (with 0 or near -0 loadings) to this factor were: nonfunctional-functional, cramped-roomy, tiny-huge, small-large, inadequate size-adequate size, closed-open. Thus it seems that this factor is not related to the function or the size of the interiors, but rather to the attraction, charm or appeal of the interiors. It carries a pleasantness and perhaps a homeliness character; "how much at home one might have felt in the interior" or "how appealing, attractive or charming" the room seems to the individual. This factor will be called as "the appeal of the interior" or simply "appeal" factor.

With its high loadings and evaluative character, this factor corresponds to Osgood's (1957) "evaluation factor", or Kashmar's (1965) "aesthetic appeal", Canter's (1969) and Kuller's (1972) "pleasantness", Hershberger's (1970-1972) "space-evaluation", or Collins's (Seaton and Collins, 1972) "aethetic evaluation" factors.

FACTOR II - Planning

The second factor of the factor analysis obtained high loadings in the following variables:

disorganized-organized	.72
poorly organized-well org.	.64
nonfunctional-functional	.61
poorly scaled-well scaled	.59
poorly balanced-well bal.	.59
uncoordinated-coordinated	.57
poorly planned-well planned	.54

poor lighting-good lighting	.48
dark-light	.46
inadequate size-adequate size	.42

The variables that had low loading with this factor were: restricted space-free space, tiny-huge, crowded-uncrowded, harsh lighting-soft lighting, single purpose-multiple purpose, unimaginative-imaginative.

As is seen, this factor is related to the organization, balance, coordination, planning of the interior but does not have much to do with the size or crowding or lighting of a room. It is mainly concerned with the organization and fitness of the room to its function, its scale, balance and coordination; simply its planning. This factor also carries a pleasantness or appeal nature, for it has some adjective pairs loaded together with the first factor (i.e., well organized, well scaled, well balanced, well planned).

FACTOR III - Space freedom

The third factor obtained high loadings in the following adjective pairs:

cramped-roomy	.67
tiny-huge	.66
small-large	.65
restricteed space-free sp.	.61
cluttered-uncluttered	.55
crowded-uncroweded	.55
closed-open	.54
narrow-wide	.52
restricted-unrestricted	.50
full-emty	.46

The adjective pairs that had low loadings were: uncoordinated-coordinated, poorly scaled-well scaled, harsh lighting-soft lighting, poorly balanced-well balanced, repelling-inviting, disturbing-restful, nonfunctional-functional, uncomfortable-comfortable. As would be expected this factor has low loadings on items of both the appeal and planning factors.

This third factor seems to encompass on the one hand the feeling of "roominess" as well as the physical size or "largeness" of the interior; on the other hand, the crowding and clutteredness of the spaces. In other words, it is made up of mainly two aspects: a) size (roomy, large) and b) clutteredness. Thus it can be considered a "space freedom" factor.

Not spacious interiors

The varimax rotated solution for "not spacious" rooms also gave way to six initial factors. Due to the difficulty of interpretation of these factors, fewer number of factors were rotated. Tables 15, 16, 17, 18, and 19, in Appendix III, give the results of the 6, 5, 4, 3, and 2-factor solutions, respectively. Among these the solutions with 5 and 4 factors seemed the most meaningful. (Table 20 in Appendix III gives the eigenvalues, percentages of variance and cumulative percentages for these factor solutions).

At this point it may be worthwhile to explain both of these solutions and the reasons why the 5-factor solution was finally selected. The 4-factor solution had a heavily loaded first factor with 16 items. On the other hand, in the 5-factor solution this factor was split up into "organization-planning" and "appeal" factors. This seemed like a more discriminative solution for the following reasons: 1) When the reliabilities of both the 4- and 5-factor solutions were calculated and alpha coefficients were found, the first factor of the 4-factor solution had the following final adjective pairs: uncomfortable-comfortable, unlivable-livable, disturbing-restful, and repelling-inviting; thus casting out the adjective pairs related to organization and planning. In the 5-factor solution, on the other hand, the retained adjective pairs by the alpha coefficient method were poorly planned-well planned, poorly balanced-well balanced, poorly organized-well organized, uncoordinated-coordinated in the first factor; and uncomfortable-comfortable, disturbing-restful, unlivable-livable in the fourth factor. Thus both of the two important sets of items were utilized.

(2) Relatively speaking, the items concerning organization and planning were more discriminative than the items concerning the appeal in not-spacious rooms. When Table III.4.2. showing the mean values of adjective pairs for spacious and not spacious rooms is examined, it can be seen that the pairs like poorly planned-well planned, poorly balanced-well balanced, poorly organized-well organized, uncoordinated-coordinated received relatively lower values as compared to the pairs like uncomfortable-comfortable, disturbing-restful, unlivable-livable

TABLE III.4.2 THE MEAN RATINGS OF 31 ADJECTIVE PAIRS FOR 5 SPACIOUS AND 5 NOT-SPACIOUS ROOMS BY 87 SUBJECTS.

Item No	Adjective pair	MEAN Spacious	MEAN Not Spacious	MEAN Difference
1	cozy-monumental	4.71	3.19	1.52
2	cramped-roomy	6.14	2.52	3.62
3	dark-light	5.85	4.44	1.39
4	poorly scaled-well scaled	4.94	3.55	1.39
5	non-functional-functional	5.73	4.98	0.75
6	full-empty	5.39	2.11	3.28
7	repelling-inviting	4.86	3.91	0.95
8	disorganized-organized	5.68	3.47	2.21
9	poorly balanced-well balanced	4.93	3.32	1.61
10	tiny-huge	5.45	3.03	2.42
11	cluttered-uncluttered	5.49	2.42	3.07
13	static space-dynamic space	5.12	3.29	1.83
14	poorly planned-well planned	5.25	3.10	2.15

TABLE III.4.2 (continued)

Item No	Adjective pair	MEAN Spacious	MEAN Not Spacious	MEAN Difference
15	single purpose-multiple purpose	4.63	3.75	0.88
16	harsh lighting-soft lighting	4.45	4.12	0.33
17	unimaginative-imaginative	5.12	2.99	2.13
18	restricted space-free space	5.85	2.37	3.48
19	closed-open	5.83	2.94	2.89
20	poor lighting-good lighting	5.62	3.89	1.73
21	poorly organized-well organized	5.38	3.19	2.19
22	disturbing-restful	4.46	3.71	0.75
23	inadequate size-adequate size	6.07	3.06	3.01
24	poor acoustics-good acoustics	4.06	3.87	0.19
25	uncomfortable-comfortable	4.39	3.77	0.62
26	uncoordinated-coordinated	5.18	3.45	1.73

TABLE III.4.2 (continued)

Item No	Adjective pair	MEAN Spacious	Not Spacious	Difference
27	unlivable-livable	4.40	4.00	0.40
28	narrow-wide	5.21	3.16	2.05
29	crowded-uncrowded	5.90	2.62	3.28
30	small-large	5.91	2.77	3.14
31	unimpressive-impressive	5.49	2.76	2.73

for not-spacious rooms. Moreover, the differences between the mean ratings of spacious and not-spacious rooms are greater for items related to "planning" in comparison those related to "appeal"; in other words, items representing planning, balance, organization and coordination were more discriminative of spacious and not-spacious rooms; hence they should not be eliminated.

The other three factors of both 4- and 5-factor solutions were very similar in character, one factor being about the physical size of the space, the other concerning the clutteredness of the room and the last one dealing with the lighting characteristics. This last factor consisted of two items in 4-factor solution (dark-light, poor lighting-good lighting) and three in 5-factor solution (two previous pairs and closed-open). This last factor accounted for only 7.0% of the total variance (12.0% of the common variance) in 5-factor solution and 7.5% of the total variance (13.7% of the common variance) in 4-factor solution; hence was considered insignificant and was not taken into consideration in interpretation of factors and in scale construction.

Table III.4.3 shows the factor loadings of those adjective pairs that had loadings of .30 or greater on each factor of the 5-factor solution. These five factors accounted for 58.4% of the total variance. Factor I accounted for 30.8% of the common variance, Factor II for 20.7%, Factor III for 18.7%, Factor IV for 17.8% and Factor V for 12.0% of the common variance. As before, a variable was ascribed to a factor if it had the highest loading in this factor. The loading which is written in front of each variable indicates to what extent the variable correlates with the entire factor.

FACTOR I - Planning

Factor I obtained high loadings on the following variables:

poorly planned-well planned	.74
poorly organized-well organized	.72
uncoordinated-coordinated	.71
poorly balanced-well balanced	.70
disorganized-organized	.69
poorly scaled-well scaled	.59
unimpressive-impressive	.54
poor acoustics-good acoustics	.49
nonfunctional-functional	.48
unimaginative-imaginative	.47

TABLE III.4.3

VARIMAX ROTATED FACTOR LOADINGS - NOT-SPACIOUS ROOMS

Distribution of variables on different factors. All loadings which after rotation show loadings >.30 have been included.

Item No.	Adjective pair	I	II	III	IV	V
14	Poorly planned-well planned	.74				
21	Poorly organized-well organized	.72		.38		
26	Uncoordinated-coordinated	.71				
9	Poorly balanced-well balanced	.70				
8	Disorganized-organized	.69		.41		
4	Poorly scaled-well scaled	.59				
31	Unimpressive-impressive	.54	.32			
24	Poor acoustics-good acoustics	.49				
5	Non-functional-functional	.48				
17	Unimaginative-imaginative	.47				.37

TABLE III.4.3 (continued)

Item No	Adjective pair	I	II	III	IV	V
30	Small-large		.81			
10	Tiny-huge		.78			
28	Narrow-wide		.77			
15	Single purpose-multiple purpose		.53			
13	Static space-dynamic space		.48			
18	Restricted space-free space		.46			.33
12	Restricted-unrestricted	.30	.40			
6	Full-empty			.81		
29	Crowded-uncrowded			.73		
11	Cluttered-uncluttered	.37		.71		
22	Cramped-roomy		.46	.51		
23	Inadequate size-adequate size	.40	.32	.49		

TABLE III.4.3 (continued)

Item No	Adjective	I	II	III	IV	V
1	Cozy-monumental				-.73	
25	Uncomfortable-comfortable	.47			.65	
27	Unlivable-livable	.48			.64	
16	Harsh lighting-soft lighting				.60	
7	Repelling-inviting	.48			.58	
22	Disturbing-restful	.40		.45	.57	
3	Dark-light					.80
20	Poor lighting-good lighting					.78
19	Closed-open		.46			.53
Proportion of total variance in %		18.0	12.1	10.9	10.4	7.0
Proportion of common variance in %		30.8	20.7	18.7	17.8	12.0

This factor shows a planning and organization dimension. It, more or less, corresponds to the spaciousness Factor II and will also be called the "planning" factor.

FACTOR II - Physical size.

Factor II obtained high loadings in the following adjective pairs:

Small-large	.81
tiny-huge	.78
narrow-wide	.77
single purpose-multiple purpose	.53
static space-dynamic space	.48
restricted space-free space	.46
restricted-unrestricted	.40

The highly loaded first three items are quite distinct from the rest of the variables. It is these three adjective pairs that label this factor: "physical size". As a less important aspect it also deals with the subjective restriction and dynamism of space.

FACTOR III - Clutteredness

Factor III obtained the following high loadings:

Full-empty	.81
crowded-uncrowded	.73
cluttered-uncluttered	.71
cramped-roomy	.51
inadequate size-adequate size	.49

This factor seems to imply both a judgement of fullness-emptiness with regards to people and items in a room, as well as a perceived adequacy of size of spaces. The relatively less loaded last two items of this factor have some loadings also in Factor I and Factor II. Because of the apparent importance of the items relating to crowding and cluttering, this factor will be called as the "clutteredness" factor.

FACTOR IV - Appeal

Factor IV obtained high loadings in the following adjective pairs:

Cozy-monumental	-.73
uncomfortable-comfortable	.65
unlivable-livable	.64

harsh lighting-soft lighting	.60
repelling-inviting	.58
disturbing-restful	.57

Like the first factor of spaciousness, this factor seems to indicate the feeling of "coziness", "comfort", "livableness" of and interior. It carries a pleasantness dimension; how attractive, charming, or appealing the room seems to the individual. This factor will also be named as the "appeal" factor - the emotional appeal of the interior. The items concerning comfort, livableness, invitingness and restfulness have some loadings in planning factor, while that of the restfulness has a loading also in clutteredness factor.

DISCUSSION

Although the selected five spacious and five not spacious interiors were grouped on a linear dimension ('very spacious-not spacious at all' continium), it is interesting to note that the ratings of the same interiors by the 87 subjects gave way to related, but not quite the same factor structures.

It seems that a spacious room is not a cramped one and a cramped interior can not score high on the spaciousness scale. But a room which is evaluated low on spaciousness (i.e., not spacious) is not necessarily a cramped one; or a room that is evaluated low on crampedness (i.e., not cramped) is not necessarily a spacious room either. In other words, there is an undetermined area between very spacious and very cramped (originally called as 'not spacious at all') situations; or one of the ends of somewhat related continiums of spaciousness and crampedness are unclear.

For a room to be spacious, first of all, it must be appealing, then well planned and finally must have space freedom. On the other hand planning seems to be the most important factor for crampedness;

for a room to be cramped, it must be poorly planned, it must fail to satisfy the functional requirement; then, it must be too small for that particular function (physical size factor); in addition to that the number of people or the number of the items in the space must seem excessive (clutteredness factor); and finally it must look unappealing. In, other words, spaciousness is a desirable quality, a quality one may not expect from an 'ordinary' or an 'average' space. For an architect, the failure of not providing a spacious interior may not be a serious or a very apparant one; but if his room is considered as being cramped, however, it means that the interior fails to meet its function - the reason why it was designed for - and this failure may lead to more serious and immediate consequences.

In the light of the above discussion, it may not be wrong to speculate that every interior must score low on crampedness scale (not cramped) at least, the failure of this condition means the failure of proper functioning of the space. On the other hand, high values on the spaciousness scale means that the particular interior not only meets its functional and physical requirements, but also gives some emotional satisfaction or comfort to the occupants.

III.5. STAGE 5: SELECTION OF THE FINAL ADJECTIVE PAIRS FOR SPACIOUSNESS AND CRAMPEDNESS SCALES

At this final stage of scale construction the task was the selection of the items or adjective pairs that were most discriminative and representative of each of the spaciousness and crampedness factors. These items would then constitute the spaciousness-crampedness scales. One concern in constructing the scales was to have the maximum reliability using the minimum number of items. This was accomplished by using the alpha reliability coefficient (Cronbach, 1951). Before going into the details of the selection procedure for each factor, it may be worthwhile to explain briefly why alpha reliability coefficient was used for this purpose.

III.5.1 Alpha as a coefficient of reliability:

Cronbach (1951) used the label "alpha" to refer to a particular type of coefficient which measures the reliability of a test, or item battery, in the special sense of its internal consistency. McKennell (1970) has shown how the following special version of the formula for alpha can be adapted for test construction purposes along with factor or cluster analysis.

$$\text{Alpha} = \frac{n\bar{r}_{ij}}{1 + (n-1)\,\bar{r}_{ij}}$$

where n = the number of separate items in the test

$\bar{r}_{ij}$ = the average of all the inter-item correlations

and alpha is the reliability of the total score obtained by summing the scores on the separate items (from McKennell, 1970, p.299).

As is indicated by the given formula, the reliability of a test depends on its internal consistency or homogeneity ($\bar{r}_{ij}$) and its length (n).

The decision to use the alpha approach rather than the other internal consistency approaches was taken in view of the following considerations:

> "Guttman scaling, the Likert technique and factor and cluster analysis are all internal consistency approaches to the problem of scale construction. The researcher who uses any of these techniques will be protected against using ostensible measures that are actually of zero or near zero reliability. Factor and cluster analysis in addition provide information on the number of separate dimensions in the item pool" (McKennell, 1970, p.241).

The reason for choosing to follow the alpha approach was that this particular approach, especially when combined with factor or cluster analysis, "does all these things and in addition provides a simultaneous criterion on reliability in relation to test length, as well as providing a criterion for item selection" (p.241).

McKennell (1970) elaborates on this topic by pointing out that:

(a) Although the item selection procedures on the alpha approach and the Likert technique are related, the latter does not yield simultaneous information on reliability; moreover, the Likert technique does not enable one to detect when more than one dimension is represented in the item set, and hence it provides no safeguards against the inadvertent scaling together of clusters of items which are actually multidimensional.

(b) When compared to Guttman or the cumulative scaling technique, the value of $\bar{r}_{ij}$ is closely related to the coefficient of reproducibility used in the Guttman technique. "A perfect Guttman scale would also be a perfectly reliable scale in terms of alpha. Perfect or even near perfect scales hardly ever occur in practice. Both item unreliability and the presence of more than one dimension can lead to low reproducibility, but the Guttman technique does not allow these quite different sources of 'error' to be distinguished. It is a technique therefore for testing a hypothesis of undimensionality rather than for exploring the number of dimensions present. Like the Likert procedure Guttman scaling focuses on what is most general in the item set at the risk of missing important secondary dimensions. But Guttman scaling, even when applied to the items in a single cluster, does not afford a criterion for assessing how far a lengthening of the scale by adding items will improve its efficiency as a measuring instrument. Nor does it provide clear-cut criterial of the selection of items" (p.241).

(c) Since the present alpha approach is based on the values of the inter-item correlations or $\bar{r}_{ij}$, it can easily be combined with factor and cluster analysis techniques. McKennell states that when so combined "there is a ready safeguard against false inferences of unidimensionality, and an additional gain in the information obtained about reliability in relation to test length" (p.241).

Thus, it was decided that the alpha approach combined with factor analysis was superior to either the Likert or the Guttman techniques and to factor or cluster analysis used alone, since it enabled us not only to explore the dimensionality of the spaciousness-crampedness domain, but also to decide on the number of items required in order to measure each main dimension or factor at an appropriate level of reliability.

III.5.2 Selection of items for spaciousness and crampedness scales

Following the selection procedure suggested by McKennell (1970), the final adjective pairs to represent each of the spaciousness and crampedness factors were determined. The details of the selection procedure will be explained separately for each factor.

Spaciousness - Factor I (appeal)

As is shown in Table III.4.1, there were 10 adjective pairs in the first factor of the varimax rotated factor solution for spacious interiors. The inter-correlations between these 10 items were found from the correlation matrix (see Appendix III, Table 7) and written in a smaller matrix form (see Table 21 in Appendix III). First the intial correlation of each item with the other 9 items ($\bar{r}_{ij}{}^{*}$) were calculated. The highest $\bar{r}_{ij}{}^{*}$ score being on one end, the lowest on the other, all 10 values were rank ordered and tabulated (see Table 22 in Appendix III).

In the next step, the average intercorrelation of the "n" items (or $\bar{r}_{ij}$ s) were found (i.e., the correlation between item 1 and 2; then the average correlation between items 1, 2 and 3; then between 1, 2, 3, and 4; and so on) and tabulated. In the final step, McKennell's alpha coefficient formula was utilized and all alpha coefficients were calculated.

As can be seen in Table 22 in Appendix III, the alpha values increased with the first three items. Then there was a sudden drop with the fourth (unimaginative-imaginative) and the fifth (unimpressive-impressive) items, causing a fluctuation in the distribution curve. The alpha coefficients for items 6 and 7 received higher values but decreased with item 8 again. In this situation there were two alternatives: (1) The first three adjective pairs with an alpha coefficient of .890 could be used to represent the first factor of the spaciousness scale; or (2) the two adjective pairs (imaginative-unimaginative and unimpressive-impressive) could be omitted and the alpha coefficients for the remaining 8 items could be recalculated. Though the alphareliability coefficient for these three adjective pairs was high, the first factor of the spaciousness scale accounted for 46% of the common variance. Thus it was a very important factor and three items might be too few to represent it. For this reason the alpha coefficients of the adjective pairs in this factor were recalculated following the second alternative stated above. Table III.5.1 shows the results of such a procedure.

TABLE III.5.1 RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS, SPACIOUSNESS FACTOR I, WHEN ITEM NO.31 (UNIMPRESSIVE-IMPRESSIVE) AND 17 (UNIMAGINATIVE-IMAGINATIVE) ARE OMITTED

Item	dynamic space-stat. space	multiple purpose-single pur.	cozy-monumental	soft lighting-harsh lighting	livable-unlivable	restful-disturbing	inviting-repelling	comfortable-uncomfortable
No.	13	15	1	16	27	22	7	25
n	8	7	6	5	4	3	2	1
r_{ij}^*	.3006	.3195	.3841	.4256	.4791	.5330	.5496	.5496
r_{ij}	.4434	.4910	.5591	.6085.	.6711	.7312	.7309	-
Alpha	.8643	.8710	.8838	.8860	.8909	.8908	.7445	-

n = number of items remaining in the scale after item on the left disgarded.

r_{ij}^* = initial correlation of each item with the other seven items.

r_{ij} = average intercorreltion of the n items

Alpha =reliability value for the n items.

As is seen in Table III.5.1., there was an increase in the alpha coefficient values with the increase of the items up to the cut-off point - livable-unlivable - followed by a decrease. The first four items, namely uncomfortable-comfortable, repelling-inviting, disturbing-restful and unlivable-livable, then constituted the first factor of the spaciousness scale with a reliability coefficient of .891.

Spaciousness - Factor II (planning)

Again there were 10 adjective pairs in this factor, two of which were similar in meaning - poorly organized-well organized and disorganized-organized. Table 23 in Appendix III, gives the correlation matrix for these 10 items by following the procedure reported for Factor I above, the alpha coefficients were calculated and can be seen in Table 24 in Appendix III.

As is shown in Table 24 in Appendix III, the alpha values increased until the sixth item, then decreased. But among the first six items there were the two similar items related to organization. The comparison of r_{ij}^* and r_{ij} values of these two pairs indicated that "poorly organized-well organized" had higher scores for both; hence was a better item to be used in spaciousness scale. Therefore, the "disorganized-organized" adjective pair was eliminated and the remaining 9 items were treated as before. Table III.5.2 tabulates the findings of this procedure.

As can be seen in Table III.5.2., the natural cut-off point was after "uncoordinated-coordinated". Hence the five items of this factor were poorly organized-well organized, poorly balanced-well balanced, poorly planned-well planned, poorly scaled-well scaled, uncoordinated-coordinated and had a reliability of .864.

<u>Spaciousness - Factor III</u> (space freedom)
This third factor also consisted of 10 adjective pairs initially. Tables 25 and 26, in Appendix III, show the correlation coefficient matrix and the computed alpha coefficients for these 10 items, respectively. As is seen in Table 26, the alpha values increased until the seventh item. Of these 7 items, since "restricted-unrestricted" and "restricted space-free space" were similar in meaning, the latter one with the higher r_{ij}^* and r_{ij} values was retained. The alpha values for the remaining 9 items were recalculated; see Table III.5.3. for

TABLE III.5.2 RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS
SPACIOUSNESS FACTOR II
WHEN ORGANIZED-DISORGANIZED No8 OMITTED

ITEM No	Dark 3	Adeq.Size 23	Poor light 20	Function 5	Coordinat. 26	W.Scaled 4	W.Planned 14	W.Balanced 9	W.Organized 21
n	9	8	7	6	5	4	3	2	-
r^*_{ij}	.1330	.2710	.2830	.2930	.3420	.4150	.4150	.4410	.4430
r_{ij}	.3423	.4021	.4400	.5060	.5600	.6030	.6100	.5600	-
Alpha	.8240	.8432	.8462	.8601	.8642	.8586	.8243	.7179	-

these final alpha values. As is shown in Table III.5.3, the alphas increased until the pair of "narrow-wide" - the cut-off point - then dropped. Thus, this spaciousness - Factor III consisted of 8 adjective pairs, namely, cramped-roomy, small-large, restricted space-free space, tiny-huge, crowded-uncrowded, closed-open, cluttered-uncluttered, narrow-wide and had a reliability of .788.

Crampedness - Factor I (planning)

Table III.4.3. shows the factor loadings of the varimax rotated solution for not-spacious rooms. Intercorrelations of the 10 items of the first factor of this solution were tabulated in a matrix form in Table 27 in Appendix III. The computed alpha values for these initial 10 items are given in Table 28 in Appendix III. As can be seen in Table 28, the alpha coefficient values increased for the first 5 items. Among these 5 adjective pairs there were both of the pairs related to organization - poorly organized-well organized and disorganized-organized; since the former pair had higher $r_{ij}{}^*$ and r_{ij} values when compared to the latter, it was retained.

TABLE III.5.3 RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS, SPACIOUSNESS FACTOR III

(WHEN RESTRICTED-UNRESTRICTED NO.12 OMITTED)

ITEM	Empty	Wide	Uncluttered	Open	Uncrowded	Huge-Tiny	Free Space	Large-Small	Roomy-Cramped
No	6	28	11	19	29	10	18	30	2
n	9	8	7	6	5	4	3	2	-
r^*_{ij}	.1760	.2920	.3110	.3160	.3230	.3320	.3510	.3660	.3870
r_{ij}	.2860	.3180	.3290	.3380	.3380	.3650	.3650	.3900	-
Alpha	.7828	.7886	.7744	.7539	.7185	.6969	.6238	.5612	-

The recalculation of alpha values for the retained 9 items can be seen in Table III.5.4. The cut-off point for this factor was at the pair of "uncoordinated-coordinated" with an alpha value of .860. This factor consisted of four pairs of adjectives, namely poorly planned-well planned, poorly balanced-well balanced, poorly organized-well organized, and uncoordinated-coordinated.

Crampedness - Factor II (physical size)
The intercorrelations between the 7 initial items of this factor can be seen in Table 29 in Appendix III, and the computed reliability coefficients in Table III.5.5. As is indicated in Table III.5.5., the reliability coefficients started to decrease after the first three items of the cluster. These three adjective pairs were tiny-huge, small-large and narrow-wide, with an alpha value of .834.

Crampedness - Factor III (clutteredness)
The intercorrelation matrix and the calculated alpha coefficients for the 5 adjective pairs of this factor can be seen in Table 30 in Appendix III, and in Table III.5.6., respectively. As is shown in Table III.5.6., the alpha values showed a continuous increase and consequently all 5 pairs were retained.

TABLE III.5.4. RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS CRAMPEDNESS

FACTOR I

(DISORGANIZED-ORGANIZED NO.8 OMITTED)

ITEM No	P.Acoustics 24	Non-Funct. 5	Unimaginat. 17	P.Scaled 4	Unimpressive 31	Uncoordinat. 26	P.Organized 21	P.Balanced 9	P.Planned 14
n	9	8	7	6	5	4	3	2	1
r^*_{ij}	.2917	.2923	.3934	.4039	.4321	.4714	.4809	.4875	.5189
r_{ij}	.4311	.4555	.5059	.5303	.5501	.6048	.6215	.6465	-
Alpha	.8721	.8700	.8775	.8713	.8594	.8596	.8313	.7853	-

TABLE III.5.5 RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS CRAMPEDNESS FACTOR II

	Static Sp. Dyn. Sp.	Single P. Multiple	Restricted Unrest.	Rest. Space Free Space	Narrow Wide	Small Large	Tiny Huge
ITEM No	13	15	12	18	28	30	10
n	7	6	5	4	3	2	1
r_{ij}	.2844	.2973	.3245	.3273	.3761	.4101	.4122
r_{ij}	.3474	.3726	.4133	.4592	.6269	.6742	-
Alpha	.7884	.7809	.7788	.7725	.8344	.8054	-

TABLE III.5.6 RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS CRAMPEDNESS FACTOR III

	Full-Empty	Inadequate size	Cramped-roomy	Cluttered	Crowded
ITEM No	6	23	2	11	29
n	5	4	3	2	1
r^*_{ij}	.4801	.4884	.4977	.5041	.5366
r_{ij}	.5018	.5149	.5134	.5476	-
Alpha	.8343	.8093	.7599	.7076	-

These were: crowded-uncrowded, cluttered-uncluttered, cramped-roomy, inadequate size-adequate size, full-empty, with a reliability coefficient of .834.

Crampedness - Factor IV (appeal)

Table 31 in Appendix III, shows the correlation matrix for the 6 initial items of this factor; their reliabilities are given in Table III.5.7. As can be seen in Table III.5.7., the alpha coefficient values decreased after the highly correlated first three items of uncomfortable-comfortable, disturbing-restful and unlivable-livable. Hence, this factor of the crampedness scale will be represented by these three adjective pairs with a reliability coefficient of .857.

In concluding this section on scale construction, let us recapitulate that the number of items in the three factors of the "spaciousness" scale were 17, and in the four factors of the "crampedness" scale were 15. Of these 13 adjective pairs were common to both of the scales; 4 were included only in spaciousness scale (poorly scaled-well scaled, restricted space-free space, repelling-inviting, closed-open) and 2 were only in crampedness

TABLE III.5.7 RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS CRAMPEDNESS (FACTOR IV)

ITEM	Harsh Light.	Cozy-Mon	Repel-Invit.	Unlivable	Disturbing Restful	Uncomfortable
No	16	1	7	27	22	25
n	6	5	4	3	2	1
r_{ij}^*	.3811	.4531	.5364	.5555	.5734	.5873
r_{ij}	.4699	.5143	.5377	.6672	.6765	-
Alpha	.8417	.8411	.8231	.8575	.8070	-

(inadequate size- adequate size, full-empty). Thus altogether 19 adjective pairs could represent the spaciousness-crampedness scale, or SCS for short. The selected items and their reliabilities for the spaciousness and crampedness scales are given in Appendix III, Table 32 and 33, respectively; and one of the four SCS forms to be used in the last group of experiments can be seen in Appendix III.E.

PART FOUR

EXPERIMENTAL STUDIES CONDUCTED BY USING SPACIOUSNESS AND CRAMPEDNESS SCALES

EXPERIMENTAL STUDIES CONDUCTED BY USING SPACIOUSNESS AND CRAMPEDNESS SCALES

IV.1. COMPARISON OF A FULL SIZE ROOM WITH ITS 1/10 SCALE MODEL AND COLOURED SLIDE

Some past studies - reported in literature survey, Part I, and Part II, Section 3.1. - have indicated a considerable degree of similarity between the visual perception of real rooms and that of their models.

This issue was also considered in relation to the experiment titled "The effect of window size, room proportion and window position on spaciousness evaluation of rooms" (Part II, Section 3.1.); specifically, when the subjects were asked to comparethe spaciousness of the actual room with that of its 1/10 scale model, it was found out that 54% did not see any difference; 29% perceived the model as being more spacious while 17% regarded the actual room as being more spacious.

Due to its many advantages, in the fields of Architecture and Architectural Psychology, colour transparencies are widely used to represent interior spaces. A number of experiments have indicated that slides were adequate means of representing the real rooms (Kuller, 1972; Acking and Kuller, 1972). Howard et al.'s (1972) study on "comparison of affective responses to real and presented environments" on the other hand concluded that "the slides elicited less extreme responses, ... and more negative feelings than did the actual environments". Wool's (1971) findings were in a parellel line.

The aim of the present experiment is to examine the problem of the differences between spaciousness evaluations of real rooms, their models, and coloured slides more systematically by using spaciousness and crampedness scales.

METHOD

Subjects

Sixty six male students, staff members and technicians from various departments of the University of Strathclyde were used as subjects. The overall mean age was 28.60 years (28.76 years, 33.19 years, and 22,85 years, for the actual room, the model and the slide conditions, respectively). There were 22 subjects in each of the three conditions of the experiment.

Stimuli

The stimuli used in this experiment were basically the same as those of the experiment reported in II.3.1.: a) a square conference room, b) 1/10 scale model, and c) coloured slide of the conference room. (See Experiment II.3.1. for detailed information about the actual room and the model, the furniture layout, view and natural lighting.) The only difference in the real room condition was the addition of a 45 x 74cm desk in the conference room, near the door which was used as an observation desk for subjects. The slide of the room was taken on 35mm Ektachrome film, using a Nikormat camera with a 24mm wide angle lens, from the observation desk.

Procedure

There were three conditions in the experiment: i) the actual room, ii) the model, and iii) the slide. In the first two cases the experiment was administered individually, in the third case in a group session in a classroom. After a short introduction, each subject was given a two-page evaluation form. On the first page of this form the purpose of the study was stated, the use of a 7-point scale was explained and illustrated; on the second page, 19 adjective pairs of the spaciousness-crampedness scale (SCS) were listed (see Appendix IV A).

After the subject finished reading the given form, an effort was made to ensure that he fully understood the usage of the evaluative scales (in the slide condition, the whole group). Then the stimulus was described as a conference room for about 15 people. In the actual room condition, the subjects evaluated the room from the observation desk near the door; in the model condition they evaluated the model which was located near the window by looking through the aperture; and in the slide condition the subjects evaluated the slide of the room taken from the observation desk, projected on a 2 x 2m white screen. Hence in all conditions the interiors were viewed from approximately the same positions. Each of the first two experimental sessions lasted about 10 minutes, the third one (slide) was part of a longer slide session; the slide of conference room was projected as the first slide of a group of 10, and took about 4 minutes. After the experiment, the experimenter gave a brief account of his general project and thanked the subject(s) for his (their) co-operation.

RESULTS

Subjects' evaluations on the 19 adjective pairs were converted into two sets of numerical scores of 1 to 7 (1 representing the undesirable end of the scale, e.g. small, cluttered, repelling, etc.; and 7 referring to the desirable one, e.g. large, uncluttered, inviting, etc., for spaciousness factors and the reverse for crampedness factors). Then the mean scores of the adjective pairs for each factor of the spaciousness and crampedness scales were calculated. These mean scores of the 22 subjects in each of the three conditions of the experiment are shown in Figures 4.1. and 4.2., for spaciousness and crampedness, respectively.

A. Spaciousness

The mean values for the spaciousness factors I, II, III of the real room were 4.97, 5.40, 5.40, respectively and those of the model were 4.75, 5.36, 5.25, and finally those of the slide were 2.67, 3.12, 4.67, respectively. The differences between the three experimental conditions were analyzed by a two-way analysis of variance for factorial designs with repeated measures on one factor. Table 4.1. summarizes the results of this analysis.

TABLE 4.1. SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR SPACIOUSNESS EVALUATION OF THE ACTUAL ROOM, ITS 1/10 SCALE MODEL, AND ITS COLOURED SLIDE

Source	SS	DF	MS	F	P
Between Subjects					
A (type of stimuli)	128.8937	2	64.4468	38.4535	$p<.001$
S within groups	105.5860	63	1.6759		
Within Subjects					
B (spaciousness factors)	31.1177	2	15.5588	25.3425	$p<.001$
AB	24.5450	4	6.1362	9.9948	$p<.001$
B x S within groups	77.3567	126	.6139		
TOTAL	367.4992	197			

As seen in Table 4.1, both the main effects and their interaction were highly significant ($p<.001$). The overall mean value for the main effect of type of stimuli were 5.25, 5.12 and 3.48 for the real room, the model and slide. That is to say, the first two conditions were evaluated similarly but different than the slide condition which was evaluated - less spacious, hence responsible for the significant main effect of type of stimuli. Seperate t-test analyses indicated the slide condition to vary significantly from both the real room ($t=2.63$, $df=42$, $p<.02$) and the model conditions ($t=2.35$, $df=42$, $p<.05$). The difference between the actual room and the model conditions was not significant.

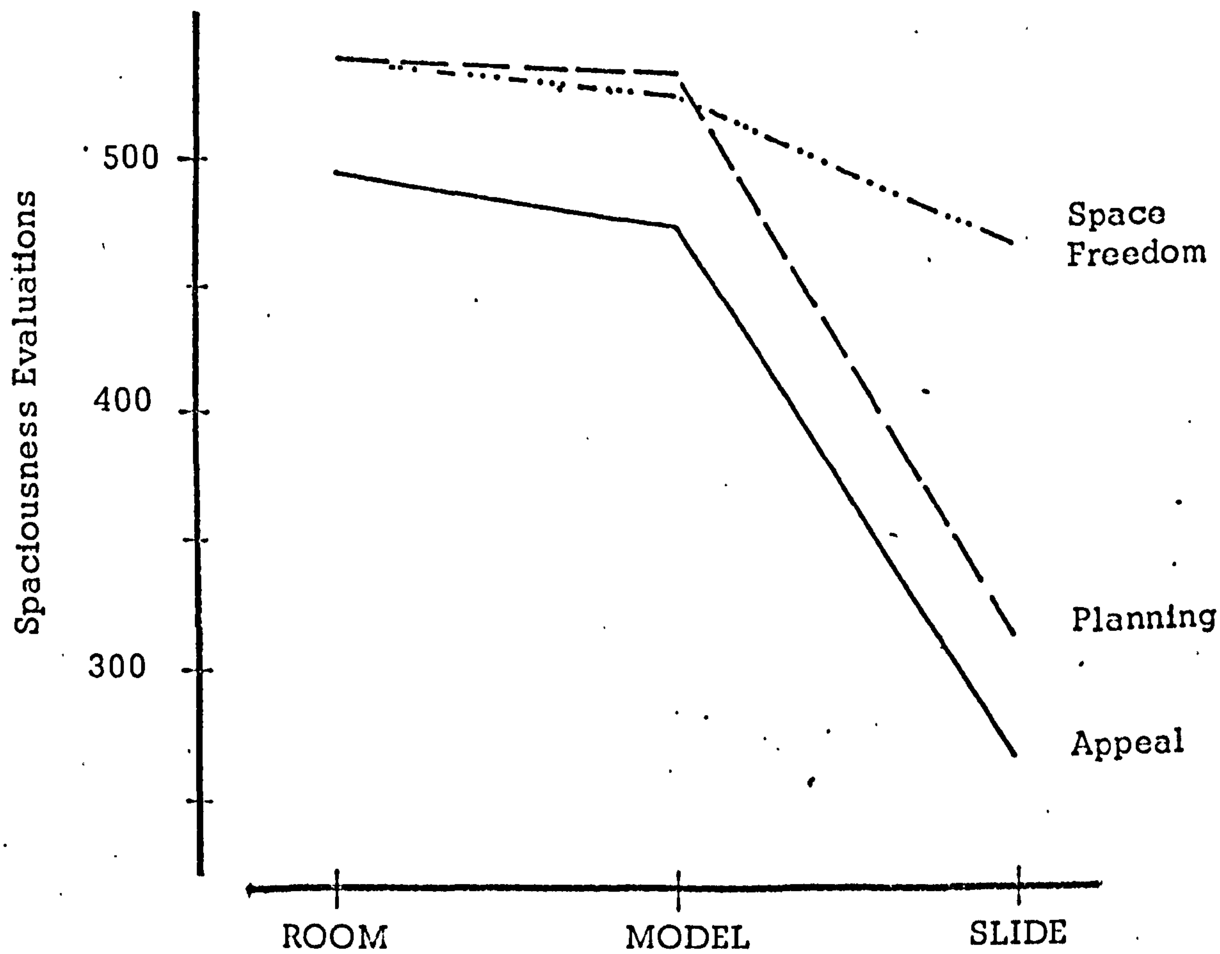


FIGURE 4.1. Mean evaluations as a function of the type of stimuli and spaciousness.

The mean valuesfor the main effect of spaciousness factors I, II and III were; 4.13, 4.62 and 5.10 respectively. It seems that generally the stimuli received the highest value in the space freedom factor, a relatively lower one in appeal. The interaction between the type of stimuli and spaciousness factors can be seen in Figure 4.1. An examination of Figure 4.1 shows that both the room and the model were evaluated positively on all three factors. The slide of the room, on the other hand, received lower values on all three spaciousness factors. Separate t-tests applied to the differences indicated that the slide of the room was evaluated significantly lower on space freedom ($t=2.71$, $df=42$, $p<.01$ for the real room and $t=2.13$, $df=42$, $p<.05$ for the model), appeal and planning factors, as compared to the actual room and the model.

B. Crampedness

The mean scores for the crampedness factors I, II, III, IV of the real room were 2.66, 3.13, 2.33, 3.02, respectively and those of the model were 2.73, 3.03, 2.83, 3.21, and finally those of the slide were 4.90, 3.51, 2.80, 5.30, respectively. The differences between the three experimental conditions were analyzed again by a two-way analysis of variance for factorial designs with repeated measures on one factor, the results of which have been summarized in Table 4.2.

As can be seen in Table 4.2, both the main effects and their interaction were highly significant ($p<.001$). The mean values for the main effect of type of stimuli were 2.79, 2.95, and 4.12, for the actual room, the model and the slide. Separate t-tests applied to the differences indicated the slide condition to vary significantly from both the real room ($t=5.30$, $df=42$, $p<.001$) and the model conditions ($t=4.16$, $df=42$, $p<.001$). The difference between the actual room and the model conditions was not significant.

TABLE 4.2. SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR CRAMPEDNESS EVALUATION OF THE ACTUAL ROOM, ITS 1/10 SCALE MODEL, AND ITS COLOURED SLIDE

Source	SS	DF	MS	F	P
Between Subjects					
A (type of stimuli)	61.1533	2	30.5766	15.7394	$p<.001$
S within groups	122.3886	63	1.9426		
Within Subjects					
B (crampedness factors)	24.7101	3	8.2367	10.9899	$p<.001$
AB	78.5189	6	13.0864	17.4607	$p<.001$
B x S within groups	141.6516	189	.7494		
TOTAL	428.4227	263			

The mean values for the main effect of crampedness factors I, II, III, and IV were: 3.43, 3.22, 2.65 and 3.84, respectively. In other words the stimuli received high values on appeal and planning, the lowest on clutteredness factors. Figure 4.2. shows the interaction between the type of stimuli and crampedness factors in a graphical form. An examination of Figure 4.2 indicates that both the room and the model received low values on all four factors (less cramped), however, the slide was evaluated high on appeal and planning factors. Separate t-test analyses in fact indicated that the slide of the room to be significantly different from both the actual room and the model with respect to appeal and planning factors; although the difference between the model and the slide on physical size factor was approaching significance ($t=2.01$, $df=42$, $p<.1$), none of the type of stimuli differed significantly on clutteredness and physical size factors.

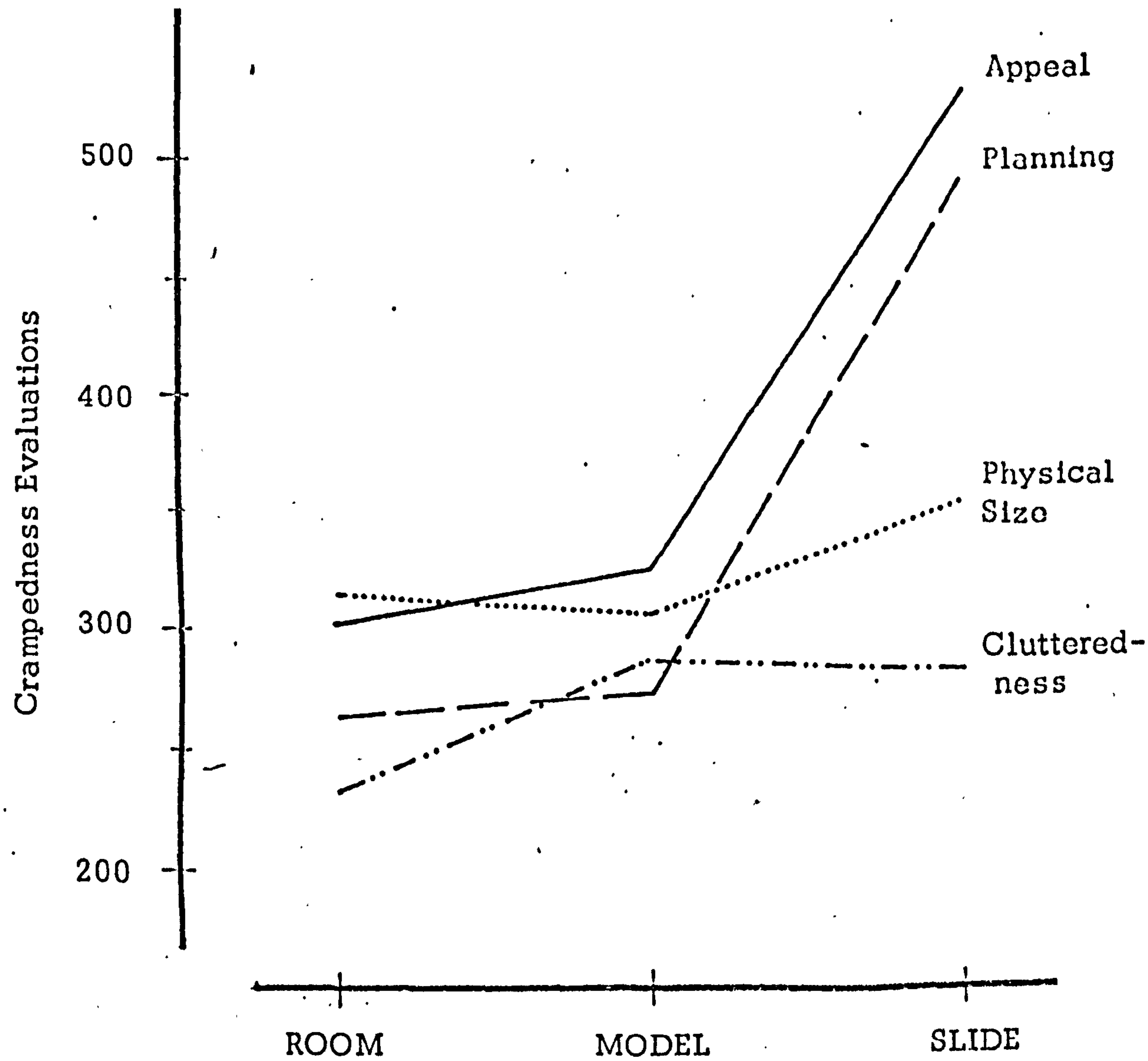


FIGURE 4.2. Mean evaluations as a function of the type of stimuli and crampedness.

DISCUSSION

The results in general indicated that the type of stimuli affects its evaluation significantly in terms of spaciousness and crampedness. The results of the spaciousness evaluation showed that there were no differences between a real room and its 1/10 scale model; however, the slide of the room was perceived as having significantly less space freedom and to be much less appealing and less well-planned, hence less spacious, as compared to the other two conditions.

As far as the general crampedness evaluations were concerned, there were no differences between the model and the real room again, but the slide of the room was evaluated as being much less appealing and less well-planned as compared to the first two types of stimuli. The physical size and clutteredness factors did not show any significant change in any of the three conditions of the experiment.

In general, the results of this experiment indicated that interiors in slides are seen less spacious than they really are, which supports Howard et al.'s (1972) early findings. The results also varified the previously obtained findings (see Section II.3.1) that the detailed 1/10 scale models can be used to represent the real rooms as far as the spaciousness-crampedness evaluations are concerned. Hence it is implied that real rooms and their models can be used interchangably in spaciousness studies. This finding led the way to the following experiments.

IV.2. EVALUATION OF REAL ROOMS AS A FUNCTION OF ORGANIZATION AND SPACIOUSNESS-CRAMPEDNESS FACTORS

One of the factors of both the "spaciousness" and the "crampedness" scales was closely related to organization and planning (Factors II and I, in spaciousness and crampedness scales, respectively). Moreover, the author's own observations, as well as some of the pilot explorations, suggested the organization or orderliness to be an important variable for spaciousness evaluations of interiors. Therefore, the present study was designed to explore this variable more systematically by comparing: (a) organized, (b) disorganized, and (c) very disorganized conditions of the conference room by using the spaciousness and crampedness scales in a two-way factorial design.

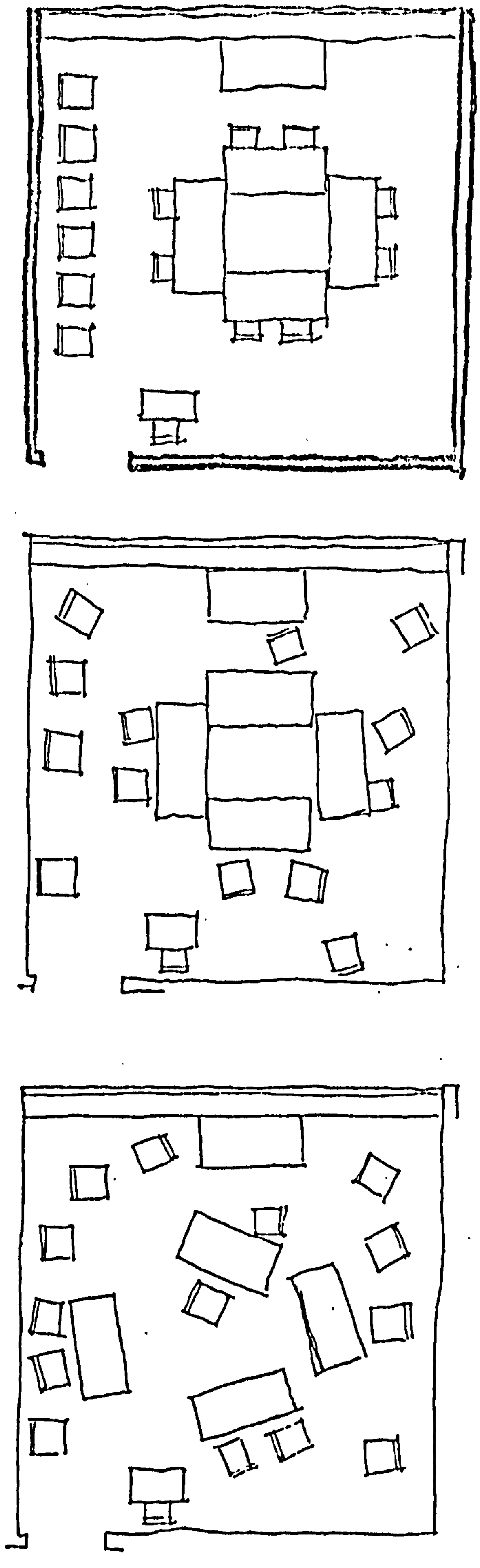
METHOD

Subjects

Sixty six volunteer students, staff members and technicians from different departments of the University of Strathclyde were used as subjects. The overall mean age was 30.81 years (28.68 years, 31.38 years, and 28.31 years for the organized disorganized and very organized conditions, respectively). There were 22 subjects in each of the three conditions of the experiment. Each subject first evaluated a model located in the toom, then one of the three conditions of this experiment.

Stimuli

The same conference room was used in this experiment as in the previous studies. In the organized condition the chairs and tables were arranged in their previous cartesian order; in the disorganized condition, the chairs were shuffled around the tables, as they might appear at the end of a meeting when people have just got up and left; whereas in the very disorganized condition the chairs and tables were more or less



A

B

C

FIGURE 4.3. The furniture arrangement of the conference room in the (a) organized, (b) disorganized, and (c) very disorganized conditions.

haphazardly arranged in the room. The three different arrangements of the room can be seen in Figure 4.3.

Procedure

The experiment was administered to each subject individually. Each subject first evaluated a model in the room as his first task - the effect of which on this experiment was counterbalanced - then judged the conference room in one of the three conditions. Upon ensuring that the subject understood how to use the scales, as in the previous experiment, he was asked to evaluate the conference room from the observation desk in one of the three conditions. Each experimental session lasted for about 8 minutes. After the experiment, the experimenter gave a brief account of his general project and thanked the subject for his co-operation.

RESULTS

As in the previous experiment each of the subjects' evaluations on the 19 adjective pairs were converted into two sets of numerical scores of 1 to 7. Then the mean scores of the adjective pairs for each factor of the spaciousness and crampedness scales were calculated. These mean scores of the 22 subjects in each of the three conditions of the experiment are shown in Figures 4.4 and 4.5, for spaciousness and crampedness, respectively.

A. Spaciousness

The mean scores for the spaciousness factors I, II, III of the organized room were 5.00, 4.90, 5.03, respectively and those of the disorganized room were 4.62, 4.35, 4.24, and finally those of the very disorganized room were 4.14, 3.30, 3.87, respectively. The differences between the three conditions of the experiment were analyzed by a two-way analysis of variance for factorial designs with repeated measures on one factor. Table 4.3 summarizes the results of this analysis.

TABLE 4.3. SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR THE EVALUATION OF THE CONFERENCE ROOM WITH ORGANIZATION AND SPACIOUSNESS FACTORS AS TWO VARIABLES

Source	SS	DF	MS	F	P
Between Subjects					
A (organization)	51.9651	2	25.9825	10.7533	p<.001
S within groups	152 .2221	63	2.4162		
Within Subjects					
B (spaciousness factors)	4.9842	2	2.4921	4.9483	p<.01
AB	4.1344	4	1.0336	2.0523	p<.1 n.s.
B x S within groups	63.5474	126	.5036		
TOTAL	276.7635	197			

As can be seen in Table 4.3, both of the main effects of organization and spaciousness factors were significant (p<.001 and p<.01, respectively), whereas their interaction was not. Figure 4.4 shows that in general, as the room became more and more disorganized, it was evaluated as being less spacious (the means being 4.98, 4.44, and 3.77 for organized, disorganized and ver disorganized conditions, respectively). In general, the organized room was evaluated quite favourably on all three spaciousness factors; however, in the disorganized and very disorganized conditions the mean values of all three factors decreased. Seperate t-test analyses indicated the differences between all three of these conditions to be significant (t=2.22, p<.05 for organized versus disorganized; t=2.19, p<.05 for disorganized versus very disorganized; and t=4.38, p<.001 for organised versus very disorganized conditions, each with df=42).

The mean values for the main effect of spaciousness factors I, II and III were 4.62, 4.18 and 4.38 respectively. It seems that generally

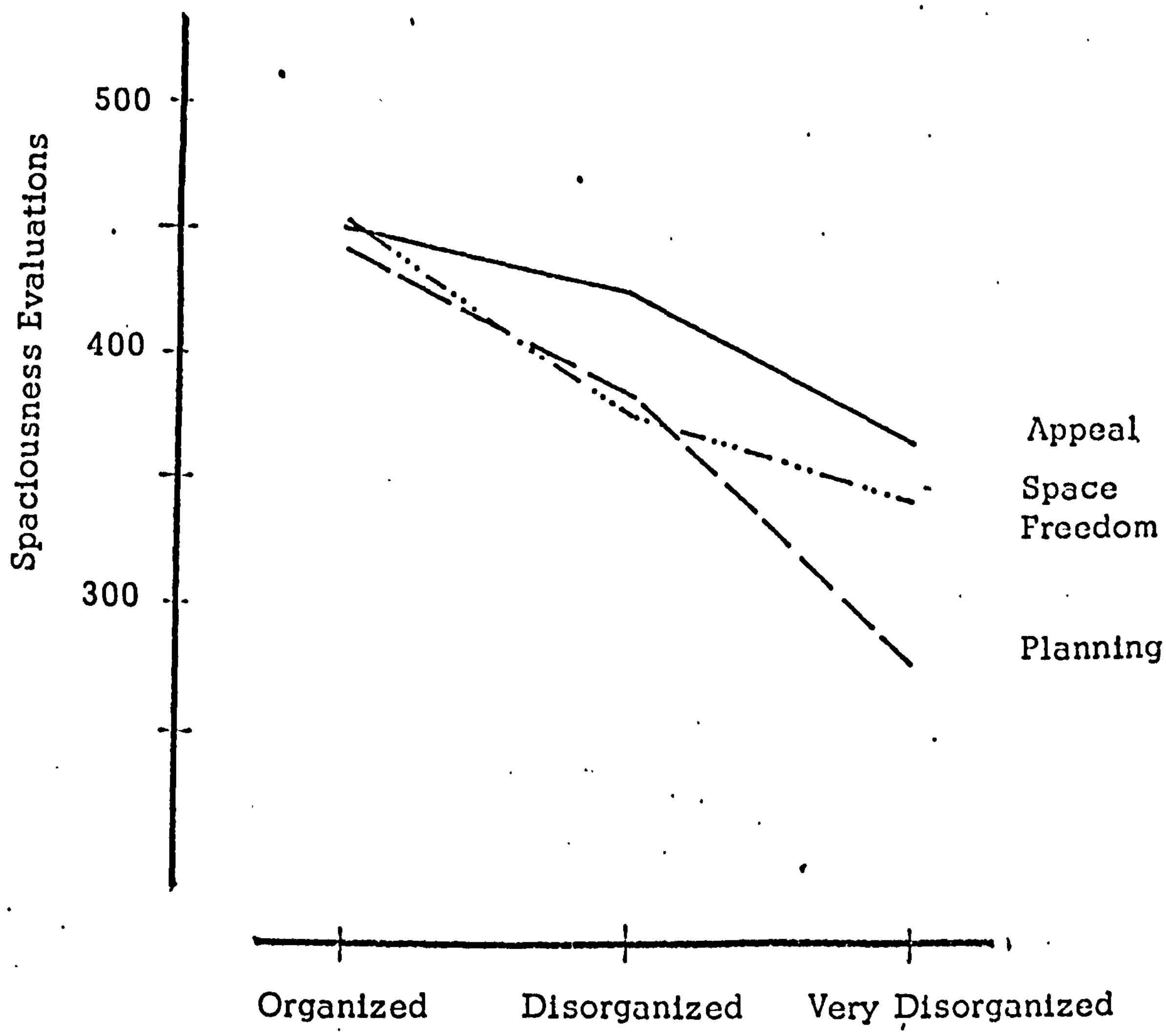


FIGURE 4.4. Mean evaluations as a function of the levels of organization and spaciousness.

the room received the highest value in the appeal factor, a relatively lower one in space freedom and the lowest in planning.

B. Crampedness

The mean scores for the crampedness factors I, II, III and IV in the organized condition were: 2.12, 2.57, 1.88, and 1.93, respectively; those in the disorganized condition were: 2.74, 2.75, 3.02, and 2.20, respectively; and those in the very disorganized condition were: 3.90, 2.58, 3.41 and 2.77, respectively. The differences between these three experimental conditions were analyzed by a two-way analysis of variance for factorial designs, the results of which have been summarized in Table 4.4.

TABLE 4.4. SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR THE EVALUATIONS OF THE CONFERENCE ROOM WITH ORGANIZATION AND CRAMPEDNESS AS TWO VARIABLES

Source	SS	DF	MS	F	P
Between Subjects					
A (organization)	47.8918	2	23.9459	8.8486	p<.001
S within groups	170.4876	63	2.7061		
Within Subjects					
B (crampedness factors)	13.8868	3	4.6289	6.9332	p<.001
AB	24.6164	6	4.1027	6.1450	p<.001
B x S within groups	126.1854	189	.6676		
TOTAL	383.0682	263			

As is seen in Table 4.4, both the main effects and their interactions were highly significant ($p < .001$). The mean values for the main effect of organization were 2.12, 2.68, and 3.16, for the organized, disorganized and very disorganized conditions, respectively; hence indicating that as the degree of disorganization of a room increased, it was perceived as being more cramped. Separate t-test analyses indicated the organized condition to vary significantly from both the disorganized ($t=2.54$, $df=42$, $p<.02$) and the very disorganized conditions ($t=4.17$, $df=42$, $p<.001$). The difference between the disorganized and very disorganized conditions was not significant.

The mean values for the main effect of the crampedness factors I, II, III and IV were: 2.92, 2.63, 2.77, and 2.30, respectively. More interesting than this main effect is the organization X crampedness factors interaction which can be seen in Figure 4.5. An examination of Figure 4.5 shows that with the exception of the physical size factor, the mean values of which interestingly did not change significantly, the means for all four crampedness factors increased as the room became less organized. The results of the separate t-test analyses for the differences between organized and very disorganized conditions being $t=4.53$, $p<.001$, $t=4.50$, $p<.001$, and $t=2.48$, $p<.02$, for Factors I, III, and IV, respectively, each with 42 df. However, the increase observed in the appeal factor was relatively less than that in the clutteredness and planning factors. Although the mean values of these three factors were close to each other in the organized condition, in the disorganized condition the difference between the mean values of Factors III and IV was significant ($t=2.54$, $df=42$, $p<.02$) and in the very disorganized condition, that between Factors I and IV reached significance ($t=2.78$, $df=42$, $p<.01$).

To understand how each of these three factors varied as a function of the three levels of organization, further t-test analyses were carried out. For the appeal factor, neither the differences between the mean values for organized and disorganized conditions, nor those for disorganized and very disorganized reached significance. As was reported above, only the the mean appeal factor for the organized room varied significantly from

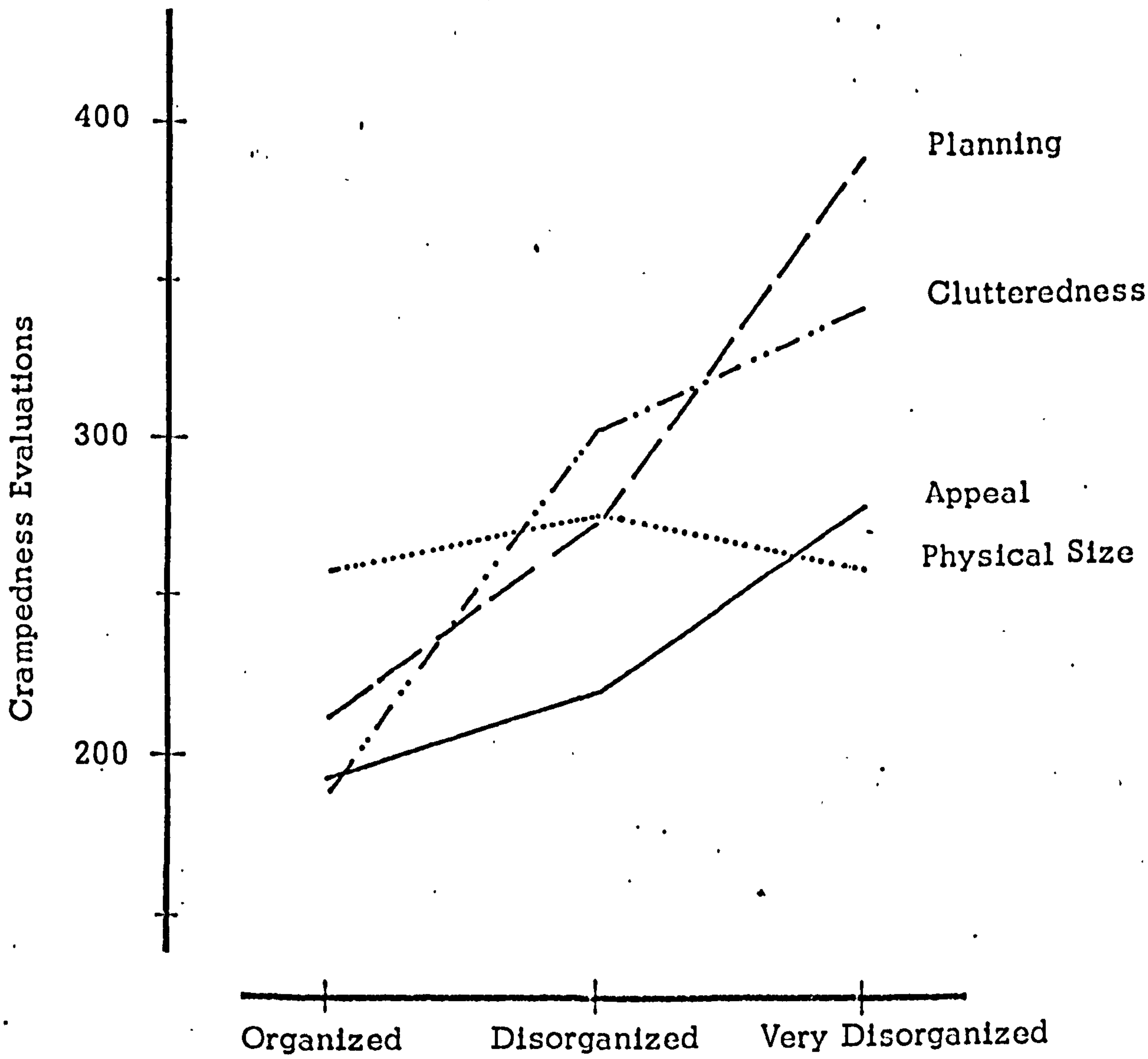


FIGURE 4.5. Mean evaluations as a function of the levels of organization and crampedness.

that of the very disorganized condition, hence indicating that a room becomes significantly less appealing only when it is very disorganized. As for the clutteredness factor, in addition to the significance of the difference between organized and very disorganized conditions, also that between organized and disorganized was significant ($t=4.23$, $df=42$, $p<.001$). The difference between disorganized and very disorganized conditions was not significant for the clutteredness factor. Thus it seems that both the disorganized and very disorganized interiors appear more cluttered than organized ones. Finally, the mean values for the planning factor did not vary in the organized and disorganized conditions, whereas in the very disorganized condition, it increased significantly - hence implying more crampedness - ($t=2.79$, $df=42$, $p<.01$, for disorganized versus very disorganized conditions). In the very disorganized condition, the planning factor received the highest value indicating that this factor was affected relatively more than the others.

DISCUSSION

The results in general indicated that the organization or orderliness of furniture in a room affects its evaluation significantly in terms of spaciousness and crampedness factors. The results of the spaciousness evaluation showed that as the room became more and more orderly it was perceived as being more and more spacious. This main effect was valid for all the three spaciousness factors.

As far as the general crampedness evaluations were concerned, there were no differences between the disorganized and very disorganized rooms, but the organized room was perceived as being significantly less cramped than both the disorganized and very disorganized ones. However, the significant organization X crampedness factors interaction indicated that the difference between the conditions of organization varied as a function of the crampedness factors. Hence, when the specific crampedness factors were considered, the very disorganized condition was evaluated as being significantly less appealing than the organized one, and less well-planned than both the organized and disorganised conditions. As for the clutteredness factor, the organized condition was perceived as being significantly less cluttered than both the disorganized and very disorganized conditions. One of the most interesting findings was the constancy of the physical size factor; regardless of the levels of organization, the values for physical size did not vary significantly.

In concluding it can be pointed out that the level of organization of the furniture in a room seems to affect all the spaciousness factors in a similar way, while there appears to be differences as far as the crampedness factors are concerned; of these, that of the physical size remains unchanged, whereas planning and clutteredness factors change relatively more than the appeal factor.

IV. 3. EVALUATIONS OF 1/10 SCALE MODELS AS A FUNCTION OF FURNITURE DENSITY AND SPACIOUSNESS-CRAMPEDNESS FACTORS

As was reported in Part II, Section II.1., the effect of furniture density on the subjective evaluation of spaciousness (and estimation of size) was studied with real rooms, by using a 7-point "carmped-spacious" scale. At this stage, the effect of furniture density was re-assured in 1/10 scale models by utilizing the spaciousness and crampedness scales. The aim of the present experiment was twofold:

1) To examine the relationship between furniture density and spaciousness more thoroughly in terms of the three spaciousness and four crampedness factors; and

2) to find out the degree to which the previously obtained relationship between furniture density and spaciousness would be valid for a 1/10 scale model of a different interior.

METHOD

Subjects

Twenty two volunteer male students, staff members and technicians from different departments of the University of Strathclyde served as subjects in each of the three experimental conditions. The overall mean age was 30.09 years (25.18 years, 33.19 years, and 32.04 years, for the empty, furnished and overfurnished conditions, respectively).

Stimuli

The model used for the experiment was 1/10 scale model of the conference room (see Figure 2.10.). In the "empty condition" there was no furniture in the model room; in the "furnished condition" the arrangement was the same as in the experiment described in IV.1.; whereas in the "over-furnished condition", the quantity of furniture was doubled; two of the added tables were combined with the other four in the middle, each of

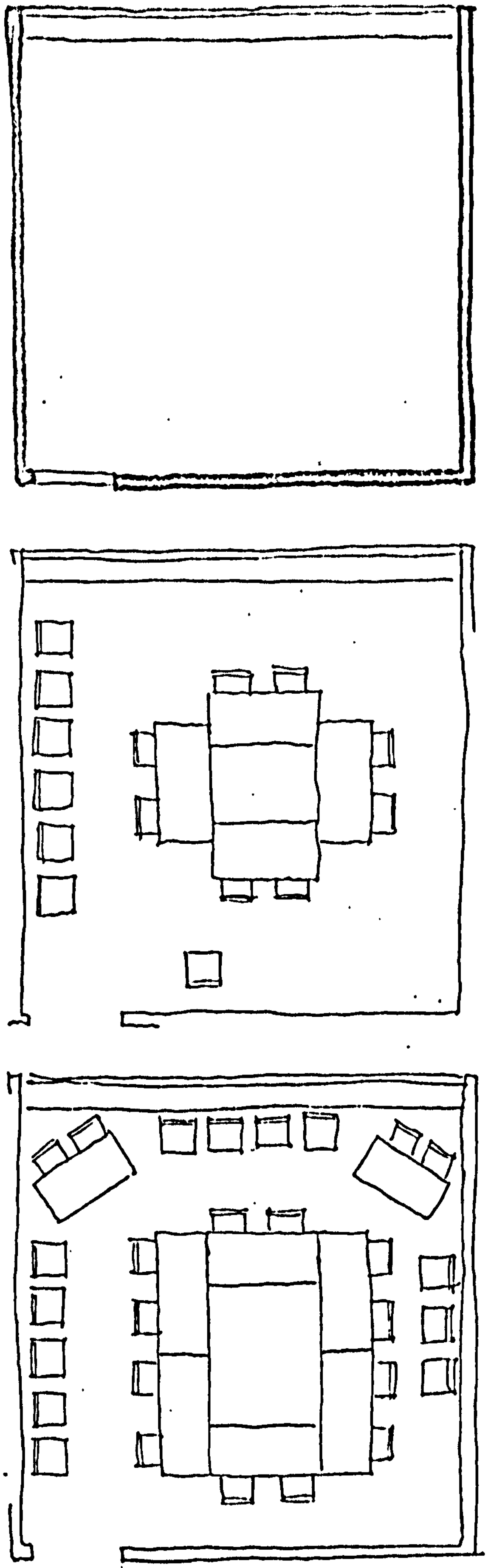


FIGURE 4.6. The plans of the 1/10 scale model in the empty, furnished and overfurnished conditions.

the other two was placed in the Western corners of the model; chairs were placed in all three apparent sides, indicating that the room had a potential of housing about 30 people. See Figure 4.6, for the layout of the "overfurnished condition".

Procedure

Each of the sixty six subjects was given the two-page evaluation form after being seated on chair D in the experimental room. When the subject finished reading the evaluation form, the experimenter made sure that he understood how to use the 7-point scales. Then the subject was asked to observe the interior of the model through its aperture and to rate it in terms of the 19 adjective pairs in the evaluation form. Each experimental session lasted for about 8-10 minutes.

RESULTS AND DISCUSSION

As was explained previously (see experiment IV.1.) each subject's ratings on each of the 19 adjective pairs were converted into two sets of numerical scores of 1 to 7. Then for each subject the mean scores of the adjective pairs for each of the three spaciousness and four crampedness factors were calculated. These two sets of scores for each subject were then used in the two separate analysis of variance for factorial designs.

A. Spaciousness

The mean values for each of the three spaciousness factors in each of the three experimental conditions are shown in Figure 4.7. As can be seen in Figure 4.7., the mean values of factors I, II, and III were: 4.73, 4.78, 5.34, respectively, for the empty condition; for the furnished condition the respective means were: 4.75, 5.36, 5.25;

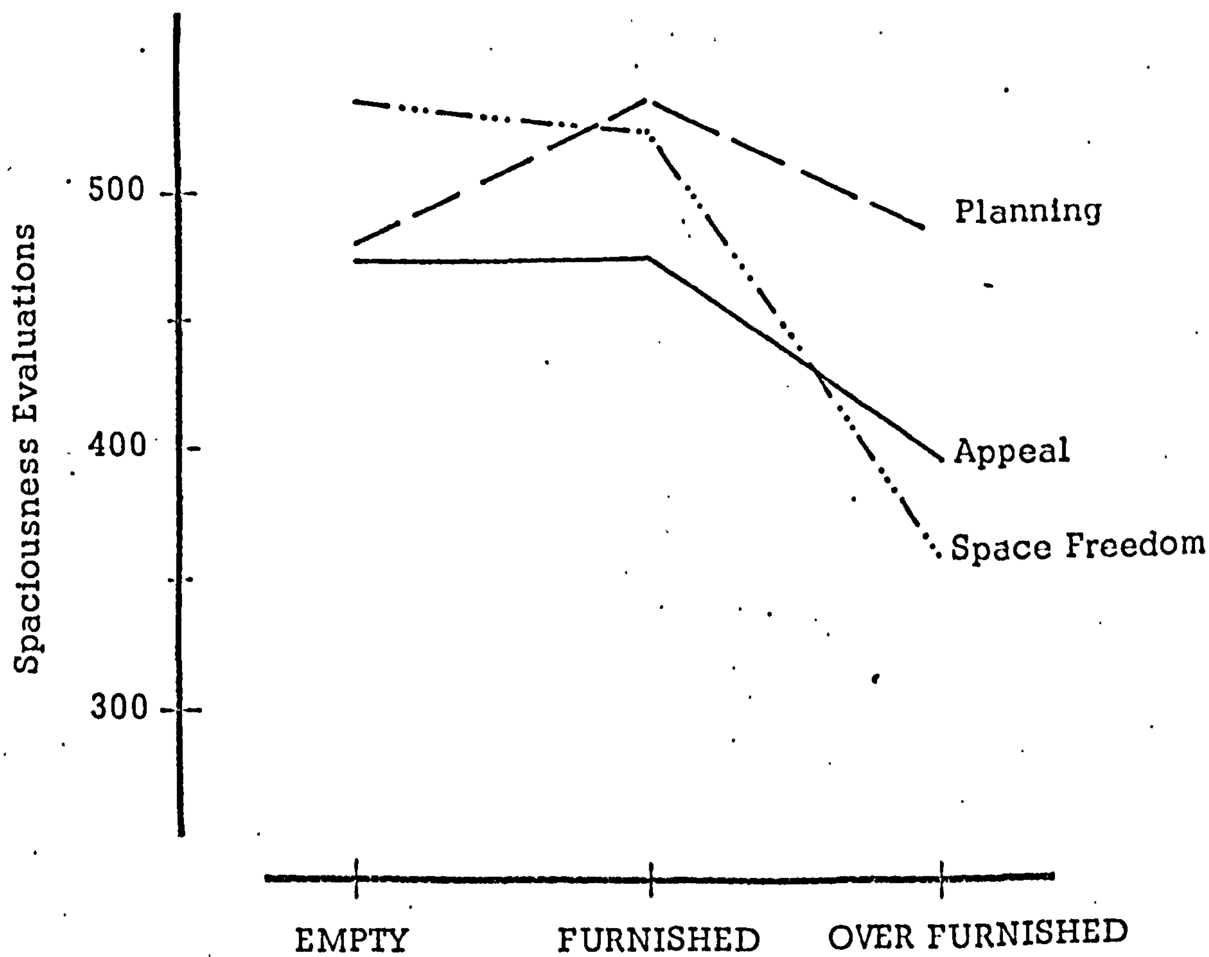


FIGURE 4.7. Mean evaluations as a function of the levels of furniture density and spaciousness.

and finally, for the overfurnished condition they were: 3.98, 4.88, and 3.60. The differences between the three conditions of the experiment were analyzed by an analysis of variance for two-way factorial designs with repeated measures on one factor, the results of which have been summarized in Table 4.5.

TABLE 4.5 SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR EVALUATION OF THE MODEL INTERIOR AS A FUNCTION OF FURNITURE DENSITY AND SPACIOUSNESS FACTORS

Source	SS	DF	MS	F	P
Between Subjects					
A (furniture density)	35.7709	2	17.8854	10.6091	$p < .001$
S within groups	106.2085	63	1.6858		
Within Subjects					
B (spaciousness factors)	8.8812	2	4.4406	7.5079	$p < .001$
AB	19.2892	4	4.8223	8.1532	$p < .001$
B x S within groups	74.5238	126	.5914		
TOTAL	244.6738	197			

As is seen in Table 4.5, both the main effects and their interaction were highly significant ($p < .001$). The main effect of furniture density indicated that the mean spaciousness evaluations varied significantly in the three experimental conditions. Specifically, in the empty condition the overall mean evaluation (of the three spaciousness factors) was 4.95; in the furnished condition it increased to 5.12; whereas in the overfurnished condition it dropped to 4.15; hence yielding an inverted U-shaped function as in experiment II.1. Separate t-test analyses indicated that the mean spaciousness evaluation of the overfurnished condition was significantly different from that of both the empty ($t=3.60$, $df=42$, $p<.001$) and the furnished conditions ($t=3.94$, $df=42$, $p<.001$). On the other hand, the difference between the empty and furnished conditions was not significant.

The mean values for the significant main effect of spaciousness factors were: 4.49, 5.01 and 4.73, for Factors I, II, and III, respectively. Although significant, this main effect does not mean much without considering the interaction effect which is shown in Figure 4.7. As can be seen in Figure 4.7, in the empty condition the model was evaluated relatively higher on Factor III (space freedom) than Factors I and II (appeal and planning, respectively). In the furnished condition the mean values of Factor I and III did not show any significant change, whereas that of Factor II showed a tendency to increase which was very close to being significant ($t=2.00$, $df=42$, $p<.1$, for the difference between the mean values of Factor II in the empty versus furnished conditions). In the overfurnished condition, on the other hand, the mean values of all three factors seemed to decrease, with that of Factor III relatively more than the others. Separate t-test analyses in fact showed that only the decrease observed in Factor III was significant ($t=7.19$, $df=42$, $p<.001$, for the difference in the mean Factor III values for the furnished versus overfurnished conditions); however, the decrease observed in the mean values of Factor I in the overfurnished condition was approaching significance ($t=1.86$, $df=42$, $p<.1$).

B. Crampedness

The mean scores for the crampedness factors I, II, III and IV of the empty condition were; 2.29, 2.02, 1.28, 2.12, respectively; and those of the furnished conditions were: 1.73, 2.04, 1.83, and 2.21, respectively; and those of the overfurnished condition were 2.13, 2.58, 4.08, and 2.98, respectively. The differences between the three conditions of the experiment were again analyzed by analysis of variance for factorial designs, the results of which can be seen in Table 4.8.

TABLE 4.8 SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR EVALUATION OF THE MODEL INTERIOR AS A FUNCTION OF FURNITURE DENSITY AND CRAMPEDNESS FACTORS

Source	SS	DF	MS	F	P
Between Subjects					
A (furniture density)	58.4028	2	29.2014	14.3337	p<001
S within groups	128.3467	63	2.0372		
Within Subjects					
B (crampedness factors)	6.5081	3	2.1693	2.9044	p<.2
AB	55.7355	6	9.2892	12.4369	p<.001
B x S within groups	141.1658	189	.7469		
TOTAL	390.1591	263			

As can be seen in Table 4.8., the significant effects were that of furniture density and its interaction with crampedness factors ($p<.001$). The overall mean values of the crampedness factors were 1.94, 1.95, and 2.96 for empty, furnished and overfurnished conditions respectively; hence indicating that the crampedness evaluation of an interior does not vary significantly for empty and furnished conditions. However, separate t-test analyses indicated that the mean crampedness value for the overfurnished condition varied highly significantly from that

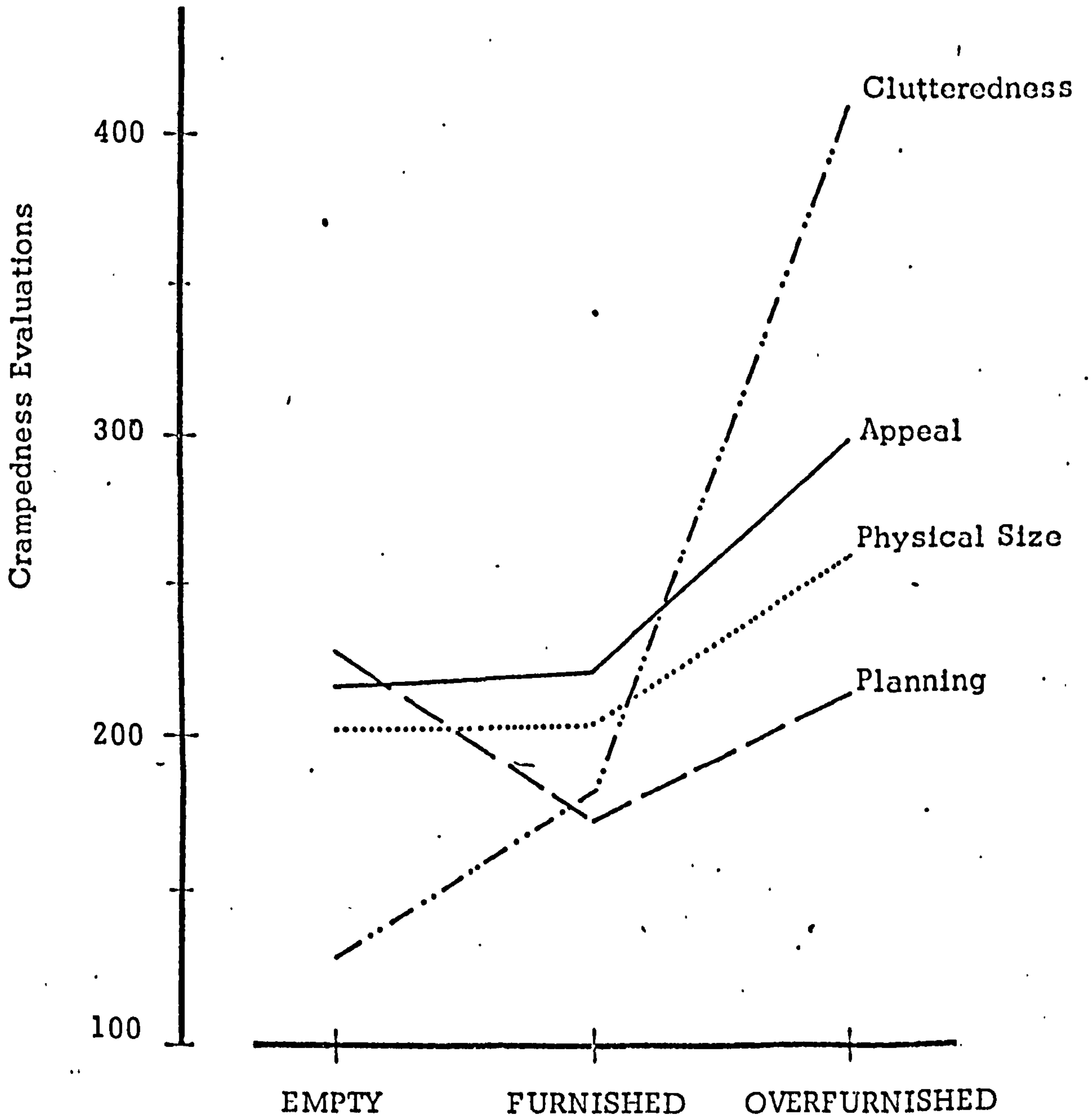


FIGURE 4.8. Mean evaluations as a function of the levels of furniture density and crampedness.

of both the empty and the furnished conditions ($t=4.84$ and $t=4.39$, respectively, each with 42 df and $p<.001$). Thus, overfurnishing appears to have a strong role on making an interior more cramped. The meaning of this main furniture density effect becomes more clear when its interaction with the four crampedness factors are considered.

Figure 4.8. shows the furniture density X crampedness factors interaction. Separate t-test analyses indicated that of the differences observed in the mean values of the crampedness factors in Figure 4.8, only the ones related to Factors III (clutteredness) and IV (appeal) were significant. The mean values of both the appeal and the clutteredness factors varied significantly from those of the furnished as well as the empty conditions (the t and p values for the difference between the furnished and overfurnished conditions being $t=7.31$, $p<.001$ and $t=2.11$, $p<.05$, for Factors III and IV, respectively, each with 42df). As is clearly seen in Figure 4.8. the clutteredness factor was affected the most as a result of overfurnishing.

DISCUSSION

The results showed that an overfurnished interior was perceived as being less spacious than both an empty and a furnished one. This finding is highly supportive of that of the previously reported experiment (see experiment II.1.). Figure 4.9. shows the striking similarity of the shapes of the functions obtained in the previous and present experiments. This similarity becomes even more interesting in view of the fact that the former study was carried out in a full-size office room while the present one utilized a 1/10 scale model of a conference room which differed in size and nature from the former.

When the specific spaciousness factors were considered, it was found that the mean values of none of the factors showed a significant change

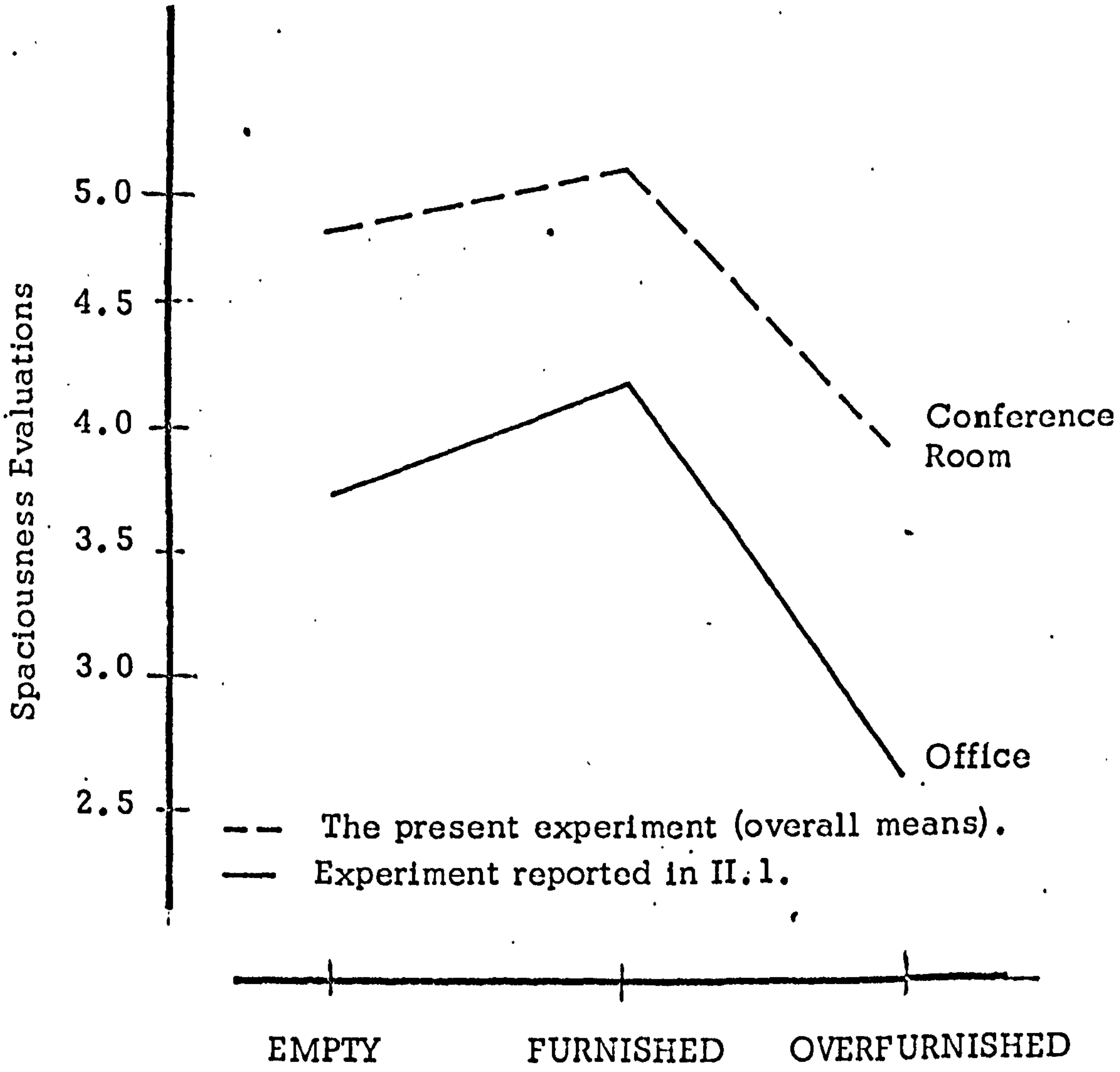


FIGURE 4.9. Mean spaciousness values obtained in the Experiments II.1. and IV.3. as a function of the levels of furniture density.

between empty and furnished conditions, although there was a slight tendency for the furnished room to be evaluated as being better planned. The overfurnishing, on the other hand, seemed to affect the space freedom factor very strongly, the mean value of which decreased sharply. Although unsignificant, the mean value of the appeal factor also showed a tendency to decrease. Thus, an overfurnished interior appears to be slightly less appealing but more noteably as having less space freedom than a furnished one.

The results of the crampedness evaluations were in general congruent with those of spaciousness; the overfurnished room was seen as being more cramped than both the empty and the furnished ones. A consideration of the specific crampedness factors indicated that the factors mainly responsible for this finding were clutteredness and appeal factors, the former relatively more so than the latter. The overfurnished condition was evaluated as being significantly cluttered and less appealing than both the empty and the furnished conditions.

It can be concluded that generally both the spaciousness and crampedness evaluations yielded similar results, particularly in that the main changes were observed when the overfurnished condition was compared with the furnished and empty ones. An overfurnished interior seems to appear as being more cluttered and less appealing and as having less space freedom than an empty and a furnished interior.

IV 4. EVALUATIONS OF 1/10 SCALE MODELS AS A FUNCTION OF ROOM PROPORTION WINDOW SIZE, WINDOW POSITION AND SPACIOUSNESS-CRAMPEDNESS FACTORS

The experiment reported in II.3.1., titled "The effect of window size, room proportion and window position on spaciousness evaluation of rooms" made use of adjustable models. In general it was found that the rooms with windows on the short side were assessed as being more spacious than the rooms with windows on the long side; another significant effect was the interaction between room proportion and window size, which indicated that root two models were evaluated as being more spacious with three-bay windows whereas root three models were seen as being more spacious with continuous windows.

The previous experiment studied the effect of the above-mentioned factors globally by having subjects equalize the spaciousness of a comparison model to that of a standard one. However, since spaciousness was found to be a complex construct compounded of several factors, a more thorough investigation of the relationship was attempted by utilizing the spaciousness - crampedness scale and by keeping the size of the models constant. For this purpose an experiment with a completely randomized 2 (toom proportion: square root two by one, and square root three by one) X2 (window size: three-bay, and continuous) X2 (window position: on short side, and on long side X3 (spaciousness factors: I, II and III) or 4 (crampedness factors: I, II, III and IV) was designed.

METHOD

Subjects

One hundred and twenty eight volunteer male students, staff members and tehcnicians from different departments of the University of

Strathclyde were used as subjects. The overall mean age for all subjects was 30.92 years, the range of the mean ages for the eight conditions being between 26.87 and 33.87 years. There were 16 subjects in each condition.

Stimuli

Two models were used as stimuli: 1) square root two by one, 2) square root three by one. They were equal in volume in all eight conditions. By using different wall panels, the size and position of windows were manipulated. The furniture layout was the same as that in the experiment reported in II.3.1.

Procedure

For each of the eight experimental conditions one of the models was placed in front of the windows of the conference room in the same position, so that in every condition of the experiment the view and the natural lighting would be similar.

The experiment was administered to each subject individually. After a short introduction, each subject was taken into the conference room, seated and given an "evaluation form". When the subject finished reading the form an effort was made to ensure that he fully understood the usage of the evaluative scales. Then the subject was asked to evaluate the model by looking through the aperture. Each experimental session lasted about 10 minutes.

RESULTS

The scoring procedure was the same as in the previous experiment: each of the subjects' evaluations on the 19 adjective pairs were converted into two different sets of numerical scores of 1 to 7, for spaciousness and crampedness. Then for each subject the mean scores of the adjective pairs for each of the three spaciousness and four crampedness factors were calculated. These two sets of scores were then used in the two separate ANOVAs for spaciousness and crampedness.

A. Spaciousness

The spaciousness data was analyzed by an ANOVA for 2 (room proportion) X2 (window size) X2 (window position) X3 (spaciousness factors) factorial designs with repeated measures on the latter variable. Table 4.7 summarizes the results of this analysis.

As is seen in Table 4.7, the only significant main effect was that of the spaciousness factors ($p < .005$). The interaction of spaciousness factors X window position, as well as that of spaciousness factors X window size X window position were also significant.

The mean values for the significant main effect of spaciousness factors were: 4.66, 4.55, and 4.93, for Factors I, II, III, respectively. On the whole, the models were evaluated relatively higher on the factor of space freedom as compared to the factors of appeal and planning which did not seem to differ significantly. For a more meaningful understanding of the relationship between the spaciousness factors and the other experimental variables, the interaction effects should be considered.

Figure 4.10 shows the interaction between window position and spaciousness factors. (The mean values for this interaction can be found in Appendix IV, Table 1.). As can be seen in Figure 4.10, when the windows were on the short side of the room, the spaciousness Factors I (appeal) and III (space freedom) received similar mean values (4.70 and 4.69, for appeal and space freedom factors, respectively), whereas

TABLE 4.7. SUMMARY TABLE FOR 'ANOVA' FOR EVALUATIONS OF THE MODEL INTERIORS AS A FUNCTION OF ROOM PROPORTION, WINDOW SIZE, WINDOW POSITION AND SPACIOUSNESS FACTORS.

Source	SS	DF	MS	F	P
A (Room proportion)	12501.25	1	12501.25	.63	-
B (Window size)	56235.96	1	56235.96	2.81	<.1
C (Window position)	6558.77	1	6558.77	.33	-
A X B	7659.44	1	7659.44	.38	-
A X C	1137.82	1	1137.82	.06	-
B X C	3202.82	1	3202.82	.16	-
A X B X C	15213.25	1	15213.25	.76	-
Error (between)	19998.14	120	19998.14		
F (Spaciousness factors)	106386.00	2	53193.13	6.89	<.005
A X F	821.26	2	410.63	.05	-
B X F	17518.30	2	8759.16	1.13	-
C X F	81205.50	2	40602.76	5.26	<.01
A X B X F	18966.50	2	9483.27	1.23	-
A X C X F	14092.30	2	7046.17	.91	-
B X C X F	47857.20	2	23928.60	3.10	<.05
A X B X C X F	12913.10	2	6456.53	.84	-
Error (within)	1853650.00	240	7723.54		
TOTAL	4655700.00	383	12155.86		

Factor II (planning) received a relatively lower value (4.59); however, separate t-test analysis indicated that none of the differences between these factors were significant when windows were on the short side.

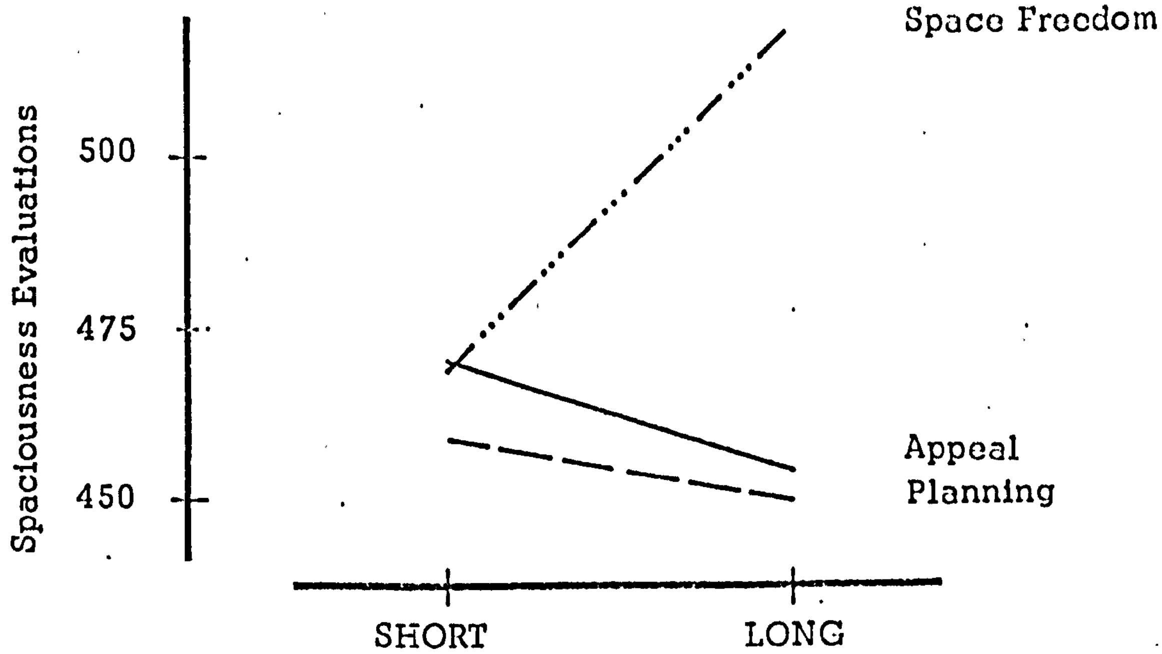


FIGURE 4.10. Window position X spaciousness factors interaction.

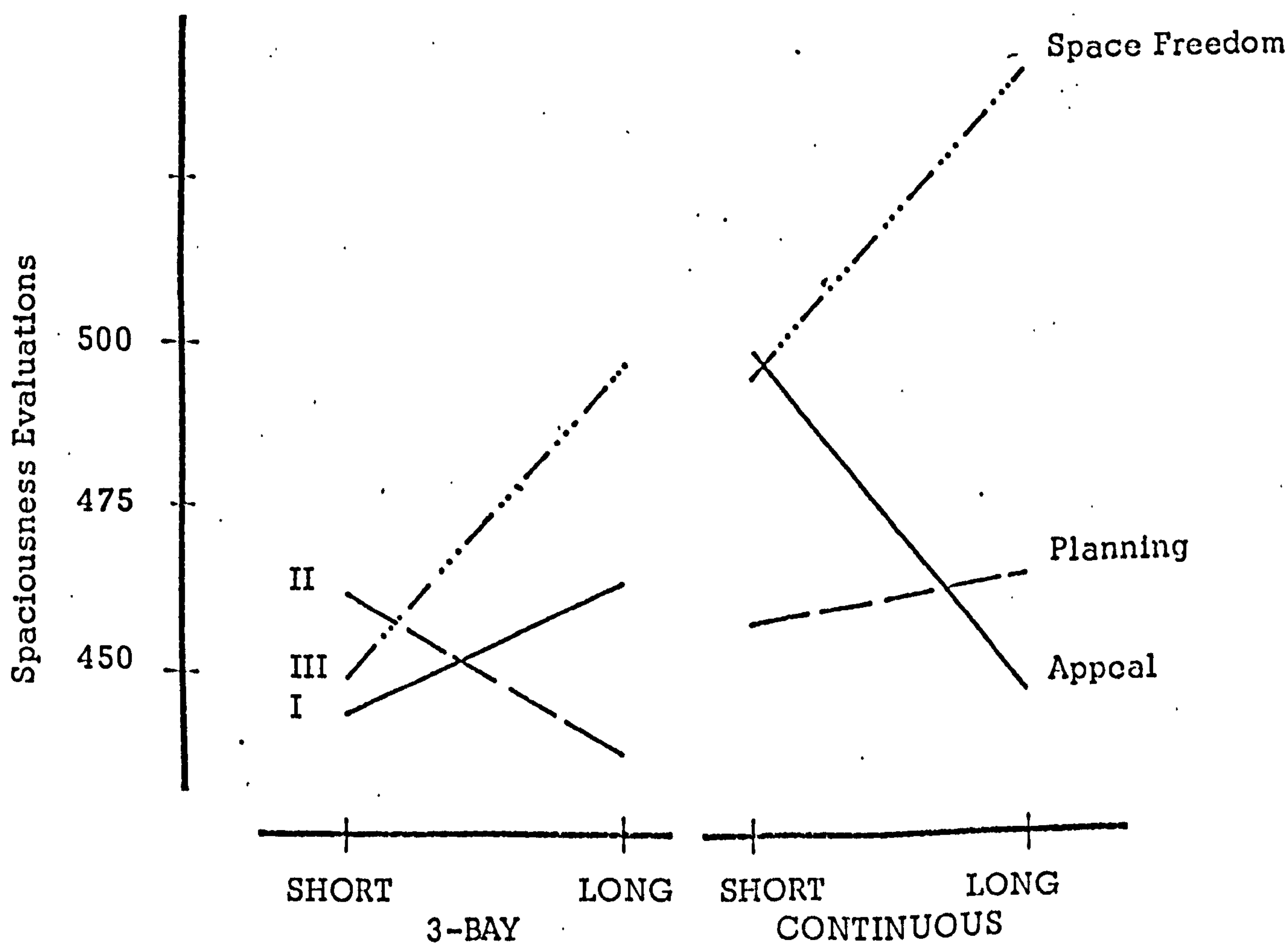


FIGURE 4.11. Window size X window position X spaciousness factors interaction.

On the other hand, when the windows were positioned on the long sides of the models, the means for both Factors I and II showed a slight tendency to decrease (4.55 and 4.50, for the appeal and planning factors, respectively); whereas that for Factor III received a sharp increase (5.18). A separate t-test comparing the mean values for Factor III when windows were on short - versus long - sides indicated this difference to be significant ($t=3.36$; $df=126$; $p<.01$). Further t-test analyses revealed that when the windows were on long sides, the means for both Factor I and Factor II differed significantly from that of Factor III ($t=3.62$; $df=126$; $p<.001$ and $t=3.66$; $df=126$; $p<.001$, respectively). Thus in general this window position X spaciousness factors interaction indicated that when windows were located on the short sides of the rooms, there were no significant differences between the spaciousness factors; on the other hand, when windows were placed on the long sides of the rooms, they were perceived as having much more space freedom without differing significantly as far as appeal and planning were concerned.

As can be seen in Table 4.7, this window position X spaciousness factors interaction was different for the two types of window size. Figure 4.11, shows this interaction in a graphical form. The mean values can be found in Appendix IV, Table 2. As is seen in Figure 4.11, the relationship between Factor III (space freedom) and the position of the window is in general in the same direction for both 3-bay and continuous windows; however, the absolute values differ depending on the size of the window. In other words, for both 3-bay and continuous window conditions the window's placed on the long side of a room rather than on short gives an increased feeling of space freedom, but the mean values are much greater for continuous window conditions, as compared to 3-bay ones. (It can be pointed out that the mean space freedom value for a 3-bay window placed on the long side (4.96) is about the same as that of a continuous window placed on shortside (4.89) .)

An examination of Figure 4.11 indicated that Factors I and II also seem to differ in relation to both Factor III and window position and size. In order to understand the significance of these relationships implied by Figure 4.11, six separate two-way (window position and a pair of spaciousness factors) ANOVAs were carried out in which the pairs of Factors II-III, I-III, and I-II were considered separately for 3-bay and continuous window conditions. Of these the ones that yielded significant results were summarized in AppendixIV, Tables 3, 4, 5. Table 3 in AppendixIV, indicated that for 3-bay window conditions Factors II and III interact with the position of the window ($F(1.62) = 6.83$, $p<.025$). In other words, when a 3-bay window is positioned on the short side of a room, then the room appears relatively better planned but with relatively less space freedom; whereas when it is located on the long side, then the room gives an enhanced feeling of space freedom but seems to be poorly planned. It should be noted that the room having a 3-bay window on the long side received the lowest mean value in absolute terms (mean =4.37) for planning factor. The analysis comparing Factor I (appeal) with others did not yield significant results for the two window positions in 3-bay window condition.

Table 4, in AppendixIV, shows that Factors II and III diffeed significantly from each other for continuous window conditions irrespective of window position ($F(1.62)=10.84$, $p<.005$). As can be seen in Figure 4.11, rooms with continuous windows in general were evaluated as giving more space freedom but as being relatively less well-planned.

Table 5, in AppendixIV, indicates that for rooms having continuous windows the mean values of Factors I and III in general differed, the former having a lower value than the latter ($F(1,62)=7.26$, $p<.01$); however, their interaction with window position indicated that this relationship was different for the two window positions ($F(1,62)=10.80$, $p<.005$). As can be seen in Figure 4.11, when continuous windows were placed on the short side of rooms Factors I and III received similar values, but when they were located on the long side, then the mean value for Factor III showed a sharp increase while that of Factor I decreased sharply. In other words, although the rooms having continuous windows on the long sides seemed to give a very high level of space freedom, they were evaluated as being quite unappealing.

It has been shown that the window position X factors interaction differed for the two window sizes. The two-way ANOVAs mentioned above did not allow a direct comparison of the effects of 3-bay windows with those of continuous ones. Therefore, six more two-way (window size X two spaciousness factors) ANOVAs were carried out separately for windows placed on short walls and long walls. Of these the ones that yielded significant effects were summarized in AppendixIV, Tables 6, 7, 8, and 9. As is indicated in Table 6 in AppendixIV, for the short wall condition spaciousness Factors I and II interacted with window size ($F(1,62)=4.45$, $p<.05$). Figure 4.11 reveals that this interaction is due to the differential mean values of FactorI. Specifically, when windows were placed on short walls, rooms having 3-bay windows seemes less appealing than those having continuous windows.

Table 7 in AppendixIV, summarizing the two-way ANOVA for Factors I and III and window size yielded a significant main effect for window size in short side condition ($F(1,62)=5.80$, $p<.025$). This main effect indicates that for both the appeal and space freedom factors, continuous windows were evaluated more positively than 3-bay windows when they were located on the short wall of the room. Thus it can be concluded that when placed on the short side of a room, continuous windows give more of a general feeling of spaciousness than 3-bay windows. This is due to the effects of appeal and space freedom factors since the planning factor did not vary significantly with window size with respect to short wall position.

Tables 8 and 9 in Appendix IV, show that for the long wall window position significant main effects were obtained for Factors II and III ($F(1,62)=17.29$, $p<.001$) and Factors I and III ($F(1,62)=14.65$, $p<.001$). These main effects indicated that for both 3-bay and continuous windows, rooms having windows on the long walls were evaluated as yielding a high feeling of space freedom but a low feeling of appeal and planning.

B. <u>Crampedness</u>

The crampedness data was analyzed by an ANOVA for 2 (room proportion) X2 (window size) X2 (window position) X4 (crampedness factors) factorial designs with repeated measures on the latter variable. Table 4.8 shows the results of this analysis.

As is seen in Table 4.8, the main effects of window size and crampedness factors reached significance. The mean values for the main effect of window size were 3.42, for 3-bay windows and 3.16 for continuous windows.* Thus in general the interiors with smaller windows were evaluated as being more cramped than the interiors with continuous windows. The mean values for the second main effect of crampedness factors were 3.54, 3.49, 2.79 and 3,32, for Factors

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* A higher numerical value implies an increased feeling of crampedness.

TABLE 4.8. SUMMARY TABLE FOR ANOVA FOR EVALUATIONS OF THE MODEL INTERIORS AS A FUNCTION OF ROOM PROPORTION WINDOW SIZE, WINDOW POSITION AND CRAMPEDNESS FACTORS

Source	SS	DF	MS	F	P
A(Room proportion)	11809.92	1	11809.92	.57	
B (Window size)	85155.48	1	85155.48	4.09	<.05
C (Window position)	21230.88	1	21230.88	1.02	-
A X B	12970.56	1	12970.56	.62	-
A X C	1879.61	1	1879.61	.09	-
B X C	10449.16	1	10449.16	.50	-
A X B X C	3195.00	1	3195.00	.15	-
Error (between)	2498020.00	120	20816.81		
F(crampedness factors)	447634.00	3	149211.33	16.14	<.001
A X F	3944.37	3	1314.79	.14	-
B X F	10765.10	3	3588.37	.39	-
C X F	107948.00	3	35982.80	3.89	<.01
A X B X F	35551.20	3	11850.40	1.28	-
A X C X F	21319.60	3	7106.55	.77	-
B X C X F	69920.00	3	23306.68	2.52	<.1
A X B X C X F	30286.20	3	10095.39	1.09	-
Error (within)	3328330.00	360	9245.36		
TOTAL	6700410.00	511	13112.34		

I, II, III, and IV, respectively. It seems that the clutteredness factor in general received a lower value than the other factors. The meaning of this main effect of crampedness factors becomes more clear when its interaction with window position is considered.

Figure 4.12 shows this window position X crampedness factors interaction. When the windows were on the short sides of the models the mean values for Factors I, II, III and IV were 3.49, 3.58, 3.08 and 3.25, respectively. The respective means for these four factors for the rooms with windows on the long sides were 3.60, 3.40, 2.51 and 3.38. In order to clarify the interpretation of this complex interaction, several two-way (window position and a pair of crampedness factors) ANOVAs were carried out considering only two factors at a time. Of these the analyses involving comparisons with Factor III yielded significant results which have been summarized in Tables 10, 11 and 12, in Appendix IV, for Factors III-IV, I-III, and II-III, respectively.

Table 10 in Appendix IV, indicated not only that Factor III in general was evaluated significantly differently than Factor IV, ($F(1,126)=15.75$, $p<.001$), but that this diffaence varied significantly depending on window position ($F(1,126)=7.47$, $p<.01$). An examination of Figure 4.12, reveals that the crampedness score for clutteredness factor was lower than that for appeal factor. Furthermore, when windows were on short sides the difference between these clutteredness and appeal factors was less than that observed when windows were on long sides.

Table 11 in Appendix IV, indicated a similar relationship between Factors I and III in that the crampedness score for Factor III was again lower than that for Factor I ($F(1,126)=34.25$, $p<.001$); and that their difference was less when windows were on short rather than on long sides ($F(1.126)=7.44$, $p<.01$).

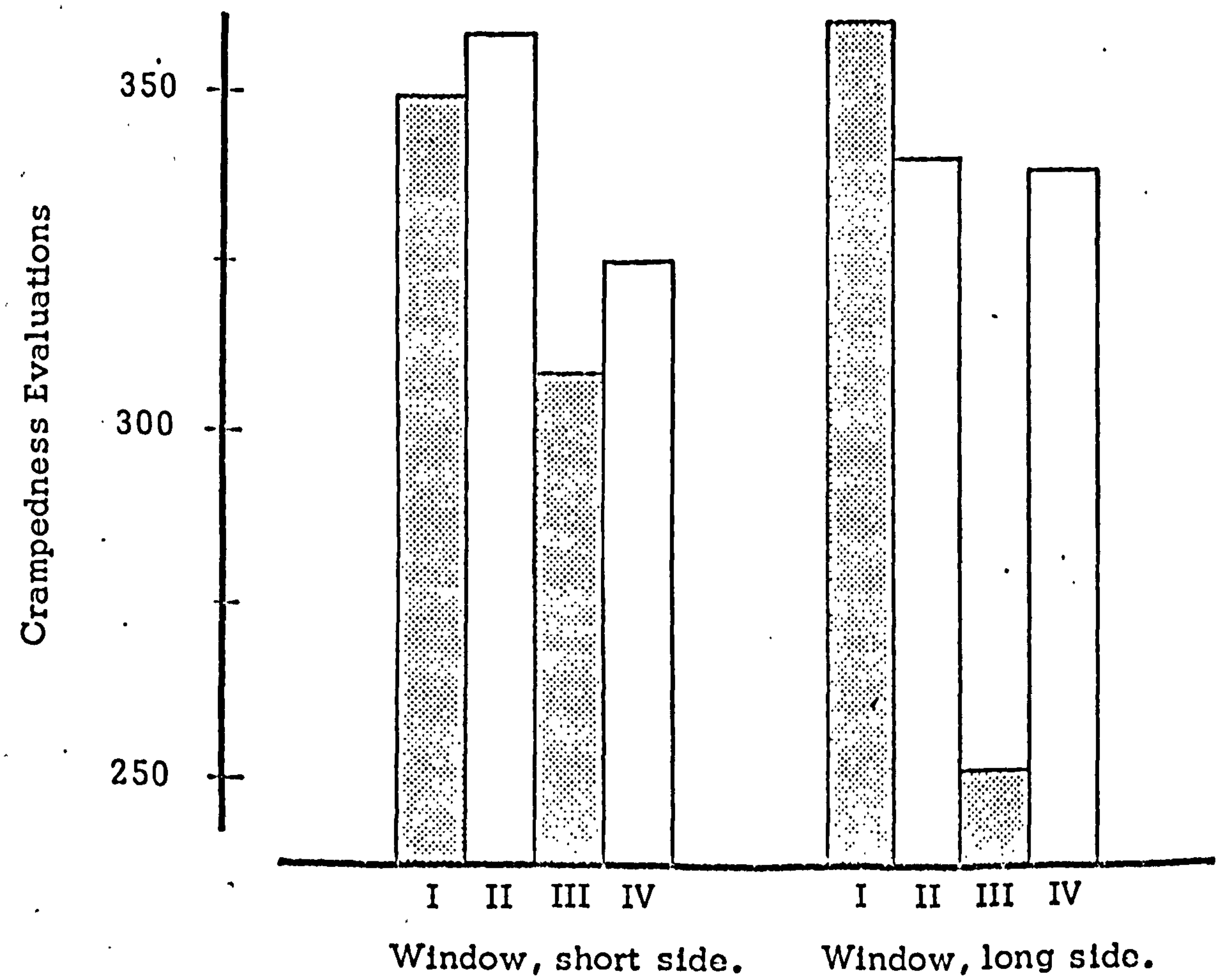

FIGURE 4.12. Window position X crampedness factors interaction.

Table 12 in Appendix IV, showed that the mean crampedness score of Factor III again differed from that of Factor II ($F(1,126)=75.60$, $p<.001$); and that this difference was less when windows were on short sides rather than on long ($F(1,126)=6.14$, $p<.025$). It should be noted, however, that as Figure 4.12 shows this interaction was due to the sharper decrease in the mean crampedness score of Factor III for the long side condition when compared to that of Factor II. The window position main effect was also significant for these Factors II and III ($F(1,126)=7.43$, $p<.01$); thus indicating that the overall mean crampedness scores for these size and clutteredness factors was relatively lower when windows were on long sides of the rooms rather than on short ones.

Results of 3-way ANOVAs for each crampedness factor:
The data for each crampedness factor was further analysed separately by four ANOVAs for 2 (room proportion) X2 (window size) X2 (window position) factorial designs. The results of these analyses indicated that window size mainly affected Factor II (size) ($F(1,120)=5.26$, $p<.025$; see Table 13 in Appendix IV); whereas window position affected Factor III (clutteredness) ($F(1,120)=12.33$, $p<.001$; see Table 14 in Appendix IV). None of the effects of these experimental variables, namely room proportion, window size and window position was significant for Factor I (planning). For Factor IV (appeal) the window size X window position interaction was significant ($F(1,120)=4.05$, $p<.05$; see Table 15 in Appendix IV). Specifically, a continuous window positioned on the short side is more appealing (mean=2.92) than one placed on the long side (mean=3.48); on the other hand, the effect of window position on 3-bay windows appears to be negligible (means = 3.59 and 3.29 for short and long sides respectively). Thus it is interesting to note that for crampedness evaluation of rooms, the size of the window mainly affects the perceived size component; its position has an effect on the feeling of clutteredness; whereas the

appeal factor is affected by neither of these variables alone but by their interaction.

DISCUSSION

For the sake of clarity, the results of the cpaciousness and crampedness analyses will be discussed separately followed by a general conclusion.

A. Spaciousness

The results indicated that (of the variables studied) the evaluation of interiors in terms of spaciousness factors was related mainly to window position and window size as is discussed below. In general (when window size was not taken into consideration) there were no significant differences between the spaciousness factors for rooms having their windows on the short sides; on the other hand, rooms having windows on the long sides were perceived as having a high degree of space freedom without differing significantly in terms of appeal and planning factors. Thus, it seems that when the size of window is not considered as a variable, then window position affects only the space freedom component of spaciousness. However, this effect differed for different window size:

a) Placement of 3-bay windows; on short versus long sides

Rooms having 3-bay windows on the long sides when compared to those having them on short, received higher evaluations on the space freedom factor but lower ones on the planning factor. The appeal factor did not change significantly.

b) Placement of continuous windows: on short versus long sides

Rooms having continuous windows on the long sides, when compared to those having them on the short, received a higher value on the space freedom factor but a lower one on the appeal factor. They did not differ on the planning factor. Thus, the placement of continuous windows on the short side seems to be a better solution since both the appeal factor and the space freedon factor received quite high values.

c) Placement on short side: 3-bay versus continuous windows

When positioned on the short side, rooms having continuous windows when compared to those having 3-bay ones, received higher values on both the appeal and space freedom factors; the planning factor did not vary significantly. Thus, it seems that when placed on the short side of a room, continuous windows give more of a general feeling of spaciousness than 3-bay windows.

d) Placement on long sides; 3-bay versus continuous windows

When located on the long side, interiors having continuous windows did not appear to vary significantly fom those having 3-bay windows, although there was a slight tendency for the former to receive slightly higher evaluations on the space freedom factor.

In general interiors having both 3-bay and continuous windows were evaluated as being quite high on space freedom factor but low on appeal and planning factors. Thus, in contrast to the conditions having windows on the short walls, those having them on the long sides did not provide an optimum solution for the three spaciousness factors to enable us to favour one window size over the other.

B. Crampedness

The results of the evaluation of interiors in terms of crampedness factors indicated window size and window position to be important; of these window size was a main effect and window position interacted with crampedness factors as is explained below.

Window Size

In general the interiors with the smaller 3-bay windows were evaluated as being more cramped than the interiors with continuous ones.

Window position

The position of the window seemed to affect only the clutteredness factor of crampedness which also differed significantly from the other three factors. When windows were located on the short walls, rather than on the long, the interiors appeared more cluttered. The other factors did not differ in relation to either window position or each other.

General Conclusion

In conclusion when the spaciousness and crampedness results are considered together, an interesting point that emerges is the fact that window size appeared as a main effect for evaluations of interiors in terms of the crampedness factors but not so for the spaciousness factors; for spaciousness evaluations not the window size main effect but its interaction with window position was significant. This is due to the difference in the structures of spaciousness and crampedness constructs. Window size affected the space freedom component of spaciousness strongly; however, this is just one of the three factors of spaciousness. In crampedness construct, on the other hand, this space freedom factor breaks up basically into the two factors of physical size and clutteredness, hence constitutes one half of the crampedness scale (see Section III.4). Consequently, what appears as an unsignificant tendency in spaciousness evaluations, emerges as a significant main effect of window size.

IV.5. EVALUATIONS OF 1/10 SCALE MODELS AS A FUNCTION OF ROOM PROPORTION, WINDOW SIZE AND SPACIOUSNESS-CRAMPEDNESS FACTORS

Of the three variables manipulated in the previous experiment (section IV.4.), namely, room proportion, window size and window position, only that of room proportion appeared unrelated to the evaluations of interiors in terms of spaciousness-crampedness factors. This is surprising in view of the findings of the experiment (section II.3.1.) reported in Part II which indicated a highly significant room proportion X window size interaction. Therefore, the present experiment was designed to explore the effect of room proportion and window size more thoroughly using a 3 (room proportion) X3 (window size) X3 (spaciousness factors) or 4 (crampedness factors) factorial design and keeping window position constant on the short side.

METHOD

Subjects

Sixteen volunteer male students, staff members and technicians from various departments of the University of Strathclyde were used as subjects in each of the 9 conditions of the experiment. (For the four conditions involving 3-bay and continuous windows on the short wall of root-2 and root-3 models the related data from the previous experiment, IV.4., was used.) The overall mean age for all subjects was 30.64 years, the range of the mean ages for the 9 conditions being between 26.56 and 34.73 years.

Stimuli

Three different 1/10 scale models with the architectural characteristics of the conference room were used as stimuli, namely, root-2 and root-3 models. All three models were equal in volume, had their windows on the same side (short side in root-2 and root-3), and had similar furniture layouts. Window size was manipulated by using wall panels with three different window widths; 2-bay, 3-bay or continuous. For more details about the models see Part II, experiment 3.1.

Procedure

One model at a time was placed in front of the windows of the conference room in a constant position, in an attempt to control the effects of view and natural lighting. The experiment was administered to each subject individually. The procedure was the same as in the previous experiments utilizing spaciousness-crampedness scales and models.

RESULTS

As before subjects' evaluations on the 19 adjective pairs were converted into two different sets of numerical scores of 1 to 7, for spaciousness and crampedness. Then for each subject the mean scores of the adjective pairs for each of the three spaciousness and four crampedness factors were calculated. These two sets of scores were then used in the two separate ANOVAs for spaciousness and crampedness.

A. Spaciousness

The spaciousness data was analyzed by an ANOVA for 3 (room proportion) X3 (window size) X3 (spaciousness factors) factorial designs with repeated measures on the latter variable. Table 4.9 summarizes the results of the analysis.

As can be seen in Table 4.9, the main effects of window size, spaciousness factors and the interaction between room proportion and spaciousness factors were significant. The mean values for the significant main effects of window size were 4.35, 4.61 and 4.94, for 2-bay, 3-bay and continuous windows, respectively. In other words, the rooms with continuous windows on the short side (on the average $4\frac{1}{3}$-bay in width) were perceived as the most spacious; and the rooms with 3-bay windows were perceived a little less spacious; and the interiors with the smallest 2-bay windows were seen as the least spacious. Thus in general the larger the windows the more spacious the interiors were perceived to be. Separate t-test analyses indicated that the difference between 2-bay and continuous windows ($t=3.29$, $df=94$, $p<.01$) as well as that between 3-bay and continuous windows ($t=2.03$, $df=94$, $p<.05$) were significant. The mean spaciousness evaluations of rooms having 2-bay windows did not differ from the evaluations of those with 3-bay windows.

TABLE 4.9 SUMMARY TABLE FOR 'ANOVA' FOR EVALUATIONS OF THE MODEL INTERIORS AS A FUNCTION OF ROOM PROPORTION WINDOW SIZE AND SPACIOUSNESS FACTORS

Source	SS	DF	MS	F	P
Between Subjects					
A (Rm. Prop.)	13.14613	2	6.57306	2.970	<.1
B (Wind. size)	25.51404	2	12.75702	5.766	<.005
AB	6.47439	4	1.61859	.731	-
S within gr.	298.67881	135	2.21243		
Within subjects					
C (Spa. fact.)	7.11779	2	3.55889	5.020	<.01
AC	7.25554	4	1.81388	2.558	<.05
BC	1.55763	4	.38940	.549	-
ABC	7.61947	8	.95243	1.343	-
C X S within gr.	191.39055	270	.70885		
TOTAL	558.75438	431			

The other significant main effect, namely the spaciousness factors received overall mean values of 4.52, 4.57 and 4.82 for Factors I, II and III, respectively. Thus the first two factors (appeal and planning) received similar values, while the third one (space freedom) received a higher overall mean. Figure 4.13 shows the interaction of these spaciousness factors with room proportion in histogram form.

As can be seen in Figure 4.13, the differences between the three spaciousness factors were much greater for the square model as compared to root-2 and root-3 models. For the square model condition Factor I received the lowest mean value (4.46), Factor III received the highest (5.18) with Factor II in between (4.80) . Hence the square model has been perceived as having a high level of space freedom, as being well planned but relatively less appealing. The root-2 model when compared to the square one received lower mean values for Factors III (4.80) and II (4.62) and a higher one for Factor I (4.67); however, of these differences only the former one was significant ($t=2.20$, $df=94$, $p<.05$). Thus in general square and root-2 models did not differ significantly as far as appeal and planning factors were concerned, but on the space freedom factor root-2 model received a lower value. Root-3 model in general was perceived as the least spacious one, the mean values being 4,44, 4.29 and 4.47, for Factors I, II and III, respectively. However, separate t-test analyses indicated that these mean values did not differ significantly from those of root-2 model; on the other hand, when compared to the square model the differences were significant both for Factor II ($t=2.04$, $df=94$, $p<.05$) and for Factor III ($t=3.84$, $df=94$, $p<.001$). In general, then the square, root-2 and root-3 models did not differ significantly as far as the appeal factor was concerned, in spite of a slight tendency for root-2 model to be more appealing. With regard to the planning and space freedom factors the square room was perceived as the best planned and as having the most space freedom, whereas root-3 model received the lowest evaluations.

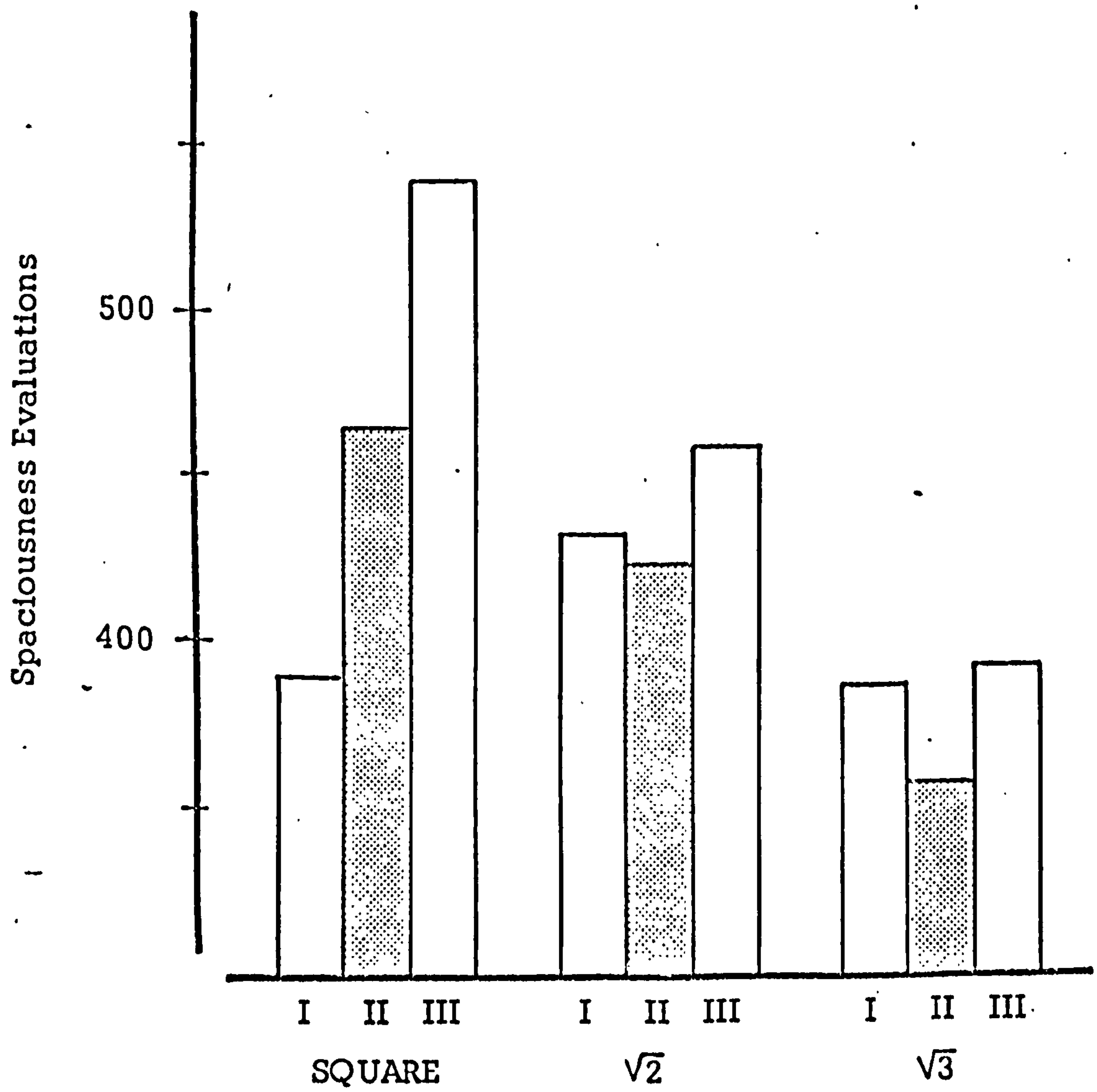

FIGURE 4.13. Room proportion X spaciousness factors interaction.

B. Crampedness

The differences between the 9 conditions of the experiment were analyzed by an ANOVA for 3 (room proportion) X3 (window size) X4 (crampedness factors) factorial designs with repeated measures on the latter variable. Table 4.10 summarizes the results of this analysis.

TABLE 4.10 SUMMARY TABLE FOR 'ANOVA' FOR EVALUATIONS OF THE MODELS AS A FUNCTION OF ROOM PROPORTION, WINDOW SIZE AND CRAMPEDNESS FACTORS

Source	SS	DF	MS	F	P
Between Subjects					
A (Rm. Prop.)	24.76	2	12.79	5.19	<.01
B (Wind. size)	25.58	2	12.38	5.36	<.01
A X B Rm. prop. X window size	7.24	4	1.81	.76	-
S within gr.	322.21	135	2.39		
Within Subjects					
C (crampedness factors)	29.07	3	9.69	11.64	<.001
A X C	10.19	6	1.70	2.04	<.1
B X C	4.07	6	.68	.81	-
A X B X C	16.86	12	1.41	1.69	-
C X S within gr.	337.27	405	.83		
TOTAL	777.26	575			

As is seen in Table 4.10, all of the three main effects (room proportion, window size and crampedness factors) were significant, whereas the interaction effects were not. The mean values for the significant main effect of room proportion were 3.10, 3.29 and 3.60 for the square, root-2 and root-3 models, respectively. These values indicated that the square room was evaluated as being the least cramped, the root-3 model as being the most cramped and the root-2 model was evaluated in between. Separate t-test analyses revealed that only the difference between the mean crampedness evaluations of square and root-3 models were significant ($t=2.98$, $df=94$, $p<.01$). Thus, it can be concluded that people feel more cramped in oblong rooms as compared to square ones.

The mean values for the second main effect of window size were 3.55, 3.39 and 3.05, for 2-bay, 3-bay and continuous windows, respectively. The rooms with the smallest windows were assessed as being the most cramped; rooms with the largest windows were seen as the least cramped. The crampedness evaluations of interiors with 3-bay windows, on the other hand, were more similar to that of the interiors with 2-bay windows. Separate t-test analyses indicated that the interiors with 3-bay windows, as well as those with 2-bay windows differed significantly from the ones with continuous windows with respect to their general crampedness evaluations ($t=2.24$, $df=94$, $p<.05$, and $t=2.99$, $df=94$, $p<.01$, respectively). The difference between the mean crampedness values of rooms with 2-bay and 3-bay windows was not significant. It seems that when the window runs from one end of the room to the other; people get less of a feeling of crampedness than they do in a room with a smaller window.

The overall mean scores for the main effect of crampedness factors were 3.49, 3.43, 2.95 and 3.44, respectively, for Factors I, II, III and IV. The planning, size and appeal factors received equally high mean crampedness values, while the clutteredness factor differed by receiving a comparatively low value.

DISCUSSION

The results of the spaciousness analysis indicated that a) interiors with continuous windows were seen more spacious than those with either a 2-bay or a 3-bay window; b) a square interior was evaluated higher on space freedom than the root-2 model; when compared to a root-3 room it was rated higher on both planning and space freedom factors. The spaciousness evaluations of root-2 and root-3 models did not differ significantly.

The crampedness results revealed that a) interiors with smaller (2-bay and 3-bay) windows were seen as being more cramped than the ones with continuous windows; b) a root-3 interior was seen as being more cramped than a square one.

On the basis of the results of this experiment in which window position was kept constant on the short side, it can be concluded that rooms with continuous windows are perceived as being more spacious than those with smaller (2-bay and 3-bay) windows; this effect was supported by crampedness results as well. With regards to room proportion, it was found that people feel generally more cramped in oblong (root-3) rooms as compared to square ones; in terms of spaciousness factors, square rooms were found as being better planned than root-3 ones and as having more space freedom than both root-2 and root-3.

IV.6. EVALUATIONS OF THE REAL ROOMS AS A FUNCTION OF THE OPEN VERSUS CLOSED CURTAINS, DAY VERSUS NIGHT-TIME AND SPACIOUSNESS-CRAMPEDNESS FACTORS

The pilot studies reported in Appendix II related to windows utilized open-closed curtains in real rooms. It was found that when the same subjects were evaluating different curtain conditions (repeated measures deisgn), they rated the same room with an open curtain as being significantly more spacious than with a closed curtain. But when different subject groups were assigned to different curtain conditions, there was not any significant curtain effect (see Appendix II). It must be remembered that the above mentioned pilot experiments were conducted in an early stage - before the development of the spaciousness-crampedness scale - at this point, the author wanted not only to check his early findings, but also to study the effects of curtains on spaciousness in a detailed way by the use of the spaciousness-crampedness scale.

Literature survey on perception of interiors did not indicate any relevant work on the effects of day versus night-time on space perception. Since people have to spend a considerably high proportion of their lives in buildings at night, any significant relationship in this area may be very important for architecture. For example, if the interiors are seen more spacious in day-time (as compared to night), spaces that will mainly be used during the night (theatre lobbies, lounges, night classrooms, etc.) must be designed to be more spacious as compared to the spaces that will only be used during the day-time and vise-versa. More important than the above mentioned reason, perhaps is the theoretical implication of the possible findings; if the interiors are perceived more spacious during the day (or night) - or/and in open (or closed) curtain conditions - which factors will be responsible; the view, the light levels during the respectable conditions, the differences between the artificial and natural light qualities, or some psychological variables? These questions may lead to further studies and a better understanding of the role of windows in architecture.

In order to study the effects of (open versus closed) curtains, and section of a day (day versus night-time) on spaciousness, a completely randomized 2 (curtain conditions: open and closed) X2 (section of a day: day and night-time) X3 (spaciousness factors: I, II and III) or 4 (crampedness factors: I, II, III and IV) experiment was designed.

METHOD

Subjects

Sixty male students from various departments of the University of Strathclyde were used as subjects. The overall mean age for all subjects was 21.15 years, the range of the mean ages for the four conditions being between 20.53 and 22.06 years. There were 15 subjects in each condition. None of the subjects had been in the room before.

Stimuli

A 4.50X6.10m rectangular room with a 3.15m ceiling height was used as stimuli. (It was the same room used for the Pilot study I and II, reported in Appendix II, then with a different colour scheme, furniture quality and layout) The room was located on the second floor of one of the University buildings. One of the long sides of the room had a complete window wall, looking West, on to a small portion of Glasgow cityscape and to a 22 x 24m paved courtyard on the same level. The room was furnished as a lounge, with high quality, brown upholstered soft chairs, brown formica coffee tables and a coffee/tea maker. The layout of the room can be seen in Figure 4.14.

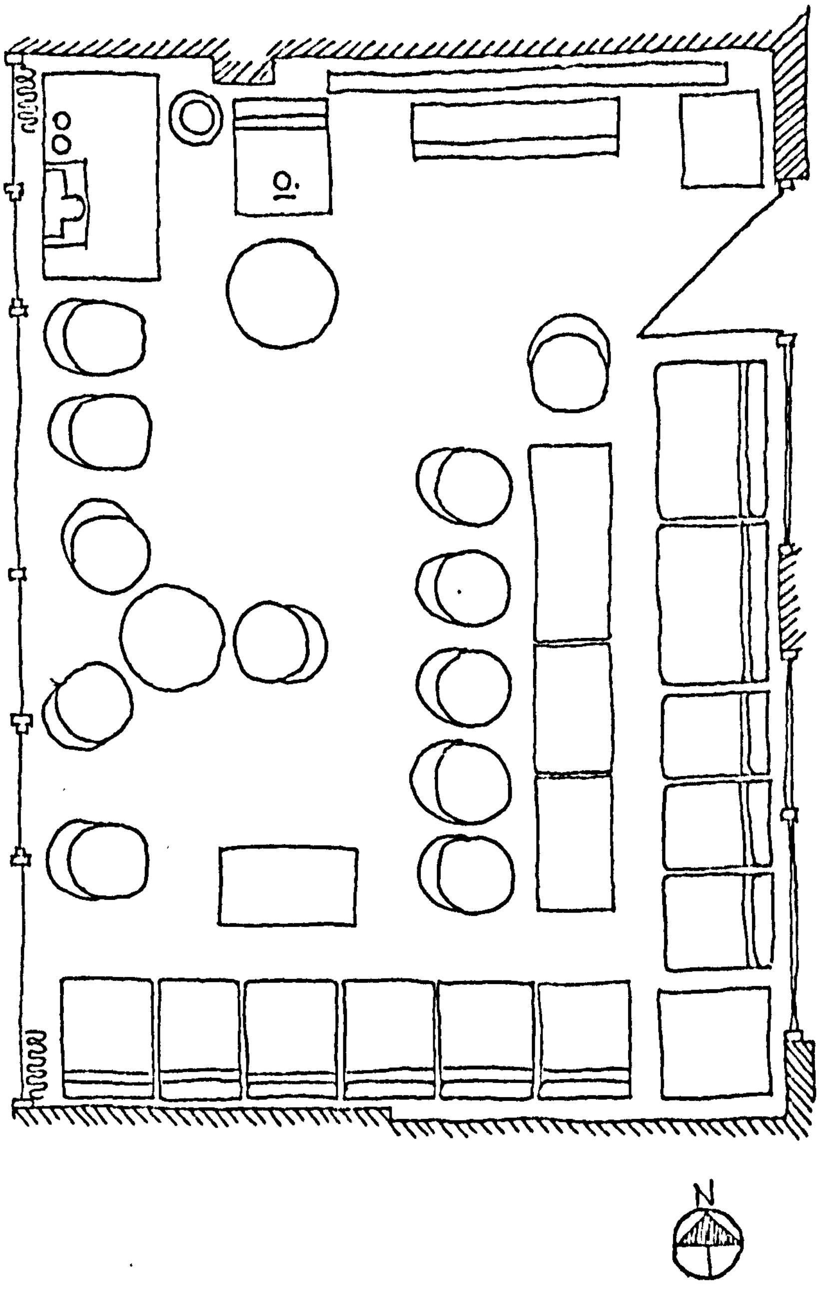

FIGURE. 4.14. Plan of the postgraduate lounge.

It had a wall-to-wall gold coloured carpet, the ceiling was painted white (BS:4800, 22 B 15, Dolomite White), three walls cactus yellow (BS:4400, Cactus). The window wall had a two-piece floor to ceiling thick, grey curtain. Four fluorescent lighting fixtures on the ceiling were kept on in all experimental conditions.

Procedure

The experiment was administered to each subject individually. After ensuring that the subject had not been in the room before, he was taken into the room, seated on the observation chair and given an "evaluation form". When the subject finished reading the given form, an effort was made to ensure that he fully understood the usage of the evaluative scales. Then the room was described as a lounge for about 18-20 postgraduate students, and the subject was asked to evaluate it. Each experimental session lasted about 8 minutes.

The experiment was conducted in February; the day-time conditions were administered between 10.30 a.m. and 1.30 p.m., on sunny days. The subject could see the sunny surfaces of one of the sides and the pavement of the courtyard and distant buildings. The experiment was stopped when the sunshine reached the window wall of the lounge. The night-time conditions, on the other hand, were carried out between 6.30 and 9.30 p.m., in darkness.

RESULTS

Each of the subject's evaluations on the 9 adjective pairs were converted into two different sets of numerical scores of 1 to 7, for spaciousness and crampedness. Then for each subject the mean scores of the adjective pairs for each of the three spaciousness and four crampedness factors were calculated. These two sets of scores were then used in the two separate analysis of variance for spaciousness and crampedness.

A. Spaciousness

The mean scores of the 3 spaciousness factors in each of the four conditions of the experiment are given in AppendixIV., Table 16. The differences between these conditions were analyzed by a three-way analysis of variance for factorial designs with repeated measures on one factor. The results of this analysis are shown in Table 4.11.

TABLE 4.11. SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR EVALUATIONS OF THE POSTGRADUATE LOUNGE AS A FUNCTION OF OPEN-CLOSED CURTAINS, DAY-NIGHT AND SPACIOUSNESS FACTORS

Source	SS	DF	MS	F	P
A (day v night)	11874.69	1	11874.69	.89	-
B (open/closed curtain)	8569.80	1	8569.80	.64	-
A X B	77.36	1	77.36	.01	-
Error (between)	748467.00	6	13365.48		
F (spaciousness factor)	1129640.00	2	564819.00	105.72	$<.001$
A X F	489.00	2	244.91	.05	-
B X F	4168540	2	20842.72	3.90	$<.025$
A X B X F	5887.21	2	2943.61	.55	-
Error (within)	598347.00	112	5342.38		
Residual	3051.76	0	0.00		
TOTAL	2545040.00	179	14218.08		

As is seen in Table 4.11, neither the effect of curtains, nor the period of a day were significant. The only significant main effect was that of the spaciousness factors ($p<.001$). The interaction between spaciousness factors and (open versus closed) curtain conditions were also significant ($p < .025$).

The mean values for the significant main effect of spaciousness factors were: 5.61, 4.67 and 3.67 for Factors I, II and III, respectively. In general, the room was evaluated high on appeal, low on space freedom factors; the planning factor received a value in between.

As for the significant interaction between spaciousness factors X curtain position, the mean values for the Factors I, II, III were: 5.47, 4.83, 3.86 and 4.76, 4.50, 3.49 for the open and closed curtain conditions, respectively. In other words, regardless of the time of the day, the room with closed curtains seemed to be perceived relatively more appealing, but less well-planned and having less space freedom in comparison with open curtains. However, the results of the separate t-test analyses for the differences between open and closed cutain conditions indicated that none of the three spaciousness factors varied significantly.

B. <u>Crampedness</u>

The mean scores for the crampedness factors in each of the four conditions of the experiment are given in AppendixIV, Table 17. The differences between these conditions were analyzed by a three-way analysis of variance for factorial designs with repeated measures, the results of which was summarized in Table 4.12.

As can be seen in Table 4.12, neither the effects of cuttain position, nor the part of the day were significant; whereas the crampedness factors and their interaction with curtain position were ($p < .001$ and $p < .05$, respectively). The mean values for the significant main effect of crampedness factors were: 3.26, 4.47, 4.27 and 2.34 for Factors I, II, III and IV, respectively. Thus, planning and appeal factors received lower values in general, while the clutteredness and physical size received higher ones.

TABLE 4.12. SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR EVALUATIONS OF THE POSTGRADUATE LOUNGE AS A FUNCTION OF OPEN - CLOSED CURTAINS, DAY-NIGHT, AND CRAMPEDNESS FACTORS

Source	SS	DF	MS	F	P
A (day v night)	18709.00	1	18709.00	1.06	-
B (open/closed curt.)	7560.04	1	7560.04	.43	-
A X B	57.04	1	57.04	.00	-
Error (between)	989011.00	56	17660.92		
F (crampedness factor)	1751090.00	3	583697.00	82.00	<.001
A X F	20713.13	3	6904.12	.97	-
B X F	60706.90	3	20235.64	2.84	<.05
A X B X F	25157.80	3	8385.93	1.18	-
Error (within)	119585.00	168	7118.18		
Residual	6103.52	0	0.00		
TOTAL	4068860.00	239	17024.52		

As forthe significant interaction effect, the mean values for open curtain conditions were: 3.11, 4.36, 4.09 and 2.55; for the closed curtain conditions these values were: 3.41, 4.59, 4.45 and 2.12, for the crampedness Factors I, II, III and IV, respectively. In other words, regardless of the time of day, there was a tendency to see the room with closed curtains more appealing, but cluttered, smaller in size, and not so well-planned as compared to thesame toom with open curtains. Separate t-test analysis indicated that although the differences between the mean values of the appeal factor was approaching significance level ($t=1.98$, $df=58$, $p<.1$, open versus closed curtain), none of the four crampedness factors varied significantly between open versus closed curtain conditions.

DISCUSSION

The results of the spaciousness and crampedness analyses were similar to each other, and indicated that neither the curtain position, nor the time of day had a direct significant effect on the spaciousness-crampedness evaluations of the interior. However, curtain position in interaction with the spaciousness (or crampedness) factors affected these evaluations. Although differences between open and closed curtain conditions for the individual factors were not statistically significant, the room with the closed curtains was percevied more appealing as compared to the open curtains; all other factors (planning and space freedom of spaciousness; and planning, physical size, and clutteredness of crampedness) received more favourable values in open curtain conditions. The relatively low score of the appeal factor in open curtain condition, which is mainly responsible for this interaction can, perhaps, be attributed to the content of the view of the particular interior: a courtyard surrounded by a two-storey building, concrete paving, and in distance a portion of Glasgow cityscape. Whether a more pleasant view would affect the score of the appeal factor on a positive direction, hence causing an unsignificant interaction effect or not, is difficult to answer within the framework of the present experiment.

It seems that the spaciousness of an interior is not affected by the time of the day; whether it is seen during the day or night time, people percieve it similarly. In other words, the change in the quality and/or amount of light does not seem to affect the spaciousness-crampedness evaluations of a room. The same is true for the curtain conditions as well, whether the curtains are kept open or closed, people perceive the room equal in spaciousness. These two findings are quite valuable for the general understanding of the construct of spaciousness for, they suggest that the spaciousness of a room is not dependent on temporary variations in a room. Interestingly, the results of the Pilot Studies I, III, and IV, on windows suggested similar characteristics for spaciousness: having a sunny or a cloudy view-out did not affect this construct, neither did the open versus closed curtains.

IV.7. SPACIOUSNESS-CRAMPEDNESS EVALUATION OF A REAL ROOM BY TWO DIFFERENT SUBJECT GROUPS: USERS AND NON-USERS

In architectural psychology a number of surveys and building appraisals investigated how people think about; use, modify the buildings an spaces; how other economical, social and psychological aspects influence this usage (BPRU 1970, Peled 1974, Lee 1974). This issue is a very complicated one because, the buildings - spaces - and people are in continuous interaction. The needs of people change, their attitudes, beliefs, change; the institutions change, and these changes reflect in building usage.

Leaving the above mentioned complicated issue aside, the present author attempted to examine the user - non-user differences in his area of study. A two-way experimental design was deviced to explore the differences between the spaciousness-crampedness evaluations of a group of people who used a room for a period of time, and those who had not been in the same room before.

METHOD

Subjects

Altogether 30 male students were used as subjects. The data for the 'non-users' were taken from the 'open-curtain, day-time' condition of the previous experiment (experiment IV.6.). The mean age for this 'non-users' group was 22.06 years with a range of 18 and 33 years. The other group, users, of the room were postgraduate (Master of Business Administration) students of Business Administration Department of the University of Strathclyde. These students had been using the room as their lounge for the last 5 months. No other students were allowed to share the room and facilities it provided. Of the 22 postgraduates, only 15 were used as subjects; two of the remaining users were females, 5 were non-British citizens. The mean age for the 15 'users' was 30.06 years with a range of 22 to 39 years.

Stimuli

The stimuli was the same as in the previous experiment. See experiment IV.6., for the description and the layout of the interior. The curtains were open, the view was sunny in both of the conditions.

Procedure

The procedure for the 'non-users' was described in the previous experiment (IV.6.). For the 'users' it was different: the room was evaluated while it was in use. After a short introduction each subject was given an evaluation form, upon ensuring that he understood how to use the scales, he was asked to evaluate the interior while he and some of his other postgraduate classmates were actually using the room (reading, having coffee or tea, talking). There was not fixed observaiton point for the subjects, each one evaluated the room where he chose to sit down. The experiment was carried out between 10.30 a.m and 1.30 p.m.

RESULTS

The scoring procedure was the same as in the previous experiment: each of the subject's evaluations on the 19 adjective pairs were converted into two different sets of numerical scors of 1 to 7, for spaciousness and crampedness. Then for each subject the mean scores of the adjective pairs for each of the three spaciousness and four crampedness factors were calculated. These two sets of scores were then used in the two separate analysis of variance for spaciousness and crampedness.

A. Spaciousness

The spaciousness data was analyzed by a two-way factorial design with repeated measures on one variable. Table 4.13 summarizes the results of this analysis.

TABLE 4.13. SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR SPACIOUSNESS EVALUATIONS OF THE POSTGRADUATE LOUNGE BY TWO DIFFERENT GROUPS OF SUBJECTS: USERS AND NON-USERS

Source	SS	DF	MS	F	P
Between Subjects	71.49	29	-	-	-
Conditions	13.74	1	13.74	6.66	$p<.025$
Error (between)	57.75	28	2.06	-	-
Within Subjects	75.11	60	-	-	-
Factors (Spac)	41.59	2	20.795	35.06	$p<.001$
Factors X cond.	.31	2	.15	.27	-
Error(within)	33.21	56	.59313	-	-
TOTAL	146.60	89			

As is seen in Table 4.13, both of the main effects (conditions and spaciousness factors) were significant, whereas that of their interaction was not. The mean scores of the spaciousness Factors I, II and III were 5.40, 4.67 and 3.86 for the non-users and 4.78, 3.81 and 2.99 for the users, respectively. Thus, subjects who did not know the room seemed to evaluate it more positively in all three spaciousness factors as compared to those who use it. Separate t-test analyses indicated that the differences between the evaluations of the two groups of subjects were significant for planning ($t=3.90$, $df=28$, $p<.001$) and space freedom ($t=2.76$, $df=28$, $p<.01$) factors, whereas that of the appeal factor was not.

The mean value for the significant main effect of spaciousness factors were: 5.09, 4.24, and 3.43, for Factors I, II and III, respectively. On the whole, the interior was evaluated high on appeal, low on space freedom; the planning factor, on the other hand, received a value in between.

B. Crampedness

The differences between the evaluations of the two groups of subjects were analyzed, again by a two-way analysis of variance for factorial designs with repeated measures on one factor. Table 4.14 summarizes the results of this analysis.

TABLE 4.14 SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR CRAMPEDNESS EVALUATIONS OF THE POSTGRADUATE LOUNGE BY TWO DIFFERENT GROUPS OF SUBJECTS: USERS AND NON-USERS

Source	SS	DF	MS	F	P
Between Subjects	29	-	-	-	-
Conditions	1	16.27		7.95	p<.01
Error (between)	28	2.05		-	-
Within Subjects	90	-	-	-	-
Factors (Cramp.)	3	21.87		24.97	p<.001
Factors X cond.	3	.14		.17	-
Error (within)	84	.88		-	-
TOTAL	119	-	-	-	-

As can be seen in Table 4.14, both of the main effects were significant, whereas their interaction was not. The mean values for the crampedness Factors I, II, III and IV were 3.28, 4.13, 4.39 and 2.64 for non-users, and 4.08, 4.84, 5.26 and 3.20 for users of the room, respectively. In other words, the postgraduate students perceived their lounge as more cramped in general. Separate t-test analyses indicated that the physical size and clutteredness factors differed significantly for two different groups ($t=2.28$, $df=28$, $p<.05$, and $t=2.27$, $df=28$, $p<.05$, for size and clutteredness factors, respectively) whereas, the appeal and planning factors did not.

The mean scores for the other significant main effect of crampedness factors were: 3.68, 4.54, 4.82 and 2.92, for Factors I, II, III and IV, respectively. In general, the lounge was evaluated high on clutteredness and physical size, low on appeal factors, that is, it was perceived cluttered and small in size, but appealing.

DISCUSSION

The results of the spaciousness evaluations showed that the postgraduate students who had been using the room as their lounge for the last 5 months, evaluated it as being less well-planned and having less space freedom as compared to those who did not know the room.

As for the crampedness factors, again the users perceived their lounge more cluttered and smaller in size as compared to the other group.

It seems that using and sharing a lounge of this size with 18-20 people is different than just "imagining" it to be used in that way. Among some social aspects there may be a number of other reasons; a) getting used to the interior, b) knowing their own needs and requirements, the type and the nature of the activities in the particular section of time, and perhaps, c) attitude to the institution and the particular social group.

IV.8. EVALUATIONS OF INTERIORS AS A FUNCTION OF THE TYPES OF ACTIVITY CARRIED ON(PERSONAL-INTIMATE, SOCIAL, PUBLIC) AND SPACIOUSNESS-CRAMPEDNESS FACTORS

Experiments reported in Section II.2.1 and II.2.2 studied the relationship between different types of activities and desirable degree of spaciousness in detail. It was found out that people wanted to carry out personal-intimate, social and public activities in interiors with different levels of spaciousness. Even if the number of people involved in each one of these activities is kept the same, people still think that most spacious interiors are more suitable for public activities; spacious interiors for social ones; and more confined rooms for personal-intimate activities. Starting from the above mentioned findings, one may hypothesize that the interiors of comperative sizes allocated for public, social and personal-intimate activities to be evaluated differently on spaciousness-crampedness scale, provided that their physical dimensions and general architectural characters are not dramatically different: specifically, one may expect the interiors allocated for public activities to be perceived as being the least spacious, while the rooms for personal-intimate activities the most; the interiors for social activities, on the other hand, can be expected to be perceived in between.

In order to study the above mentioned hypothesis three rooms were selected: a staff-student common room; a postgraduate students' lounge; and finally a private office room to represent the interiors for public, social, and personal-intimate activities, respectively. All three interiors were in the same building, on the same floor, had equal ceiling heights and were designed by the same architect.

METHOD

Subjects

There were 15 male students in each of the three conditions of the experiment. The subjects for the "office" and the "common room" were taken from various departments of the University of Strathclyde; the respectible mean ages for these two groups being 19.66 and 28.26 years. All the subjects for the "lounge" condition, on the other hand, were postgraduate male students from the same department (Business Administration - MSc class). (See experiment IV.7. for more information for this group of subjects.) The mean age for this latter group was 30.06 years.

Stimuli

Three different rooms were used as stimuli: i) a private office room, ii) a lounge for postgraduate students, and iii) a staff-student common room. Of these, the lounge was described in Experiment IV.6, hence, only the other two interiors will be discussed here:

i) The office was a 2.87 x 5.35 m rectangular room (The same room was used as the standard, in Pilot Study III, reported in Appendix II.) It had a complete window wall on one of its short sides, looking East, giving a view of a Univeristy tower block and some other buildings. The colour scheme of the room was the same as in the lounge; gold coloured wall-to-wall carpeting, cactus yellow walls, white ceiling, grey curtains (see experiment IV.6.). It was furnished as an office for a university lecturer; had 6 aluminium tubular, upholstered charcoal coloured chairs, 2 brown desks, 3 metallic colour filing cabinets and 2 portable closets. For the layout of the office room see Figure 4.15.

iii) Although called "staff-student common room" the third room was used mainly by the students from various departments of the University. It was a kind of a 'multi-purpose' interior; people could have soft

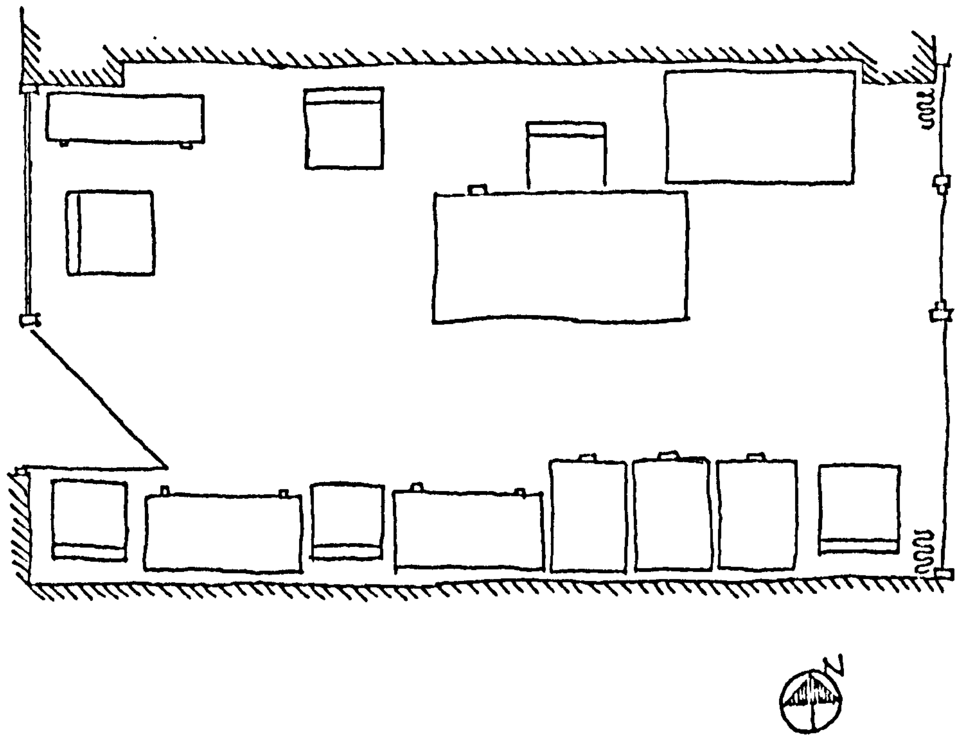

FIGURE 4.15. Plan of the office room.

drinks (there was a vending machine outside), talk to each other, read newspapers, study, date, etc. It was in constant use during the day and night.

The room was 4.85 x 11.00 m in size. A 50cm wide, continuous band window was located high on the South wall of the room and did not allow any outside view. The floor was covered with 50 x 50cm dark red carpet tiles. The ceiling was painted white (BS 4800, 22 B 15, Dolomite White), three of the walls were blue (18 E 69, Astral Blue), the fourth wall was screened by a floor to ceiling curtain of brown, red, orange compositions. The room was furnished with 24 60 x 70cm plastic covered seats, 5 coffee tables, 2 brown desks and 4 chairs (see Figure 4.16 for the layout). The quality of the furniture was lower as compared to the lounge and the office room.

All three rooms were located on the same floor and had the same ceiling height: 3.15m. The office was 15.35 sq.m., the lounge 27.45 and the common room 53.35 sq.m., in floor area.

Procedure

The procedure for the office room was the same as in the experiment IV.6.: the experiment was administered individually. Each subject was taken into the office, seated on the observation chair, given an evaluation form. Upon ensuring that he understood how to use the scales, he was asked to evaluate the interior. The room was said to be used by a lecturer for preparing lectures, meeting students, his friends, etc. There was nobody in the room other than the subject and the experimenter.

The procedure for the other two rooms was slightly different; both the lounge and the common room were evaluated by the subjects who were actually using the room in the presence of some other students. The

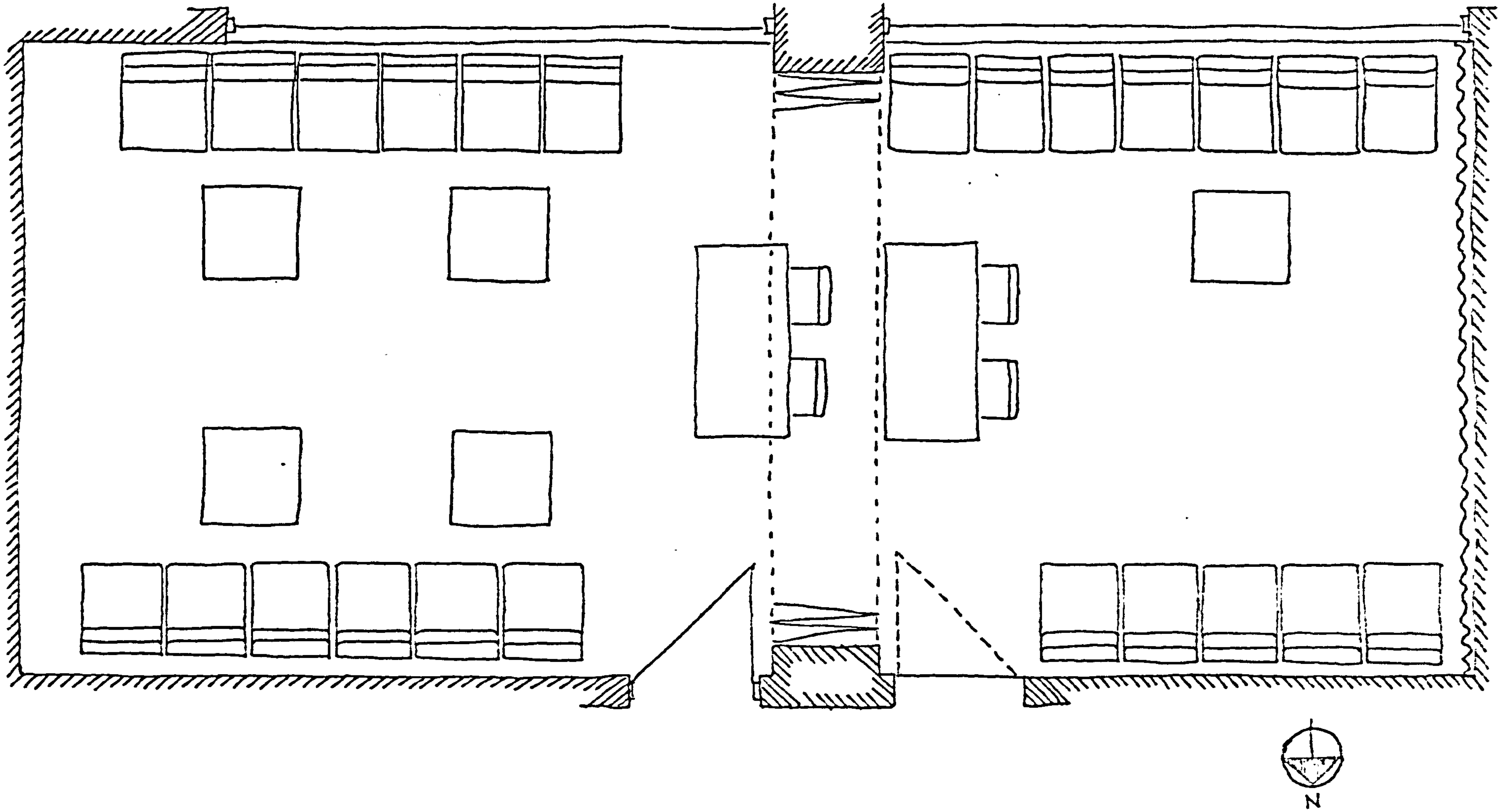

FIGURE 4.16. Plan of the staff-student common room.

experiment was carried out on sunny days, between 10.30 a.m. and 1.30 p.m.

RESULTS

As it was in the previous experiments, each of the subject's evaluations on the 19 adjective pairs were converted into two different sets of numerical scores of 1 to 7 for spaciousness and crampedness. Then for each subject, the mean scores of the adjective pairs for each of the three spaciousness and four crampedness factors were calculated. These two sets of scores were then used in the two seperate analysis of variance for spaciousness and crampedness.

A. Spaciousness

The spaciousness data was analyzed by a 3(room-activity types) X3 (spaciousness factors I, II, III) factorial design with repeated measures on one variable. Table 4.15, summerizes the results of this analysis.

As is seen in Table 4.15, both of the main effects as well as their interaction were significant. The overall spaciousness evaluation for the office room was 4.65, for the lounge 3.86, and for the common room 3.40. Thus, in general, the office room was perceived as the most spacious, and the common room the least.

The mean values for the other significant main effect of spaciousness factors were 4.57, 3.93 and 3.40 for factors I, II, and III, respectively. On the whole, the interiors were evaluated high on appeal, low on space freedom; the planning factor received a value in between.

Figure 4.17. shows the interaction between the room types and the spaciousness factors. The mean values of the spaciousness factors

TABLE 4.15. SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR SPACIOUSNESS EVALUATIONS OF THE OFFICE ROOM, POSTGRADUATE LOUNGE AND STAFF-STUDENT COMMON ROOM.

Source	SS	DF	MS	F	P
Between Subjects	135.27	44	-	-	-
Conditions	36.30	2	18.15	7.70	p<.005
Error (between)	98.97	42	2.35	-	-
Within Subjects	95.04	90	-	-	-
Factors (Spac.)	30.99	2	15.49	24.39	p<.001
Factors X con.	10.67	4	2.67	3.71	p<.01
Error (within)	53.38	84	.63	-	-
TOTAL	230.31	134	-	-	-

I, II and III were: 4.73, 4.86 and 4.37 for the office room, 4.78, 3.81 and 2.99 for the postgraduate lounge, and 4.21, 3.13 and 2.85 for the staff-student common room, respectively. As can be seen in Figure 4.17, the values of the appeal and planning factors for the office room were very similar (4.73 and 4.86, respectively); the space freedom factor received a relatively low value (4.37). The evaluation of the lounge on appeal factor was not different from that of the office room, but planning and space freedom factors sharply decreased. Separate t-test analyses indicated these differences to be significant ($t=2.74$, $df=28$, $p<.02$, for the planning and $t=4.12$, $df=28$, $p<.001$ for the space freedom factors). In other words, the lounge was perceived as being less well-planned and having much less space freedom as compared to the office room.

The staff-student common room, on the other hand, received the low-

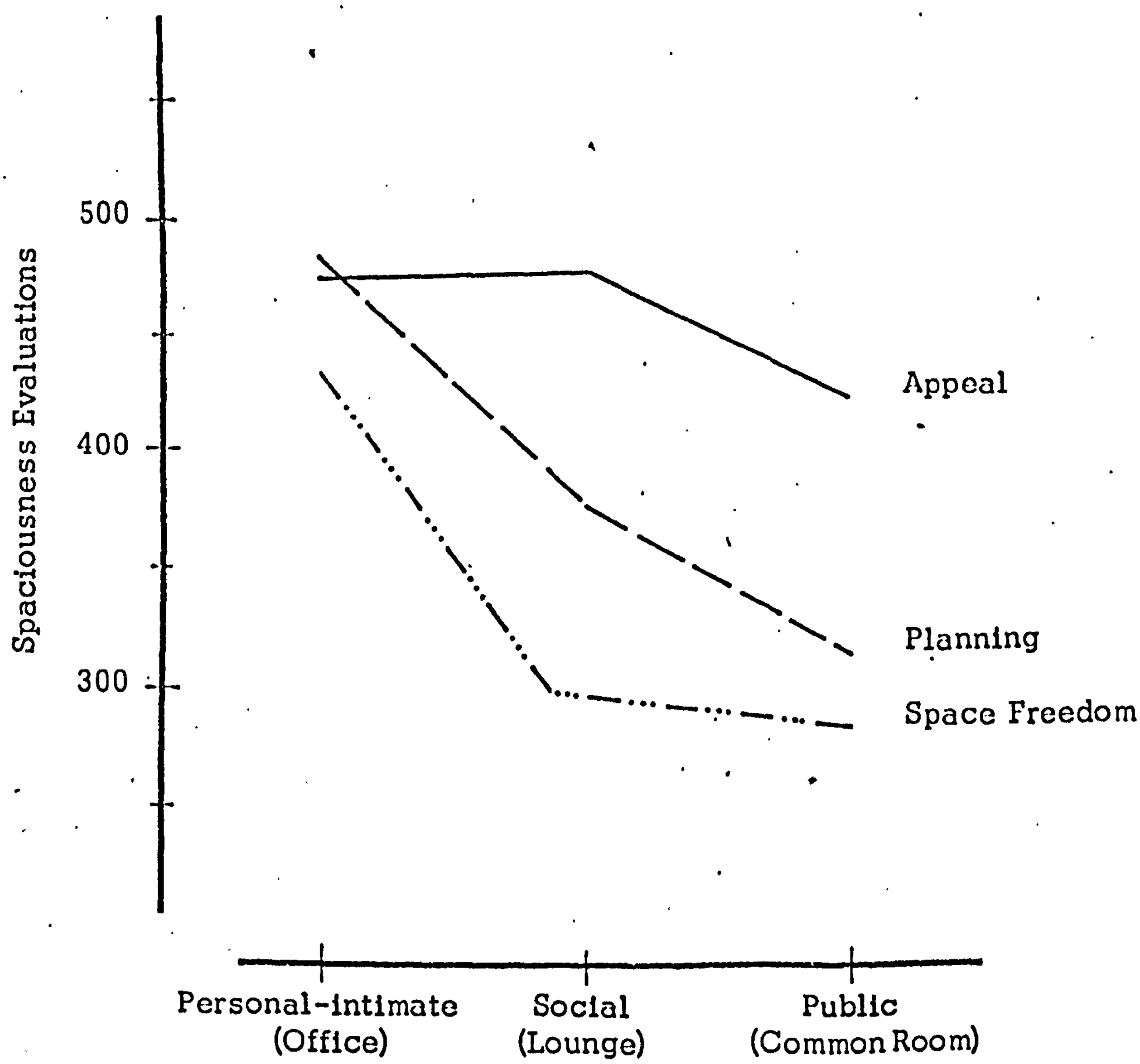

Figure 4.17. Activity (room) types X spaciousness factors interaction.

est scores on each of the three spaciousness factors, but separate t-test analyses applied to the differences indicated that none of these low scores differed significantly from that of the lounge. The difference between the appeal factor of the common room and that of the office did not reach significance level either; but the other two factors (planning and space freedom) were significantly different for the office and the common room conditions.

Thus, although the common room was perceived a little less appealing than the other two interiors, the appeal factor did not differ significantly for any room conditions. There were no significant differences between the lounge and the common room; but the office room was evaluated as being significantly better planned and having significantly more space freedom than both the lounge and the common room.

B Crampedness

The crampedness data was analyzed by a 3(room types) X4 (crampedness factors) factorial designs with repeated measures on the latter variable. Table 4.16 summerizes the results of this analysis.

As can be seen in Table 4.16, both of the main effects as well as their interaction were significant. The overall crampedness evaluation for the office, the lounge, and the common room were 3.45, 4.35 and 4.69, respectively. In other words, the common room was perceived as being the most cramped and the office room the least. The mean scores for the significant main effect of crampedness factors were 4.01, 4.65, 4.68 and 3.34 for Factors I, II, III and IV, respectively. The clutteredness and physical size factors received similar high values; the appeal factor received the lowest value, whereas, the planning factor received a value in the middle.

TABLE 4.16 SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR CRAMPEDNESS EVALUATIONS OF THE OFFICE ROOM, POSTGRADUATE LOUNGE AND STAFF-STUDENT COMMON ROOM

Source	SS	DF	MS	F	P
Between Subjects	169.14	44	-	-	-
Conditions	48.76	2	24.38	8.50	$p<.001$
Error (between)	120.38	42	2.87	-	-
Within Subjects	170.08	135	-	-	-
Factors (Cramp.)	57.69	3	19.23	24.62	$p<.001$
Factors X con.	13.96	6	2.33	2.98	$p<.01$
Error (within)	98.43	126	.78	-	-
TOTAL	339.22	179	-	-	-

Figure 4.18 shows the significant interaction between the room types and the crampedness factors in graphical form. The mean scores for the crampedness factors I, II, III and IV were : 3.08, 4.06, 3.56 and 3.11 for the office room, 4.08, 4.84, 5.26 and 3.20 for the lounge, and 4.87, 5.06, 5.23 and 3.60 for the common room, respectively. As can be seen in Figure 4.18, the scores for the first three crampedness factors were much higher for the lounge as compared to the office room; separate t-test analyses indicated these differences to be significant ($t=2.29$, $p<.05$ for the planning; $t=2.49$, $p<.02$ for the physical size; and $t=4.35$, $p<.001$ for the clutteredness factors, each with $df=28$). The fourth factor, appeal, on the other hand, did not differ significantly.

The values of the crampedness factors I, II and IV for the common room were higher than those of the lounge; whereas the third factor, clutteredness, did not change. However, separate t-test analyses

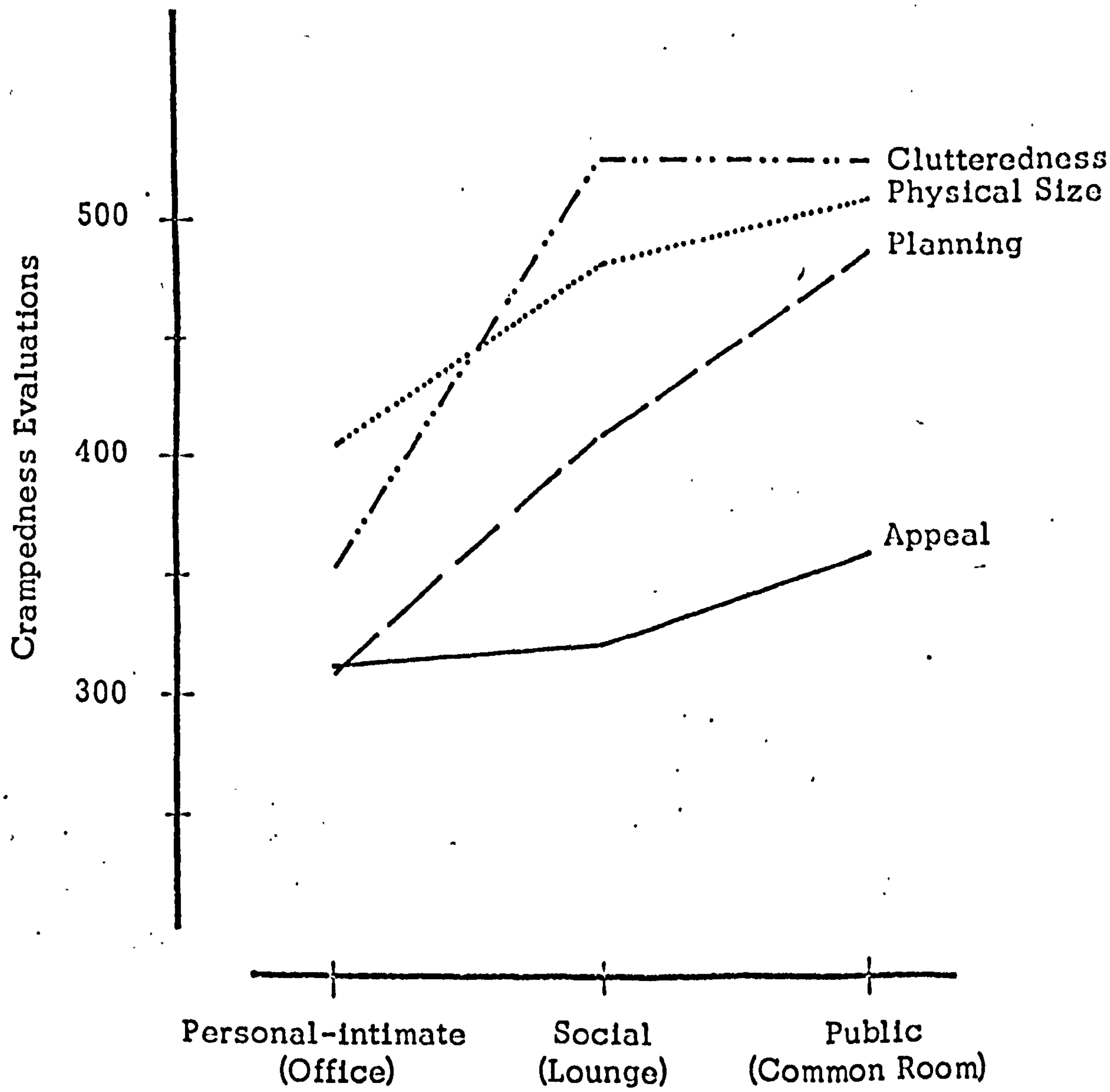

FIGURE 4.18. Activity (room) types X crampedness factors interaction.

applied to the differences between the lounge and the common room did not give any significant t values for any of the crampedness factors. The comparison between the mean values of the office and the common room, on the other hand, were significant for the planning, physical size and clutteredness; the appeal factor did not vary significantly.

In general , all three interiors were evaluated similar on the appeal factor. As for the remaining three crampedness factors; the lounge and the common room did not differ significantly, but the office room was evaluated significantly less cramped than the other two interiors with regards to these three factors.

DISCUSSION

The results of the spaciousness and crampedness evaluations supported the hypothesis that people want more spacious interiors for public and social activities as compared to personal-intimate ones.

A room of 53.35 sq.m. with 28 seats for public activity was evaluated as being the least spacious interior; that of 15.35 sq.m. with 6 seats for a personal-intimate activity was perceived as being the most. On the other hand, the room of 27.45 sq.m. with 26 seats allocated for social activities, although little more favourable, was rated similar to that of the room for public activity. In other words, in spite of the fact that, the common room was about twice as big as the postgraduate lounge, and $3\frac{1}{2}$ times as the private office room, it was evaluated the lowest in spaciousness scale.

Although these finding seem clear cut, they must be treated with some caution, for:

a) The selected interiors were the best ones the present author could get in comparable dimensions and character to represent the three types of activities in University boundaries. Whether these particular rooms represent the public, social and personal-intimate activities properly or not is debatable, especially in the private office case.

b) Due to the nature of the personal-intimate activity, the procedure used in the office room condition was different than the one used in the other two conditions. The spaciousness evaluation in the office was carried out with the presence of the subject and the experimenter only, while the other two rooms were rated when they were in use, in the presence of some other people.

c) All three rooms were similar in many ways but they differed in some aspects; i. the common room had a smaller window (about 5.5 sq.m.) as compared to the office and the lounge (respective window sizes being 7.5 and 18 sq.m.), and it was located high on wall; hence did not provide view or much of natural light. ii. The lounge was furnished with higher quality of items than the other two rooms; the office was the next in furniture quality and the colour schemes of the lounge and the office were very similar to each other. The common room, on the other hand, had a different colour scheme and lower quality of furniture. Although these differences reflected in the evaluations of the appeal factor, and the lounge was perceived as the most appealing, the common room the least, the above mentioned differences might have affected the whole spaciousness-crampedness evaluations.

PART FIVE

CONCLUSIONS

PART FIVE — CONCLUSIONS

V.1. AN OVERVIEW OF THE GENERAL FINDINGS

The present part aims to give an overview of the main findings and to speculate about some of their theoretical and empirical implications. First, let us refresh our memories by summarizing the main findings.

In general terms, the research described in previous chapters aimed to understand the meaning and structure of spaciousness of interiors and its relationship to some architectural variables. Of these, the pilot studies attempted to explore the significance of the concept for assessing interiors and to gain some insight as to which variables need to be considered in the future experiments. These studies, consisting of open-ended questionnaires, card-sorting, survey of newspapers, suggested that spaciousness was an important construct on which people often based their descriptions and evaluations of interiors and that it was closely related to such variables as size, clutteredness and the general atmosphere of interiors.

After this general investigation of the topic, in the second part some specific variables were studied experimentally. The first experiment of this group explored the effect of furniture density on the spaciousness evaluations and size estimation of rooms. The results indicated that an overfurnished room was assessed as being less spacious than both an empty and a furnished one; as for the size estimations, an empty room was seen larger than an overfurnished one. Thus there was a clear effect of furniture density on the spaciousness evaluations and size estimations of real rooms.

The next two studies examined the relationship between the function and desirable degree of spaciousness of rooms. Of these, the results of the first experiment indicated that people desire to carry out "intimate-personal", "social" and "public" activities in interiors with different degrees of spaciousness from the least to the most, respectively. The second one was designed to clarify the results of the first one by controlling the number of people involved in the three groups of activities. The results verified the early findings. In other words, when the number of people involved in the activities was kept constant, people still wanted to carry out "intimate-personal", "social" and "public" activities in interiors with increasing levels of spaciousness.

The last group of studies in Part II aimed to examine the effect of window size, window position and room proportion on spaciousness evaluation of rooms. After a number of exploratory studies in real rooms, two main experiments were carried out with 1/10 scale, adjustable models of different proportions. The first experiment of this group studied the effects of two levels of window size, room proportion and window position. According to the results, (a) rooms with windows on the short walls were assessed as being more spacious than the ones with windows on the long sides; (b) root-three models were perceived as being more spacious with continuous windows, whereas root-two rooms with smaller (3-bay) windows. The fact that the window size effect did not reach significance in this first experiment might have been due to the relatively large size of 3-bay windows. Particularly when the windows were located on the short sides of the models, the size of 3-bay windows were very close to that of continuous ones. Hence, perhaps the two levels used had not varied the size of windows sufficiently to study the main effect of this variable. To examine this possibility, the next experiment studied the effects of three levels of window size (by adding a 2-bay window condition) and two levels of room proportion by keeping window position constant on the short side. The results indicated that (for interiors having windows on the short sides): (a) the smaller windows (2-bay) made the interiors appear less spacious; (b) the room proportion did not seem to be significantly related to the spaciousness evaluations.

Since in all these first group of five experiments a global spaciousness measure was taken (either by using a single 7-point spacious-cramped - or confined - scale or by having subjects equalize the feeling of spaciousness of a comparison model to that of a standard one), their findings gave a general understanding of the effects of the variables studied. In order to understand this construct better and to get a more detailed measure of spaciousness, the need was felt to develop a more sophisticated scale. For this purpose, on the basis of the judgments of a large group of subjects, university students as well as office workers, and by following factor analysis and alpha approaches, a large pool of bipolar adjectives for describing interiors was reduced to 19 which comprised the spaciousness-crampedness scale (SCS). The spaciousness scale consisted of three factors, namely, appeal, planning and space freedom, whereas the crampedness scale was made up of the four factors of planning, physical size, clutteredness and appeal. Of these factors appeal had the highest proportion of the total variance for spaciousness, whereas planning seemed most important for crampedness. Thus, as was aimed this scale-construction stage of the project not only enabled us to understand the structure of the construct of spaciousness, but also provided us with a scale to assess interiors in this respect.

The last group of experimental studies made use of this spaciousness-crampedness scale and yielded more specific information about the effects of the variables studied on each of the spaciousness and crampedness factors. The first of this second series of experiments aimed to study the differences between different mediums of presentation of interiors: a real room, its 1/10 scale model and its coloured slide. The results indicated that the evaluations of a full-size room and those of its model did not differ, whereas those of the slide differed from both. In other words, a 1/10 scale model of a room could be used in place of the actual room for experimental purposes. In the light of this finding, the final group of experiments used full-size rooms or models interchangeably.

One study explored the effects of organization (orderliness) of furniture in full-size rooms. It was found that the more organized a room, the more spacious it appeared to be. The most affected factor of spaciousness was the planning one; there was a constant decrease in this factor from organized condition to very disorganized one. As far as the total crampedness scores were concerned, there were no differences between the disorganized and very disorganized rooms, but the organized room was seen as being less cramped than both the disorganized and very disorganized ones. When the specific crampedness factors were considered, the very disorganized condition was evaluated as being significantly less appealing than the organized one, and less well-planned than both the organized and disorganized conditions. As for the clutteredness factor, the organized condition was perceived as being significantly less cluttered than both the disorganized and very disorganized conditions. One of the most interesting findings was the constancy of the physical size factor; regardless of the levels of organization, the values for physical size did not vary significantly.

Another study in this group examined the effect of furniture density on the spaciousness and crampedness evaluations of model interiors. The related study reported among the first group of experiments was carried out in full-size office rooms. This time the study was done with a conference room model, which was of different size and nature from the previous office room. The results strongly supported the earlier findings that an overfurnished interior was perceived as being less spacious than both the empty and the furnished ones, the main spaciousness factor responsible for this relationship being that of space freedom. As far as the ratings of crampedness scale was concerned, the findings in general were similar; an overfurnished room was seen as being more cramped than both an empty and a furnished one. As for the specific crampedness factors, an overfurnished interior was evaluated as being more cluttered and less appealing than both an empty and a furnished one.

The following two experiments reconsidered the effects of window size, window position and room proportion with the aim of expanding and clarifying the previously obtained findings. These new experiments were similar in design to the ones carried out before; however, while the previous ones asked for movable models to be adjusted to a standard one in terms of spaciousness, the present ones required immovable models, that were constant in volume, to be evaluated in terms of the spaciousness-crampedness scale. The results of the first experiment indicated that (a) when windows were located on the long sides rather than on the short, the interiors were evaluated as having significantly more space freedom for both 3-bay and continuous windows (the effect being relatively more pronounced for the latter), but as being less well-planned for 3-bay and less appealing for continuous windows; (b) when located on short walls, continuous windows were evaluated more positively than 3-bay windows on both appeal and space freedom factors of spaciousness; the planning factor did not vary, so it can be concluded that when placed on the short side of a room, continuous windows give more of a feeling of spaciousness than 3-bay windows. As far as the crampedness scale data was concerned the findings were: (a) in general, the interiors with smaller (3-bay) windows were evaluated as being more cramped than the interiors with continuous windows; (b) the window position X crampedness factors interaction indicated that when windows were located on the short walls, rather than on the long, the interiors appeared more cluttered and hence more cramped. The other factors did not differ significantly.

The second study of this type was designed to investigate the effects of window size and room proportion in a more detailed way in interiors with their windows on the short sides. The results indicated that (a) models with continuous windows were seen more spacious than those with either a 2-bay or a 3-bay window; (b) a square interior was evaluated higher on space freedom than the root-two model; when compared to a root-three model, it was rated higher on both planning and space freedom factors of spaciousness. With regards to crampedness scale, it was found that (a) interiors with smaller (2-bay and 3-bay) windows were seen more cramped than the ones with continuous windows; (b) a root-three interior was seen more cramped than a square one. Thus interiors with elongated floor proportions and smaller windows were perceived as being more cramped.

Another experiment examined the effects of open versus closed curtains, day versus night-time on the spaciousness-crampedness evaluations of a real room. It was found that none of these variables had a direct significant effect on spaciousness, but interaction between the curtain position and spaciousness — or crampedness — factors was significant. (The room with the open curtains, although not significantly, was seen as relatively less appealing but better planned, having more space freedom — or in the case of crampedness, bigger and less cluttered — as compared to the closed curtains.)

In another experiment the difference between the spaciousness-crampedness evaluations of two groups of subjects was studied; users of a room and those who had not seen the room before. The overall scores indicated that users perceived the interior as being significantly less spacious than non-users. As far as the specific spaciousness factors were concerned users saw the room as being less well-planned and having less space freedom; as for the crampedness factors, they perceived the room smaller in size and more cluttered as compared to non-users.

The last experiment was designed to see the effects of types of activity (personal-intimate, social, and public) on the evaluations of spaciousness of real rooms. A private office, a postgraduate lounge and a staff-student common room were selected to represent the interiors for personal-intimate, social, and public activity groupings, respectively. The results generally supported the hypothesis that social and public activities required more spacious interiors than the personal-intimate ones. Specifically, the analysis of spaciousness data indicated that the office room was perceived as being more spacious than both the lounge and the common room. Although the common room received a relatively lower overall spaciousness score, it did not differ significantly from the lounge. With respect to individual spaciousness factors, both the lounge and the common room were evaluated as being less well-planned and having less space freedom compared with the private office room. As far as the crampedness results were concerned, again, there was not any significant difference between the overall crampedness evaluations of the lounge and the common room, but they were both rated more cramped than the private office. As for the specific crampedness factors, both the lounge and the common room were evaluated as being less well-planned, smaller in size and more cluttered than the office.

V.2. IMPLICATIONS FOR THE FUTURE WORK

Since the findings have already been discussed in detail in appropriate contexts, in this concluding section we intend to highlight only some general issues.

The development of spaciousness-crampedness scale as well as other findings of this project implied that spaciousness was a powerful construct bringing together all important aspects of an interior: its appeal or pleasantness in general; its planning and organization; its physical size with respect to the type of activity and the number of people that will be involved in that activity. In other words, spaciousness judgments of interiors take into account not only the affective aspects of spaces but also their intricate functional sides with all its complicated nature. Hence, spaciousness scale can be considered a general evaluation scale for interior spaces. This scale, when properly utilized, can give not only a complete picture of how people feel and think about an interior as compared to another one (e.g., choice between a number of interior design schemes), but also can be used as a standard evaluation measure for interiors of comparable functions. When used by other researchers, spaciousness-crampedness scale may lead to improved communication on different problems of interiors. In addition to that people in the field; architects, interior designers, and perhaps behaviour scientists, can possibly find practical use for this type of scale in understanding and designing better interiors. This common tool, in turn, may bring the researchers and practising professionalstogether in solving complex, ever increasing problems of interior spaces.

Spaciousness of a room is related to size, but they are not the same thing as referred in many instances. A large room is not necessarily a spacious one, or vice versa; a small room, provided that it is a pleasant, well-planned room and affords enough space for comfortably carrying on the particular activity or group of activities, may be considered a spacious one. Spaciousness is more than the physical size, it constitutes the size element among many other aspects of an interior. Future studies of spaciousness will do well to consider rooms of different sizes and different functions.

As for the room proportion; the experiment utilizing spaciousness-crampedness scale seemed to indicate that square rooms were seen as being more spacious than the oblong ones (root-3). This result is parallel to Jeanpierre's (1968). Future studies most consider ceiling heights and floor proportions other than the present project manipulated.

Experiments related to windows indicated that rooms with larger (continuous) windows were perceived as being more spacious than those with smaller (2 - 3-bay) ones. This was in agreement with Inui and Miyata's (1973), Collingro and Roessler's (1972), and Mercer's (1971) early findings. Our findings also offered the architect an optimum solution for practical design purposes — that is locating a continuous window on the short side of a room. However, other window shapes, sizes and the effects of various types of view must be studied; by concentrating on this topic it may be possible to have a (critical) minimum window size for an acceptable level of spaciousness for different room functions.

Two separate experiments, one using a model with spaciousness-crampedness scale, the other in a real room without the scale, clearly showed that the number of items in a room (chairs, tables) affected the spaciousness of the interiors. The more furniture, which also has the implication of more people, the less spacious a room appeared. Another experiment related to the furniture was the organization or orderliness of the furniture. The more organized a room, the more spacious it appeared to be. Future spaciousness studies may consider different levels of furniture density and organization.

General findings implied that the spaciousness of a room did not change with temporary changes, like opening or closing a curtain, or seeing it during the day or night time, having a sunny or a cloudy view out. It is more dependent on relatively stable or unchanging features of the interior: its dimensions, its contents, the size and placement of windows. This finding, implying that neither the quality or quantity of light has an effect on spaciousness, may seem in conflict with the results of window experiments which showed that the rooms with larger windows were perceived to be more spacious. But the function of a window is much more than the natural light it transmits to an interior: the view, communication with outside, and perhaps the sensation of being open — not only in terms of visual, but also audial and olfactory sensations.

Before concluding this final section, let us consider some other suggestions for future research. It is believed that future studies of spaciousness would do well to consider each of the spaciousness-crampedness factors, especially the appeal factor in detail; first empirically determining its relationship to architectural elements, such as room proportion, window size, colour and texture of surfaces, type and style of furniture, then systematically manipulating the relevant variables.

It may also be worthwhile to consider different groups of people; the young and the aged, people of different socio-economic class, and female portion of the population. Future cross-cultural investigations may also be of considerable value.

And finally, the relevance of spaciousness-crampedness scale for open (roofless) or urban spaces — courtyards, gardens, plazas, parks — can be checked. If the present scale is not relevant, a similar procedure to the one used can be followed to develop a scale for exterior spaces.

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APPENDIX I

TABLE 1 RESULTS OF THE OPEN-ENDED QUESTIONAIRE: FREQUENCY OF THE MENTIONED CHARACTERISTICS OF A SPACIOUS ROOM BY THREE GROUPS OF SUBJECTS

i. 36 undergraduate architecture students

ii. 24 postgraduate architecture students, secretaries, and janitors

iii. 10 nursery school teachers

Mentioned characteristics	frequency counts in groups		
	i	ii	iii
a) <u>Activity in the room</u>			
general:			
functional, confortable for performance	2	3	-
suitable for various activities	2	2	2
free floor space	1	4	3
important, not specified	3	-	-
circulation:			
free, easy circulation	9	7	2

TABLE 1 Contd.

Mentioned characteristics	frequency counts in groups i	ii	iii
b) <u>Shape, dimensions and size of the room</u>			
shape:			
rectangular	5	1	-
close to square, squarish	6	2	1
others (polygon, circular)	2	-	-
height:			
very high	2	1	-
high	12	8	5
slightly higher	5	1	1
need not be high	2	-	1
low ceilinged	1	1	1

TABLE 1 Contd.

Mentioned characteristics	frequency count in groups i	ii	iii
combination of low and high ceilinged	1	-	-
size:			
very large	4	-	1
large	10	7	6
slightly larger than necessary	6	1	-
not necessarily large	5	-	-
c) <u>Materials used</u>			
general:			
natural, soft	2	1	-
a lot of chrome, steel, glass	1	1	-
different textures on different surfaces	1	1	-

TABLE 1 Contd.

Mentioned characteristics	frequency count in groups i	ii	iii
walls:			
wood finish	1	-	1
floor:			
wall to wall carpeting	-	2	7
rugs, Persian rugs, rugs and parquet	2	2	-
d) Furniture used			
general:			
few, minimum number	1	2	1
uncluttered	9	10	3
free space left after furnishing	6	3	2
right amount of furniture	3	2	1
simple, horizontal lines	2	-	-

TABLE 1 Contd

Mentioned characteristics	frequency count in groups i	ii	iii
type:			
built in	2	-	1
not built in	2	-	-
compact, simple	2	1	-
modern	1	-	1
modern and traditional together	-	1	1
traditional, antique	1	1	1
important, not specified	1	-	-
size:			
small, compact	3	-	-
low, with low back	2	1	4
small tables	-	2	-
important, not specified	1	-	-

TABLE 1 Contd.

Mentioned characteristics	frequency count in groups i	ii	iii
colour:			
light in shade	1	-	-
dark	1	-	-
harmonized	2	-	-
important, not specified	2	-	-
arrangement:			
well apart	1	2	-
free vision	2	1	-
against walls, perimeter	2	1	2
fitted into walls	1	-	1
important, not specified	3	-	-
functional, attractive	-	2	1

TABLE 1 Contd.

Mentioned characteristics	frequency count in groups i	ii	iii
e) <u>Light and view</u>			
natural light			
general:			
strong, plenty, lots of daylight	6	10	4
sufficient, good natural light	22	8	2
window size:			
large	21	8	10
important, not specified	5	-	-
window shape:			
complete window wall	2	-	1
continuous, long	2	1	1
floor to ceiling	1	2	1
clearstorey or skylight	2	1	-

TABLE 1 Contd.

Mentioned characteristics	frequency count in groups i	ii	iii
view:			
unobstructed, extensive	2	-	-
landscape	2	1	-
garden or skyscape	1	1	-
important, not specified	3	2	-
artificial light:			
bright, well lit	4	6	-
indirect, soft	2	1	-
important, not specified	2	1	-

TABLE 1 Contd.

Mentioned characteristics	frequency count in groups		
	i	ii	iii
f) <u>Colour</u>			
general			
light	7	3	5
pale, muted, soft	2	5	2
bright	2	2	1
dark	1	-	-
combination of light and dark	1	-	-
important, not specified	1	1	-
walls:			
light	5	3	4
light in shade, cool	1	1	1
bright	2	1	2

TABLE 1 Contd.

Mentioned characteristics	frequency count in groups i	ii	iii
important, not specified	2	-	-
floor	-	1	1
white or pale	1	-	2
dark	2	1	-
important, not specified	2	-	-
ceiling:			
light, pale	3	-	1
bright	1	-	-
dark	1	-	1
important, not specified	2	-	-

TABLE 1 Contd.

Mentioned characteristics	frequency count in groups i	ii	iii
g) <u>Other sensory stimuli</u>			
temperature and air movement:			
comfortable temperature and air movement	2	3	-
airy, well-ventilated	1	1	-
non-humid, cool	1	1	-
important, not specified	-	1	-
auditory:			
comfortable, suitable	-	2	-
quiet	-	2	-
echoes sound	1	-	-
important, not specified	-	1	-
olfectory			
not stuffy, no smells	-	1	-

TABLE 1 Contd.

Mentioned characteristics	frequency count in groups i	ii	iii
h) <u>General atmosphere of the room</u>			
free, open	7	-	-
airy, fresh	4	5	-
light, bright	7	4	10
likeness to natural environment	1	-	-
well-planned, functional	3	-	1
tasteful	1	1	1
modern	1	-	-
elegent, luxurious	2	1	-
tidyness	2	-	-

TABLE 1 Contd.

Mentioned characteristics	frequency count in groups i	ii	iii
unity	1	-	-
large, uninterrupted	3	1	6
horizontal emphasis	2	1	-

TABLE 2 RANK ORDER OF 49 CHARACTERISTICS OF A SPACIOUS ROOM

Extremely important - 4

Quite important - 3

Slightly important - 2

Unimportant - 1

	Total Score	Mean Value
Uncrowded	55	2.50
Roomy	51	2.31
Lots of daylight	49	2.22
Well ventilated	46	2.09
Orderly	41	1.86
Large windows	40	1.81
Pleasant	40	1.81
Tidy	39	1.77
High ceilinged	38	1.72
Large	36	1.63
Clean	35	1.59
Functional	35	1.59
A fairly good view	35	1.59
Non-restricted view	35	1.59
Diffuse lighting	34	1.54
Comfortable	34	1.54
Comfortable temperature	33	1.50

TABLE 2 Contd.	Total Score	Mean Value
Tasteful	31	1.40
Windows looking South	30	1.36
Good acoustics	30	1.36
Cool	28	1.27
Pleasant odour	28	1.27
Few pictures	28	1.27
Vertical windows	27	1.22
Bright coloured ceiling	26	1.18
Impressive	26	1.18
Light coloured door	25	1.13
Window looking East or West	23	1.04
Small furniture	22	1.00
Plain	22	1.00
Direct lighting	21	0.95
Elegant	19	0.86
Quiet	18	0.81
Window looking North	18	0.81
Horizontal windows	17	0.77
Brightly coloured wall	17	0.77
Tungstan lighting	17	0.77
Fluorescant lighting	17	0.77
Bright coloured Fluorescent	15	0.68
Colourful curtains	14	0.63

TABLE 2 Contd

	Total Score	Mean Value
Brightly coloured curtains	12	0.54
Well above ground	10	0.45
Many pictures	9	0.40
Modern	7	0.31
Different Coloured walls	6	0.27
Complex	6	0.27
Ornate	5	0.22
New	5	0.22
Expensive	2	0.09

TABLE 3 RESULTS OF THE NEWSPAPER SURVEY: NUMBER AND PERCENTAGE OF ACCOMMODATION ADVERTISEMENTS EMPLOYING THE WORD "SPACIOUS" AS COMPARED TO THE TOTAL NUMBER.

Name of the Newspaper	Date	Number of Advert. Total	Number of Advert. with "spacious"	%
Evening Times	26 Nov. '73 1 Dec. '73	512	49	9.57
Sunday Post	2 Dec. '73	-	-	-
Total Scottish Papers		512	49	9.57
The Times	26 Nov. '73 1 Dec. '73	620	60	9.68
The Sunday Times	2 Dec. '73	671	83	12.37
Total English Papers		1291	143	11.08
OVERALL		1803	192	10.65

APPENDIX II

TABLE 1. CATEGORIZATION OF SELECTED ACTIVITIES WITH RESPECT TO THE NUMBER OF PEOPLE INVOLVED OTHER THAN ONE ACTOR (The figures and capital letters in parentheses refer to the mean values assigned by 22 judges to each activity and to its activity group, respectively : I = personal-intimate, S = social, P = public)

Single person or a few :	
Dining with a lover	(1.00, I)
Dining with a businessman to make a deal	(2.04, S)
Playing a musical instrument for a few people you don't know	(2.68, P)
A few :	
Reading in the company of a few family members	(1.18, I)
Reading in the company of a few classmates	(2.00, S)
Reading in the company of a few strangers	(2.55, P)
Half a dozen :	
Half a dozen close friends meeting for a prayer group	(1.41, I)
Half a dozen students meeting for a tutorial	(2.00, S)
Half a dozen passengers waiting for a train	(3.00, P)
Eight to ten :	
Discussing an intimate problem with a group of eight to ten close friends	(1.32, I)
Discussing the manner of selecting student representatives for a university union with eight to ten classmates	(2.18, S)

Discussing the role of the youth organizations in the politics with eight to ten M.P.s	(2.82, P)
A bunch of .. or your family :	
Playing a musical instrument for your family	(1.45, I)
A bunch of skiers having a party	(1.95, S)
A bunch of boy-scout representatives from different schools debating	(2.64, P)

PILOT STUDIES TO EXPLORE THE EFFECT OF WINDOW SIZE ON SPACIOUSNESS - USING REAL ROOMS

The review of the relevant literature and the pilot studies indicated that spaciousness was closely related to windows. Inui and Miyata (1973), Mercer (1971), and Dalkvist and Garling (1971) showed a positive relationship between openings and the feeling of spaciousness. A high proportion of subjects in our pilot studies have also mentioned that spacious rooms should have either 'good' or 'plenty' of daylight.

In order to explore this area and gain some insight, four pilot studies were carried out in real rooms. In each of these studies, after evaluating the spaciousness of a particular interior, each subject's comments on the interior, his (her) opinion on the construct of spaciousness in general and the factors that he (she) thinks are strongly related to the construct was also asked and recorded.

PILOT STUDY I

METHOD

Subjects

Thirty (half male - half female) students from varrious departments of the University of Strathclyde were used as subjects. The mean age was 20.2 years with a range of 18 and 27 years. There were 5 male, 5 female subjects in each of the three conditions of the experiment.

Stimuli

A 4.50X6.10 m room with a 3.15m ceiling height was used as stimuli. One of the long sides of the room had a complete window wall looking to west to a 22X24m paved courtyard on the same level. The room was furnished as a seminar room with 6 tables in the centre and a row of chairs near the east wall. (See Figure 1, for the plan arrangement.) The window wall had a two-piece floor to ceiling, thick, grey curtain and could be manipulated to close any proportion of the window. Four flourescent lamps on the ceiling were kept on, through the experiment.

Procedure

There were three conditions in the experiment; i) room with closed curtains, ii) half-open curtains, and iii) open curtains. In all three cases the experiment was administered individually. After a short introduction each subject was taken into the experimental room, seated at the "subject's" chair. The use of a 7-point scale was explained, and he (she) was asked to evaluate the room by using a 7-point "spacious-cramped" scale. The experiment was carried out on day-time, overcast sky conditions.

RESULTS AND DISCUSSION

Subjects' responses on the "cramped-spacious" scale were converted into numerical scores of 1 to 7, respectively. The mean scores of the 10 subjects in each of the three conditions of the experiment were 3.9, 3.9, and 3.6 for closed, half-open, and open curtains, respectively. The differences between the three spaciousness evaluations for the three conditions of the room were analyzed by ana-

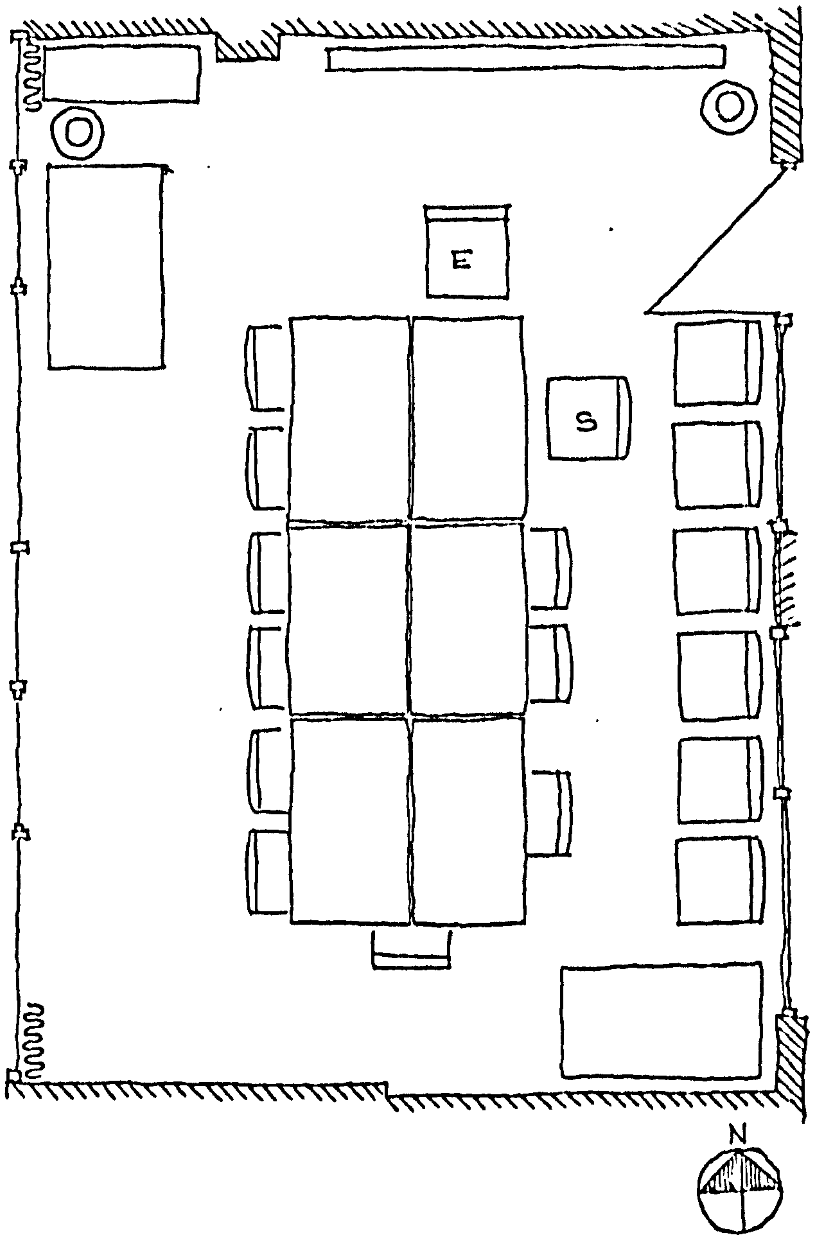

FIGURE 1. Plan of the seminar room used in Pilot Study I and II.

lysis of variance for factorial designs (3 curtain positions X 2 sex). The results indicated that neither of the two main effects nor their interaction was significant. t-tests applied to paired comparisons (open versus closed, open versus half-open, and closed versus half-open) were not significant either.

The insignificant main sex effect indicated that the room was not evaluated differently by two different sex groups with respect to spaciousness. As for the other main effect -curtain openings-, the results indicated that the room with an open curtain, with a half-closed one, or with a closed curtain was not assessed differently. This insignificant main effect can, perhaps, be explained in the following ways: Either the window size does not affect the spaciousness of a room, or curtains are not adequate means to manipulate the window size. The subjects of the closed and half-open curtain conditions might have realized that the whole wall -or a large proportion of it- was a window, and that the curtain was only a temporary adjustmant not to be considered in spaciousness evaluation of an interior.

An interesting finding was that of a loose end type: After each evaluation, when his (her) opinion on the factors influencing the spaciousness of a room was asked, a large proportion of the subjects mentioned the function of the room and the number of people who would be involved in that function. Also, in closed and half-open curtain conditions, more than the half of the subjects pointed out directly or indirectly that they were aware of the "closed curtains".

PILOT STUDY II

In order to study the effect of window size (open versus closed curtain conditions) on spaciousness of a room, this time a repeated measures experimental design was devised. It was expected that, seeing the both conditions, subjects would evaluate the same room more spacious with open curtains, as compared to the closed ones.

METHOD

Subjects

Sixteen male students from various departments of the University of Strathclyde were used as subjects. The mean age was 21.87 years with a range of 19 to 32 years.

Stimuli

The stimuli was the same as in the previous pilot experiment.

Procedure

The experiment was administered individually. Each subject assessed the room both with an open and a closed curtain, the order of which was counterbalanced within the experiment. Thus, half of the subjects first responded to the room with closed curtains, then with that of open curtains; whereas the other half evaluated first the open curtain condition, then the closed curtain one. Two spaciousness evaluations were obtained by using two separate 7-point "spacious-cramped" scales for the two experimental conditions.

RESULTS AND DISCUSSION

Subjects' responses to both of the conditions on the "cramped-spacious" scale were converted into numerical scores of 1 to 7, respectively. The mean scores of the 16 subjects in closed curtain and open curtain conditions were 3.84 and 5.46, respectively. The differences between the two evaluations of the room were analyzed by analysis of variance for repeated measures, the results of which have been summarized in Table 2.

TABLE 2 SUMMARY TABLE FOR ANALYSIS OF VARIANCE FOR REPEATED MEASURES FOR SPACIOUSNESS EVALUATIONS OF THE SEMINAR ROOM WITH "OPEN" AND "CLOSED" CURTAIN CONDITIONS

Source	SS	df	ms	F	p
Total	76.22	31	-	-	-
Subjects	45.47	15	-	-	-
Treatments	21.12	1	21.12	32.92	$p < .001$
Error	9.63	15	.64	-	-

As can be seen in Table 2, the treatments were highly significant. In other words, the subjects evaluated the open curtain condition more spacious as compared to the closed curtain condition of the same room.

A number of subjects, again mentioned the importance of the function of the room, the number of people and furniture density for spaciousness.

PILOT STUDY III

In order to study the effect of window size on spaciousness evaluation of rooms, another attempt was made; this time two office rooms were selected, one being standard, the other being comparison, and subjects were asked to compare the spaciousness of the two.

METHOD

Subjects

Thirty male students were used as subjects. The mean age was 21.8 years with a range of 18 and 34 years. There were 10 subjects in each of the three conditions of the experiment.

Stimuli

Two rectangular office rooms, on the same corridor, 10m apart from each other, were used as stimuli. One of the rooms was employed as the standard, the other as the comparison; the floor dimensions of the two rooms were 2.87X5.35 and 2.60X5.35m, respectively. Although the comparison room was furnished with a better quality furniture and looked more pleasant, the general characteristics of the rooms with respect to building materials, colour of surfaces and lighting were similar. Both had their window-walls on the short sides, looking east. The furniture layout of the rooms are shown in Figure 2 . The standard room curtain was kept open in all three conditions of the experiment, whereas that of the comparison

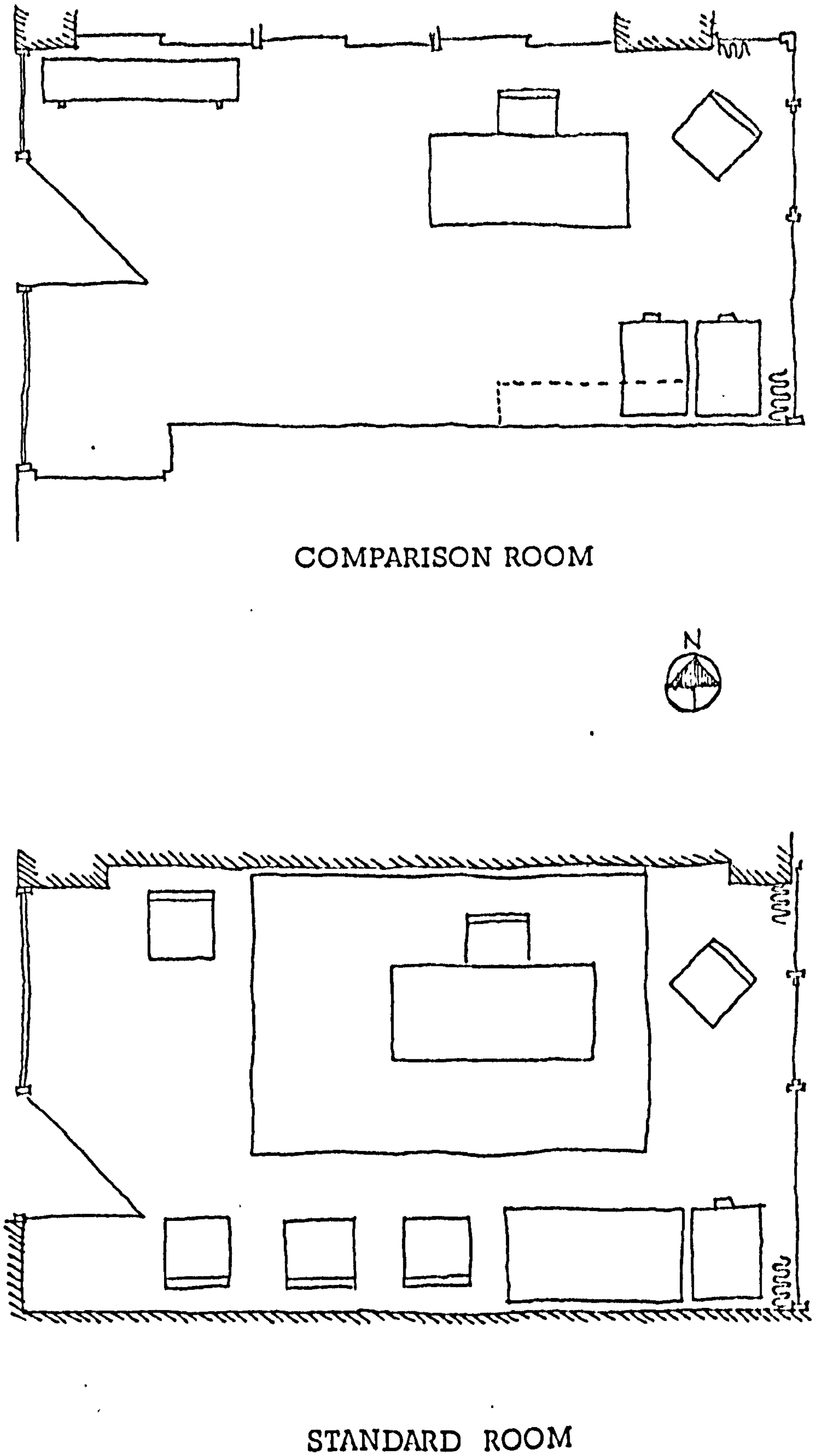

FIGURE 2. Two office rooms used in Pilot Study III.

room was manipulated as i) closed, ii) half-open, and iii) open. The flourescent lights of both of the rooms were kept on during the all three conditions of the experiment.

Procedure

The experiment was administered individually. Each subject was taken first to the standard room and was asked to evaluate the interior by using a 7-point "spacious-cramped" scale. Then he was taken to the comparison room and was asked to evaluate it again with a 7-point spacious-cramped scale. Experiment was carried out on day-time, overcast-sky conditions.

RESULTS AND DISCUSSION

Subjects' responses to the comparison as well as to the standard room on the "cramped-spacious" scale were converted into numerical scores of 1 to 7, respectively. The mean scores of the 10 subjects in closed curtain, half-open and open curtain conditions were 3.7, 3.7, and 4.7, respectively. The differences between the three spaciousness evaluations for the three conditions of the comparison room were analyzed by analysis of variance for completely randomized factorial designs. The results again indicated no overall significant differences between the three experimental conditions. t-tests applied for paired comparisons were not significant either. In other words, the room with a closed curtain, or a half-open one, or an open curtain was not evaluated differently.

To check whether or not any uncontrolled factors were contaminating the results, the differences between the mean spaciousness evaluations of the standard room by 10 subjacts in each of three experimental groups were also analyzed by an F-test; however, since the standard room was kept constant all through, the differences were not significant. (The mean spaciousness evaluations of the standard room were 4.3, 4.7, and 4.9 for the respective subject groups of closed, half-open, and open curtain conditions.)

A high proportion of the subjects correctly pointed out that the standard room was larger in size (15.50 sq.m) as compared to the comparison room (13.90 sq.m). Also in closed curtain and half-open curtain conditions, half of the subjects mentioned that the curtains were manipulated.

PILOT STUDY IV

This study was designed to explore the effect of a sunny view-out as compared to a cloudy one, on the spaciousness evaluation of a room. This time an 11-point "spacious-cramped" scale was utilized.

METHOD

Subjects

Twenty male students from different departments of the University of Strathclyde were used as subjects. The mean age was 21.45 years with a range of 18 to 31 years. There were 10 subjects in each of the two experimental conditions.

Stimuli

The "comparison room" of the previously reported Pilot Study III was used as stimuli. The curtains of the room was kept open in both of the experimental conditions.

Procedure

The experiment was administered individually. Each subject was taken to the experimental room. The usage of a bipolar scale was explained, and he was asked to evaluate the room on an 11-point spacious-cramped scale. One of the experimental conditions was conducted on sunny days; the other, on cloudy days. The experiment was carried out in the afternoons, since the room had an east orientation the sun did not enter the room during the experimental session.

RESULTS AND DISCUSSION

Each subject's rating on the cramped-spacious scale was converted into numerical scores of 1 to 11, respectively. The mean scores of the 10 subjects in the sunny condition was 5.25 and for the cloudy one 5.30. t-test applied to the differences between the two conditions indicated that this difference was not significant. In other words the spaciousness of a room on a cloudy day did not differ from that of a sunny one.

CONCLUDING DISCUSSION OF THE PILOT STUDIES ON WINDOWS

1- The evaluations of the standard room by three different groups of subjects in Pilot Study III have indicated that there were no significant differences between these three groups. In addition to that, the evaluation of the open curtain condition in Pilot Stuy I and the evaluation of the same condition of the very same room by another group of subjects who first saw the room with open curtains in Pilot Study II, were also very similar. Therefore, one may say that people make stable spaciousness evaluations with a bipolar spacious-cramped scale.

2 - Different sex groups do not evaluate the interiors differently with respect to spaciousness (Study I).

3 - It seems that the spaciousness of a room does not depend on having a sunny view out or a cloudy one; which may lead the way that spaciousness is more dependent on internal constituents of the space. (Study IV)

4 - Comments made by the subjects strongly pointed out the importance of the function of the room and the number of people to participate.

5 - Although the second study with repeated measures design yielded significant effects of open versus closed curtain conditions, the other two studies (I and III) with randomized designs did not indicate any significant main effects. In other words, when the subjects were aware of the variable and evaluated the room with different curtain conditions, 14 out of 16 rated the open curtain condition as being more spacious than the closed curtain one. On the other hand, when the subjects did not know the manipulated variable

(curtain openings), different subject groups for different curtain conditions evaluated the room similarly. That is to say, when a direct question about the role of a curtain (or window size) on spaciousness was put forward to the subjects (opening or closing the curtain in front of the subject, and asking him to evaluate it each time), they pronounced the existance of a relationship; but when the question was not put in an open way, subjects did not see the curtains as a factor influencing the spaciousness of a room.

6 - No matter how well fitted and adjusted, curtains are not suitable means to manipulate the window size of a room. More than the half of the subjects who evaluated the closed and half-closed curtain conditions in the first 3 studies verbally expressed that the curtains were "closed" or "pulled", and pointed out that they were aware of this temporary situation. Therefore, it is not a realistic approach to try to manipulate the window size by the help of curtains in a real room. If it is attemped, as in these pilot experiments, the results cannot be attributed simply to the window size, but perhaps, to curtains.

7 - Although attempted, it was not possible to study the effect of window position (window on short wall or on long wall) on the spaciousness evaluations of real rooms, mainly due to different sizes, functions, window orientations of the available rooms.

In order to be able to study the effect of window size (and window position), a more systematic experimental approach is necessary. This might be done either in full size rooms of similar functions, similar dimensions and characteristics, similar orientations and view; or more economically, by the help of finely made scale models.

APPENDIX II - A

The activity list and the introduction given to 10 judges in Experiment II.2.1.

Name:

Year:

Below you will find a list of activities. We would like you to identify them as to one of three types of groupings; namely, "personal-intimate"; "social"; and "public". The "personal-intimate grouping" refers to those activities which involve only yourself and/or someone with whom you have very close relationships; such as, a lover, a mother, a very close friend, etc. With such people you would tolerate more physical contact and may engage in intimate; ego-involving activities. The "social grouping", on the other hand, includes the activities, which usually involve more than two persons with whom you have more distant relationships and would tend to talk about more general, neutral topics. These relationships may involve friends in general, t teachers, etc. Finally, the "public grouping" refers to those activities that you engage in with people whom you either know very little or do not know at all.

If you think that an activity in the list below can be regarded as belonging to a "personal-intimate grouping", then put an "I" next to its number. If you regard it as belonging to a "social grouping", put an "S" next to its number; and if you think that a "public" relationship is involved, just put a "P" next to the number of the activity.

1. Dining with a group of friends
2. Studying alone
3. Lecturing to a group of 20-30 people
4. Playing a musical instrument for a group of friends
5. Taking a bath
6. Debating
7. Studying for an exam with a group of friends
8. Listening to an orchestra
9. Sewing
10. Making love
11. Dancing
12. Praying alone
13. Dining witha a close friend
14. Giving a public speech
15. Watching a fireplace

16. Waiting for a train
17. Draughting
18. Studying
19. Discussing an intimate problem with a very close friend
20. Listening to the radio
21. Watching T.V.
22. Painting
23. Resting
24. Listening to a lecture
25. Doing clerical work
26. Ice skating
27. Praying with some other people
28. Watching a play
29. Eating alone
30. Swimming at a pool
31. Being at a party
32. Singing by yourself
33. Waiting for a plane
34. Sleeping
35. Drinking

APPENDIX II - B

Form used for the Experiment II.2.1.; the introduction page and the activity list.

NAME: AGE: SEX:

Below you will find a list of activities which you may have engaged in at some time or other within a specific place. What we would like you to do is to forget about the specific places in which you have carried on these activities and to think about the kind of place which would be most desirable for these activities. In other words, please concentrate on the kind of place you would like for carrying out each one of these activities.

We would like you to consider each of the activities separately and describe the place that you think is most suitable for this activity on a spacious-confined scale.

If you feel that it is more desirable for an activity (e.g., sewing) to be carried on in a place that is either extremely spacious or extremely confined, you should tick the line nearest to the word "spacious" or "confined". For example:

sewing SPACIOUS ✓:__:__:__:__:__:__ CONFINED
sewing SPACIOUS __:__:__:__:__:__:✓ CONFINED

If you feel that it is more desirable for this activity to be carried on in a place that is quite spacious or quite confined, you should tick the line next nearest to the word "spacious" or "confined". For example:

sewing SPACIOUS __:✓:__:__:__:__:__ CONFINED
sewing SPACIOUS __:__:__:__:__:✓:__ CONFINED

If you feel that it is more desirable for this activity to be carried on in a place that is slightly spacious or slightly confined, then you should tick the line as follows:

sewing SPACIOUS __:__:✓:__:__:__:__ CONFINED
sewing SPACIOUS __:__:__:__:✓:__:__ CONFINED

If you consider that it is more desirable for this activity to be carried on in a place which is neither spacious nor confined, or if the scale is completely irrelevant to this activity, you should tick the line in the center.

Only tick one line for one activity.
Be sure that every activity is covered.
Make a separate and independent judgment for each activity.

THANK YOU VERY MUCH.

Drinking	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Being at a party	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Ice skating	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Discussing an intimate problem with a very close friend	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Studying alone	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Waiting for a train	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Watching a fireplace	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Giving a public speech	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Making love	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Studying for an exam with a group of friends	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Debating	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Playing a musical instrument for a group of friends	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Lecturing to a group of fifty people	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Praying alone	SPACIOUS ___:___:___:___:___:___:___ CONFINED
Dining with a group of friends	SPACIOUS ___:___:___:___:___:___:___ CONFINED

APPENDIX II - C

The activity list and the introduction given to 22 judges in Experiment II.2.2.

NAME: AGE: SEX:

Below you will find a list of activities. We would like you to identify them as to one of the three types of groupings; namely, "personal-intimate", "social", and "public". The "personal-intimate" grouping refers to those activities which involve yourself and/or people with whom you have close relationships; such as, a lover, a mother, a close friend, etc. With such people you will tolerate more physical contact and may engage in intimate, ego-involving activities. The "social" grouping, on the other hand, includes the activities which involve people with whom you have more distant relationships and would tend to talk about more general, neutral topics. These relationships may involve friends in general, teachers, etc. Finally, the "public" grouping refers to those activities that you engage in with people whom you either know very little or do not know at all.

If you think that an avtivity in the list below can be regarded as belonging to a "personal-intimate" grouping, then put an "I" next to its number. If you regard it as belonging to a "social" grouping, put an "S" next to its number; and if you think that a"public" relationship is involved, just put a "P" next to the number of the activity.

THANK YOU VERY MUCH.

___ 1. A bunch of boy-scouts dining
___ 2. Playing a musical instrument for a small group of friends
___ 3. Half a dozen close friends meeting for a prayer group
___ 4. Discussing the manner of selecting student representatives for a university union with eight to ten classmates
___ 5. Half a dozen passengers waiting for a train
___ 6. Reading in the company of a few classmates
___ 7. A bunch of boy-scout representatives from different schools debating
___ 8. Discussing the role of the youth organizations in the politics with eight to ten M.P.s
___ 9. Dining with a colleague
___ 10. Dining with a group of non-Arab tourists
___ 11. A bunch of boy-scouts studying
___ 12. Reading in the company of a few family members
___ 13. Half a dozen students meeting for a tutorial
___ 14. Playing a musical instrument for a few pople you don't know
___ 15. Dining with a businessman to make a deal

____ 16. A student - lecturer group of ten dining
____ 17. Watching T.V. with your lover
____ 18. A bunch of skiers warming up in front of a fireplace
____ 19. Watching T.V. with a stranger
____ 20. Discussing an intimate problem with a group of eight to ten close friends
____ 21. A bunch of skiers attending a lecture especially prepared for them
____ 22. Watching T.V. with a colleague
____ 23. Playing a musical instrument for your family
____ 24. Dining with a lover
____ 25. Reading in the company of a few strangers
____ 26. A bunch of skiers having a party
____ 27. Dining with a group of ten family members
____ 28. A bunch of boy-scouts sleeping

APPENDIX II - D

The activity list used in Experiment II.2.2. (the introduction page was the same as in Experiment II.2.1., see Appendix II B)

Dining with a colleague	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Half a dozen passengers waiting for a train	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Reading in the company of a few classmates	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Discussing the role of the youth organizations in the politics with eight to ten M.P.s	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Half a dozen close friends meeting for a prayer group	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Playing a musical instrument for a few people you don't know	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Reading in the company of a few family members	SPACIOUS	___:___:___:___:___:___:___	CONFINED
A bunch of skiers having a party	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Half a dozen students meeting for a tutorial	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Discussing the manner of selecting student representatives for a university union with eight to ten classmates	SPACIOUS	___:___:___:___:___:___:___	CONFINED
A bunch of boy-scout representatives from different schools debating	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Reading in the company of a few strangers	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Dining with a lover	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Playing a musical instrument for your family	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Discussing an intimate problem with a group of eight to ten close friends	SPACIOUS	___:___:___:___:___:___:___	CONFINED
Dining with a businessman to make a deal	SPACIOUS	___:___:___:___:___:___:___	CONFINED

APPENDIX III

TABLE 1. TWO-TAILED KENDALL'S TAU AND SPEARMAN'S RHO CORRELATION COEFFICIENTS AND THEIR LEVELS OF SIGNIFICANCE FOR THREE DIFFERENT SUBJECT GROUPS, MALES, FEMALES AND THE TOTAL SUBJECT SAMPLE.

	restful-disturbing	pleasant-unpleasant	uncluttered-cluttered	empty-full	contemporary-traditional	distinctive-ordinary	graceful-clumsy	livable-unlivable	neat-messy	huge-tiny
GROUP 1										
number of Ss	36	36	36	36	36	36	36	36	36	00
Kendall's tau	.345	.542	.394	.584	.660	.586	.456	.406	.406	—
significance	.003	.001	.001	.001	.001	.001	.001	.001	.001	—
Spearman's rho	.408	.698	.500	.732	.777	.710	.549	.495	.573	—
significance	.013	.001	.002	.001	.001	.001	.001	.002	.001	—

TABLE 1 Contd.

GROUP 2	restful-disturbing	pleasant-unpleasant	uncluttered-cluttered	empty-full	contemporary-traditional	distinctive-ordinary	graceful-clumsy	livable-unlivable	neat-messy	huge-tiny
number of Ss	42	42	42	41	42	42	42	42	42	42
Kendall's tau	.341	.545	.434	.633	.673	.383	.554	.514	.411	.747
significance	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001
Spearman's rho	.435	.686..	.552	.773	.755	.518	.640	.611	.465	.867
Significance	.004	.001	.001	.001	.001	.001	.001	.001	.001	.001

TABLE 1 Contd.

GROUP 3 (OFFICE WORKERS)

	restful-disturbing	pleasent-unpleasant	uncluttered-cluttered	empty-full	contemporary-traditional	distinctive-ordinary	graceful-clumsy	livable-unlivable	neat-messy	huge-tiny
number of Ss	55	57	56	54	56	56	54	55	55	53
Kendall's tau	.3248	.5246	.5022	.4389	.3501	.2876	.4180	.4260	.5758	.5347
significance	.001	.001	.001	.001	.001	.002	.001	.001	.001	.001
Spearman's rho	.3868	.6286	.5907	.5037	.4316	.3570	.5288	.5199	.6774	.6169
Significance	.004	.001	.001	.001	.007	.001	.001	.001	.001	.001

TABLE 1 Contd

MALES

	Kendall Correlation coefficients			Spearman Correlation Coefficients	
	Coefficients	Significance	No. of Sub.	Coefficients	Significance
Restful-Dist.	.2887	.001	94	.3443	.001
Pleasant-Unpl.	.5421	.001	94	.6706	.001
Cluttered-Unclut.	.4341	.001	94	.5353	.001
Empty-Full	.5846	.001	93	.7260	.001
Tradit.-Cont.	.5785	.001	93	.6800	.001
Distinctive-Ord.	.3302	.001	93	.4260	.001
Graceful-Clumsy	.9076	.001	94	.5004	.001
Livable-Unlivable	.5193	.001	94	.6484	.001
Neat-Messy	.4669	.001	93	.5598	.001
Huge-Tiny	.6483	.001	61	.7393	.001

Table 1 Contd

FEMALES

	Kendal Correlation coefficients			Spearman Correlation coefficients	
	Coefficients	Significance	No. of Sub.	Coefficients	Significance
Restful-Dist.	.4288	.001	39	.5009	.001
Pleasant-Unpl.	.4746	.001	41	.5704	.001
Cluttered-Unclut.	.5495	.001	40	.6360	.001
Empty-Full	.4165	.001	38	.4464	.005
Tradit-Cont.	.3426	.002	41	.4133	.007
Distinctive-Ord.	.4109	.001	41	.5144	.001
Graceful-Clumsy	.5905	.001	38	.7052	.001
Livable-Unlivable	.3099	.009	35	.3555	.036
Neat-Messy	.6057	.001	40	.7125	.001
Huge-Tiny	.6408	.001	34	.7266	.001

Table 1 Contd

ALL GROUPS

	Kendal Correlation coefficients			Spearman Correlation Coefficients	
	Coefficients	Significance	No. Of. Sub.	Coefficients	Significance
Restful-Dist.	.3562	.001	133	.4229	.001
Pleasant-Unpl.	.5406	.001	135	.6616	.001
Cluttered-Unclut.	.4872	.001	134	.6006	.001
Empty-Full	.5236	.001	131	.6303	.001
Tradit-Cont.	.5193	.001	134	.6177	.001
Distinctive-Ord.	.3869	.001	134	.4914	.001
Graceful-Clumsy	.4550	.001	132	.5633	.001
Livable-Unlivable	.4488	.001	133	.5493	.001
Neat-Messy	.5255	.001	133	.6301	.001
Huge-Tiny	.6375	.001	95	.7331	.001

TABLE 2. MEANS, STANDARD DEVIATIONS AND NUMBER OF QUESTION MARK RATINGS FOR EACH OF THE 161 PAIRS OF OF ADJECTIVES.

n = Number of subjects who rated the particular adjective pair

M = Mean appropriateness for the total subject sample

SD = Standard deviation of the assigned values

QM = Number of question marks assigned by the subjects

ADJECTIVE PAIR	n	M	SD	QM
Cheerful-Gloomy	135	7.548	3.031	-
Bright Coloured-Muted Col.	135	6.866	3.063	-
Busy-Calm	135	6.251	3.135	-
Restful-Disturbing (Repeated)	133	7.390	2.961	-
Pleasant-Unpleasnat(Repeated)	135	7.207	3.076	-
Uncluttered-Cluttered "	135	8.125	2.811	-
Adequate size-Inadequate size	135	8.459	2.803	-
Appealing-Unappealing	133	6.714	3.117	2
Attractive-Unattractive	134	6.873	3.139	2
Beautiful-Ugly	133	5.345	3.307	1
Bright-Dull	133	7.240	3.072	1
Calming-Upsetting	135	5.933	3.162	1
Clean-Dirty	134	6.067	3.615	-
Drafty-Stuffy	135	6.600	3.483	-
Efficient-Inefficient	134	6.552	3.229	1

TABLE 2 Contd.

ADJECTIVE	n	M	SD	QM
Elegant-Unadorned	134	6.313	3.300	1
Empty-Full (Repeated)	132	7.500	3.199	1
Expensive-Cheap	134	4.761	3.342	2
Fashionable-unfashionable	134	5.089	3.406	1
Feminine-Masculine	132	3.916	3.143	2
Colourful-Drab	134	6.425	3.249	1
Comfortable-Uncomfortable	134	7.634	2.853	-
Complex-Simple	132	6.689	3.167	2
Confused-Clear	133	6.135	3.071	-
Consonant-Dissonant	121	5.000	2.848	24
Contemporary-Traditional (Rëp)	134	5.723	3.456	-
Comfortable temperature-Uncomforatable temperature	134	7.111	3.428	-
Exciting-Unexcitint	134	6.985	3.073	-
Dynamic space-Static space	131	7.488	2.907	4
Convenient-Inconvenient	134	7.007	2.887	1
Coordinated-uncoordinated	132	7.083	2.892	1
Cozy-Monumental	132	7.174	3.165	1
Cultured-Uncultured	133	5.105	3.073	2
Dated-Timeless	130	4.707	3.335	3
Decorated-Stark	132	6.931	3.162	3
Definite volume-Indefinite volume	131	6.854	3.096	4

TABLE 2 Contd

ADJECTIVE	n	M	SD	QM
Depressing-Exhilarating	134	7.007	3.122	-
Diffuse lighting-Direct lighting	132	6.946	3.288	1
Dignified-Undignified	133	5.639	3.097	-
Distinctive-Ordinary (Rep.)	135	5.933	3.040	-
Hormonious-Discordant	132	6.522	3.185	-
Healthy-Unhealthy	134	5.828	3.501	1
Flashy colours-Subdued col.	132	5.954	3.028	2
Flexible-Rigid	131	6.580	3.065	2
Formal-Informal	130	6.646	3.06	2
Free space-Restricted space	134	9.179	2.098	-
Fresh odour-Stale odour	134	5.970	3.503	1
Friendly-unfriendly	134	6.850	3.254	-
Functional-Nonfunctional	134	7.447	3.125	-
Gay-Dreary	134	6.447	3.196	-
Welcoming-Unwelcoming	97	7.278	3.261	-
Huge-Tiny (Rep)	98	8.193	3.200	-
Gentle-Brutal	133	4.458	3.139	4
Good-Bad	132	5.257	3.553	4
Happy-Sad	135	5.614	3.459	-
Empty-Full (Rep)	132	7.560	3.194	2
Good acoustics-poor acoustics	134	7.589	2.991	-
Pleasing-Annoying	134	7.201	3.159	-
Contemporary-Traditional (Rep)	134	6.462	3.266	-
Good colours-Bad colours	134	5.552	3.298	-

TABLE 2 Contd

ADJECTIVE	n	M	SD	OM
Good lighting-poor lighting	135	7.896	3.225	1
Quiet-Noisy	135	6.896	2.965	-
Graceful-Clumsy (Repeated)	134	5.992	3.291	1
Private-Public	134	7.037	3.277	-
Good lines-Bad lines	132	6.015	3.303	6
Good temperature-bad temp.	134	6.276	3.412	-
Popular-Unpopular	135	4.903	3.400	-
Distinctive-Ordinary (Rep)	135	5.466	3.213	-
Imagninative-unimaginative	135	7.207	3.204	-
Personal-Impersonal	135	7.185	3.287	-
Good ventilation-Poor vent.	135	7.118	3.574	-
Impressive-Unimpressive	134	7.358	3.017	-
Inner directed-Outer direct.	124	6.161	3.129	14
refined-Unrefined	134	5.208	2.917	2
Human scale-Inhuman scale	127	7.881	3.483	9
Sympathetic-Unsympathetic	97	5.680	3.393	3
Suitable-Unsuitable	98	7.214	3.413	1
Expected-Unexpected	97	4.835	3.362	3
Large-Small	135	8.348	3.212	-
Inspiring-Discouragning	134	6.947	3.039	-
Mechanical space-Non-mechanical space	125	5.216	2.930	14
Light-Dark	135	7.925	2.790	1
Interesting-uninteresting	135	7.014	3.126	-

TABLE 2 Contd.

ADJECTIVE	n	M	SD	QM
Multiple purpose-Single pur.	133	7.609	2.732	1
Livable-unlivable (Rep)	134	7.746	3.074	-
Natural-Artificial	133	6.571	3.362	2
Inviting-Repelling	135	7.148	3.165	-
Neat-Messy (Rep)	134	6,761	3,176	-
Lively-Dull	134	6,410	3.131	-
Open-Closed	135	7.725	3.288	1
Modern-Old fashioned	135	5.955	3.584	-
Pleasant-Unpleasant (Rep)	135	6.992	3.233	-
Nice-Aweful	135	5.022	3.592	-
Sterile-Filthy	133	4,736	3,546	1
Stimulating-Unstimulating	134	6.656	3.355	1
Organized-Disorganized	134	7.589	2.772	1
New-Old	133	4,736	3.505	1
Ornate-Plain	135	5.859	3.167	-
Strong-Weak	131	4.748	3.201	2
Pleasant odour-Unpleasant Od.	135	4,740	3.538	1
Orderly-Chaotic	133	7.233	2.909	-
Commonplace-Unique	98	5.336	3.314	-
Coherent-Incoherent	96	5.458	3.349	-
Confident-Hesitant	97	4.597	3.331	4
Delicate-Rugged	98	5.132	3.225	-
Passive-Active	97	5.123	3.282	3

Table 2 Contd.

ADJECTIVE	n	M	SD	QM
Regular-Irregular	135	6.614	3.140	1
Relaxed-Tensed	135	6.637	3.196	-
Stylish-Unstylish	135	5.881	3.248	-
Refreshing-Wearying	135	6.659	3.054	-
Symmetrical-Asymmetrical	131	6.465	3.377	2
Tasteful-Tasteless	132	5.848	3.378	1
Rich-Poor	133	4.180	3.341	2
Soft lighting-Harsh Lighting	135	7.511	2.924	-
Well kept-Rundown	135	6.548	3.413	1
Scenic-Unsenic	135	6.192	3.397	1
Wide-Narrow	133	7.789	3.207	1
Roomy-cramped	134	9.171	2.236	-
Sparkling-Dingy	135	6.829	3.001	-
Well balanced-Poorly balanced	134	7.462	2.795	2
Unusual-Usual	135	5.414	3.267	1
Tidy-Untidy	133	6.436	3.303	1
Crowded-Uncrowded	133	8.195	2.893	1
Well scaled-Poorly scaled	131	8.274	2.726	4
Useful-Useless	135	5.762	3.372	-
Warm-Cool	134	6.910	3.240	1
Well organized-poorlu organized	134	7.947	2.918	1

TABLE 2 Contd.

ADJECTIVE	n	M	SD	QM
Neat-Messy (repeated)	134	6.485	3.055	-
Rough-Smooth	99	4.848	3.208	2
Peaceful-Ferocious	98	5.663	3.299	2
Statusful-Statusless	97	4.969	3.447	4
Stable-Unstable	97	5.360	3.354	4
Restrained-Unrestrained	130	6.384	3.108	3
Uncluttered-Cluttered (rep)	134	7.843	2.865	-
Sensitive-Insensitive	133	5.583	3.079	-
Graceful-Clumsy (rep)	133	5.992	3.139	-
Livable-unlivable (rep)	133	7.293	3.221	-
Soothing-Distracting	132	6.598	3.108	-
Well planned-Poorly planned	133	8.609	2.650	-
Restful-Disturbing (rep)	131	7.183	2.819	-
Romantic-Unromantic	131	4.916	3.118	-
Restricted-Unrestricted	131	7.748	2.753	-
Sophisticated-Unsophisticated	131	4.916	2.943	-
Alive-Dead	96	5.708	3.713	1
Dry-Humid	96	5.458	3.227	1
Defined space-Undefined space	97	7.525	2.858	1
Hard-Soft	97	4.721	3.200	1
Heavy-Light	97	5.618	3.583	1
Mystic-Nonmystic	92	4.260	3.133	6
Secure-Insecure	96	6.156	3.513	1

TABLE 2 Contd.

ADJECTIVE	n	M	SD	QM
Sociable-Unsociable	96	7.302	2.988	-
Urban-Rustic	96	5.635	3.353	2
Valuable-Worthless	95	4.294	3.457	2
Temporary-Permenant	97	5.835	3.695	4
Huge-Tiny (repeated)	96	7.895	3.326	-
Proud-Humble	94	5.393	3.186	1
Superior-Inferior	96	5.343	3.368	-
Agreeable-Disagreeable	97	6.608	3.203	-
Clear-Vague	96	5.666	2.954	1
Enjoyable-Not enjoyable	97	6.298	3.509	-
Changeable-Constant	97	6.185	3.282	1

TABLE 3

Means, standard deviations, medians and interquartile ranges of the retained adjective pairs at the end of the 'stage 1'.

	Adjective pair	Mean	St.D.	Median	Int.Q.R.
1.	Adequate size-Inadequate size	8.46	2.80	9	4
2.	Uncluttered-Cluttered	8.13	2.81	9	3
3.	Comfortable-Uncomfortable	7.63	2.85	8	4
4.	Free space-Restricted space	9.18	2.10	10	3
5.	Dynamic space-Static space	7.49	2.91	8	4
6.	Functional-Nonfunctional	7.45	3.13	8	4
7.	Cozy-Monumental	7.17	3.17	8	5
8.	Coordinated-Uncoordinated	7.08	2.89	8	3
9.	Good lighting-Poor lighting	7.90	3.23	9	5
10.	Good acoustics-Poor acoustics	7.59	2.99	8	4
11.	Impressive-Unimpressive	7.36	3.02	8	4

TABLE 3 Contd

	Adjective pair	Mean	St.D.	Median	Int.Q.R.
12.	Imaginative-Unimaginative	7.21	3.20	8	4
13.	Large-Small	8.35	3.21	10	5
14.	Dark-Light	7.93	2.79	8	5
15.	Open-Closed	7.73	3.29	9	5
16.	Multiple purpose-Single purpose	7.61	2.73	8	4
17.	Organized-Disorganized	7.59	2.77	8	4
18.	Inviting-Repelling	7.15	3.17	8	5
19.	Roomy-Cramped	9.17	2.24	10	3
20.	Well scaled-Poorly scaled	8.27	2.73	9	3
21.	Crowded-Uncrowded	8.20	2.89	9	3
22.	Well organized-Poorly organized	7.95	2.92	9	4
23.	Wide-Narrow	7.79	3.21	9	5

TABLE 3 Contd

	Adjective pair	Mean	St.D.	Median	Int.Q.R.
24.	Soft lighting-Harsh lighting	7.51	2.92	8	4
25.	Well balanced-Poorly balanced	7.46	2.80	8	3
26.	Well planned-Poorly planned	8.61	2.65	9	3
27.	Restricted-Unrestricted	7.75	2.76	8	4
28.	Restful-Disturbing	7.39	2.96	8	5
29.	Empty-Full	7.50	3.20	8	4
30.	Livable-Unlivable	7.75	3.07	8	5
31.	Huge-Tiny	8.19	3.20	9	5

TABLE 4

36 slides of interiors and order of presentation in 'Stage 2'

1. Villa Maerea, Noormarkku, Pori, Finland, Architect; A. Aalto. S.
2. A study room of a house in Scotland, C.
3. University of Strathclyde, Dept. of Architecture, G 10 B, postgraduate room. Architect; F. Fielden. C.
4. University of Sussex, Cafeteria. S
5. Univ. of Strathclyde, Dept. of Arch., G 1, Professor's room. S
6. A hotel lounge in Nyborg, Denmark. C
7. Hall of a secondary school in Arhus, Denmark. S
8. 'Hvittrask'-Eliel Saarinen's office, in 1930's, kept as a museum, Pori, Finland. Architect; E. Saarinen, 1935. S
9. Olympia Exhibition Hall, London, a small portion of an exhibition. S.
10. N. Kelvinshide Church, Glasgow. C
11. 'Modern Art Gallery', Nyborg, Denmark. S
12. Sittingroom of a farm house in Devon, England. C
13. University of Jyvåskyle, Library, Jyvaskyla, Finland. C
14. Univ. of Strathclyde, Dept. of Arch., Design Studio, Architect; F. Fielden. C

TABLE 4 Contd

15. 'La Tourette Chapel'. Architect; Le Corbusier. C
16. F. Fielden House, Dining Room. Architect; F. Fielden. S
17. Fleet Air Arm Base, aircraft exhibition, Yeovilton, England. C
18. Oulu University, restaurant, Oulu, Finland. C
19. University of Jyvaskyla, student lounge, Jyvaskyla, Finland. Architect; A. Aalto. S
20. Cafeteria of a secondary school in Arhus, Denmark. S
21. Odense Public Library, Odense, Denmark. S
22. Alborg Student Residences, Lounge, Alborg, Denmark. S
23. University of Jyvaskyla, Library, view from the gallery. C
24. Univ. of Strathclyde, Dept. of Arch., Ground floor exhibition hall. Architect; F. Fielden. C
25. A church in Odense, Denmark. S
26. Univ. of Strathclyde, Dept. of Arch., another view from design studios. Architect; F. Fielden. C
27. A primary school, classroom with children. C
28. Motherwell Town Council Building, Multipurpose room, Motherwell. C

TABLE 4 Contd.

29. Univ. of Strathclyde, Dept. of Arch., S 11, an office. Architect; F. Fielden. C

30. Showhouse, Living room. Architect; F. Fielden. S

31. A training centre, lounge, Denmark. S

32. A house in 1950's, living room. S

33. Alborg Modern Art Museum, Alborg, Denmark. S

34. Humlebaek Loisiana Art Museum, Humleback, Denmark. S

35. An 18. century church, England. S

36. A cafateria. C

S : spacious

C : not spacious

(the preliminary categerization of the slides by the author)

TABLE 5

Rank order of slides from the most spacious to not spacious. Very Spacious = 4, Spacious = 3, Not spacious = 2, Not spacious at all = 1

	Slide No	Name	Mean for two groups	Student M.	Office M.
1.	19	Lounge, A.Aalto	3.92	3.87	4.00
2.	31	Lounge, Denmark	3.74	3.74	3.73
3.	20	School cafeteria	3.70	3.63	3.82
4.	7	School entrance hall	3.60	3.47	3.80
5.	33	Alborg Art Museum	3.57	3.74	3.30
66.	4	Sussex, Cafteria	3.44	3.37	3.56
7.	34	Humlebaek Art Mus.	3.41	3.26	3.65
8.	32	Living room, old Fashion	3.23	3.11	3.42
9.	8	E. Saarinen's office	3.16	3.21	3.08
10.	5	Arch. Building. G.1	3.14	3.05	3.28
11.	6	Hotel lounge	3.14	3.13	3.16
12.	21	Odense Library	3.07	2.95	3.26

TABLE 5 Contd

	Slide No	Name	Mean for two groups	Student M	Office M
13.	22	Student lounge, Alborg	2.95	2.97	2.91
14.	16	F. Fielden, Dining room	2.90	2.84	3.00
15.	25	Church in Odense	2.90	3.05	2.65
16.	17	Aircraft exhibition	2.89	2.84	2.95
17.	11	Nyborg Art Gallery	2.84	2.82	2.88
18.	30	Showhouse, F. Fielden	2.79	2.74	2.86
19.	35	Old church	2.79	2.68	2.95
20.	18	University Restour. Fin.	2.74	2.58	3.00
21.	10	Kelvinside Church	2.67	2.37	3.12
22.	13	Jyvaskyla Library	2.49	2.50	2.48
23.	15	La Tourette, L.C.	2.39	2.45	1.91
24.	24	Arch. Building Exhibition	2.26	2.08	2.56
25.	1	Villa Maerea, A. Aalto	2.25	2.45	1.92

TABLE 5 Contd

	Slide No	Name	Mean for two groups	Student M	Office M
26.	23	Jyvaskyla Library	2.10	2.21	1.91
27.	36	Cafetreria, 2 storey	2.07	2.16	1.91
28.	3	Arch. Building G.10 B	1.98	1.92	2.08
29.	28	Motherwell Rown Council	1.79	1.84	1.69
30.	29	Arch. Building F 11	1.77	1.77	1.73
31.	12	House in Devon	1.68	1.66	1.80
32.	2	Study room	1.57	1.58	1.56
33.	9	Olympia Exhibition	1.24	1.24	1.24
34.	27	Primary school	1.23	1.21	1.26
35.	26	Arch. Building Studio	1.21	1.18	1.26
36.	14	Arch. Building Studio	1.08	1.11	1.04

TABLE 6 MEANS AND STANDARD DEVIATIONS OF THE 'MOST SPACIOUS' AND 'LEAST SPACIOUS' INTERIORS FOR THE TOTAL SUBJECT SAMPLE

Most spacious interiors

Slide No.	Name	Mean	St.dev.	
19	Lounge, A. Aalto	3.92	.276	selected
31	Lounge, Denmark	3.74	.443	selected
20	School cafeteria	3.70	.459	selected
7	School entrance hall	3.60	.583	selected
33	Alborg Art Museum	3.57	.740	selected
4	Sussex, cafeteria	3.44	.666	
34	Humlebaek Art Museum	3.41	.559	

TABLE 6 Contd.

Least spacious interiors

Slide No.	Name	Mean	St.dev.	
14	Arch. Bldg. Studio	1.08	.326	selected
26	Arch. Bldg. Studio	1.21	.451	
27	Primary School	1.23	.461	selected
9	Olympia Exhibition	1.24	.530	selected
2	Study room	1.57	.640	selected
12	House in Devon	1.68	.617	selected
29	Arch. Bldg. F 1	1.77	.616	
28	Motherwell Town Council	1.79	.709	

TABLE 7. PEARSON PRODUCT-MOMENT CORRELATION CO-EFFICIENTS OF 31 ADJECTIVE PAIRS FOR THE SPACIOUS INTERIORS.

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FILE NONAME (CREATION DATE = 06/24/74)

CORRELATION COEFFICIENTS..

	VAR001	VAR002	VAR003	VAR004	VAR005	VAR006	VAR007	VAR008	VAR009	VAR010
VAR001	1.00000	0.11062	0.09163	-0.38282	-0.19035	0.35670	-0.48294	-0.20568	-0.40542	0.43076
VAR002	0.11062	1.00000	0.24596	0.13946	0.18763	0.18215	0.14055	0.16271	0.12851	0.35585
VAR003	0.09163	0.24596	1.00000	0.03735	0.17778	0.09498	-0.04538	0.19697	0.05716	0.19031
VAR004	-0.38282	0.13945	0.03735	1.00000	0.38710	-0.18140	0.52370	0.48856	0.64001	-0.11121
VAR005	-0.19035	0.18763	0.17778	0.38710	1.00000	-0.02875	0.23258	0.36851	0.34503	-0.02353
VAR006	0.35670	0.18215	0.09498	-0.18140	-0.02875	1.00000	-0.29641	-0.09693	-0.23265	0.29133
VAR007	-0.48294	0.14055	-0.20538	0.52370	0.23258	-0.29641	1.00000	0.41394	0.66721	-0.19109
VAR008	-0.20568	0.16271	0.19897	0.48858	0.36851	-0.09693	0.41394	1.00000	0.49620	0.03796
VAR009	-0.40542	0.12651	0.05716	0.64001	0.34503	-0.23265	0.66721	0.49620	1.00000	-0.13184
VAR010	0.43076	0.35585	0.19031	-0.11121	-0.02353	0.29130	-0.19109	0.03796	-0.13184	1.00000
VAR011	0.02587	0.35855	0.16569	0.11361	0.10591	0.16106	0.19124	0.36147	0.14005	0.25095
VAR012	-0.08492	0.35107	0.12934	0.25542	0.09692	0.06951	0.30846	0.31402	0.31025	0.09752
VAR013	-0.16759	0.17284	-0.02828	0.29875	0.21904	-0.01109	0.44970	0.28847	0.42151	-0.05714
VAR014	-0.37792	0.15293	0.06937	0.58555	0.29727	-0.07814	0.58543	0.51261	0.63058	-0.03305
VAR015	-0.20028	0.13194	0.06682	0.27475	0.14454	-0.09978	0.37028	0.19431	0.34036	-0.10339
VAR016	-0.33770	0.10831	-0.14720	0.34188	0.10969	-0.11426	0.52120	0.24855	0.43047	-0.15759
VAR017	-0.30913	0.13594	-0.22691	0.35412	0.08179	-0.09701	0.60658	0.24930	0.45421	-0.10632
VAR018	-0.01226	0.38903	0.26970	0.20162	0.13763	0.10002	0.25010	0.16576	0.22552	0.22861
VAR019	0.02341	0.39932	0.24339	0.15910	0.08620	0.07727	0.18707	0.10969	0.20482	0.25572
VAR020	-0.14847	0.23761	0.39458	0.27344	0.16383	-0.12741	0.31882	0.29229	0.35021	0.10091
VAR021	-0.34238	0.15824	0.11742	0.56116	0.38472	-0.15414	0.56529	0.55640	0.65377	-0.03155
VAR022	-0.48066	0.12269	0.00145	0.46872	0.19059	-0.25585	0.73327	0.34499	0.54400	-0.10708
VAR023	-0.03243	0.26651	0.14757	0.26681	0.36172	0.06416	0.24218	0.35450	0.27516	0.14792
VAR024	-0.20468	0.10794	0.12941	0.24182	0.17322	-0.05259	0.23047	0.15946	0.28521	-0.02572
VAR025	-0.51786	0.06789	0.03549	0.46066	0.19225	-0.25420	0.73092	0.35514	0.54654	-0.20739
VAR026	-0.25029	0.13051	0.06215	0.40499	0.23323	-0.15253	0.43544	0.48346	0.56479	-0.04521
VAR027	-0.47377	0.09136	0.01696	0.39658	0.23551	-0.25215	0.59992	0.26772	0.45476	-0.27531
VAR028	-0.03418	0.34449	-0.01741	0.20555	0.11818	0.07093	0.35046	0.09257	0.25652	0.24741
VAR029	0.22991	0.33945	0.11037	0.09253	0.09375	0.18688	0.21714	0.20935	0.14082	0.15814
VAR030	0.17447	0.38571	0.21878	0.03529	0.08739	0.17963	0.09187	0.14826	0.05170	0.55145
VAR031	-0.22024	0.23384	0.02585	0.40155	0.14536	-0.04605	0.59884	0.32028	0.47956	0.02915

TABLE 7. (Cont'd.) PEARSON PRODUCT-MOMENT CORRELATION CO-EFFICIENTS OF 31 ADJECTIVE PAIRS FOR THE SPACIOUS INTERIORS.

	VAR011	VAR012	VAR013	VAR014	VAR015	VAR016	VAR017	VAR018	VAR019	VAR020
VAR001	0.02587	-0.08492	-0.18768	-0.32790	-0.20028	-0.33770	-0.30313	-0.01226	0.02341	-0.14847
VAR002	0.35855	0.35107	0.17084	0.15093	0.13194	0.10801	0.13594	0.38903	0.39932	0.23761
VAR003	0.16569	0.12934	-0.02828	0.06937	0.06062	-0.14720	-0.02691	0.06970	0.24339	0.39450
VAR004	0.11361	0.25542	0.29875	0.58555	0.27475	0.34188	0.35412	0.20162	0.15910	0.27344
VAR005	0.10591	0.09692	0.21904	0.29727	0.14454	0.10969	0.08179	0.13763	0.26020	0.16383
VAR006	0.18106	0.06951	-0.01109	-0.07814	-0.09978	-0.11425	-0.09701	0.10002	0.07727	-0.12741
VAR007	0.19124	0.36346	0.44000	0.58543	0.37028	0.52120	0.63658	0.25012	0.12777	0.31082
VAR008	0.36147	0.31492	0.28847	0.51281	0.19431	0.24605	0.24930	0.16576	0.16969	0.29229
VAR009	0.14666	0.31025	0.42151	0.63058	0.34636	0.43840	0.45421	0.22652	0.20462	0.35021
VAR010	0.25695	0.09762	-0.05714	-0.03386	-0.10339	-0.15769	-0.10632	0.24661	0.25872	0.10081
VAR011	1.00000	0.41853	0.30722	0.22309	0.11344	0.10184	0.13417	0.37060	0.28177	0.12322
VAR012	0.41853	1.00000	0.39372	0.39639	0.34252	0.27496	0.37982	0.51589	0.25222	0.19415
VAR013	0.30722	0.39372	1.00000	0.41333	0.31377	0.28445	0.41795	0.39778	0.16680	0.18553
VAR014	0.22309	0.39639	0.41333	1.00000	0.27393	0.37371	0.47669	0.20167	0.21715	0.31096
VAR015	0.11344	0.34252	0.31377	0.27393	1.00000	0.29842	0.31633	0.28560	0.11635	0.19741
VAR016	0.10184	0.27496	0.28445	0.37371	0.29842	1.00000	0.46058	0.23763	0.12729	0.29198
VAR017	0.13417	0.37982	0.41795	0.47669	0.31633	0.46058	1.00000	0.26232	0.20977	0.27527
VAR018	0.37060	0.51589	0.39778	0.20167	0.28560	0.23763	0.26232	1.00000	0.40542	0.18277
VAR019	0.28177	0.25222	0.16680	0.21715	0.11635	0.12729	0.20977	0.40542	1.00000	0.29590
VAR020	0.12322	0.19415	0.18553	0.31096	0.19741	0.29198	0.27527	0.18277	0.29590	1.00000
VAR021	0.25583	0.35169	0.37439	0.63726	0.28414	0.35045	0.41385	0.27293	0.18373	0.32696
VAR022	0.13592	0.27976	0.27131	0.52049	0.35440	0.54956	0.49394	0.22529	0.17219	0.31949
VAR023	0.25923	0.28787	0.28068	0.29910	0.13234	0.16536	0.24150	0.30723	0.19344	0.22345
VAR024	0.07106	0.16857	0.17619	0.32241	0.24369	0.16769	0.24687	0.15982	0.10929	0.22254
VAR025	0.09317	0.31749	0.35525	0.57090	0.34219	0.54256	0.55345	0.23251	0.15923	0.34103
VAR026	0.24003	0.29653	0.24546	0.47887	0.18725	0.27836	0.30097	0.11379	0.29522	0.24269
VAR027	0.26615	0.19970	0.24364	0.39772	0.35817	0.44572	0.40055	0.13877	0.16357	0.26592
VAR028	0.18614	0.39022	0.34857	0.25550	0.26095	0.31535	0.37399	0.38277	0.20367	0.17837
VAR029	0.29148	0.28493	0.19412	0.16073	0.09790	0.16444	0.15950	0.32581	0.32451	0.11598
VAR030	0.26509	0.20316	0.03227	0.02939	-0.03881	-0.01458	-0.02611	0.29235	0.31897	0.15599
VAR031	0.23482	0.41065	0.44038	0.52271	0.34935	0.46066	0.65336	0.30467	0.22145	0.25325

	VAR021	VAR022	VAR023	VAR024	VAR025	VAR026	VAR027	VAR028	VAR029	VAR030
VAR001	-0.34288	-0.48956	-0.03243	-0.20468	-0.51786	-0.25029	-0.47377	-0.03418	0.02991	0.17447
VAR002	0.15324	0.12269	0.26651	0.10794	0.06789	0.13451	0.09136	0.34449	0.33945	0.35071
VAR003	0.11742	0.00145	0.14757	0.12941	0.03549	0.06215	0.01696	-0.01741	0.11037	0.21379
VAR004	0.56116	0.46872	0.26681	0.24182	0.46066	0.40499	0.39658	0.20555	0.09250	0.03529
VAR005	0.38472	0.19059	0.30172	0.17322	0.19225	0.23323	0.23551	0.11616	0.09375	0.06739
VAR006	-0.15614	-0.25585	0.06416	-0.05259	-0.25428	-0.15253	-0.25215	0.07093	0.18688	0.17963
VAR007	0.58529	0.73307	0.24218	0.28047	0.73092	0.43544	0.59992	0.35046	0.21714	0.40187
VAR008	0.55548	0.34499	0.35450	0.15946	0.36514	0.48346	0.26772	0.09257	0.20908	0.14526
VAR009	0.65377	0.54403	0.27518	0.20821	0.54654	0.56479	0.45476	0.25650	0.14980	0.25173

TABLE 7. (Cont'd.) PEARSON PRODUCT-MOMENT CORRELATION CO-EFFICIENTS OF 31 ADJECTIVE PAIRS FOR THE SPACIOUS INTERIORS.

	VAR021	VAR022	VAR023	VAR024	VAR025	VAR026	VAR027	VAR028	VAR029	VAR030
VAR010	-0.23155	-0.16738	0.14790	-0.02502	-0.20739	-0.04521	-0.20531	0.24741	0.19814	0.55146
VAR011	0.25583	0.13592	0.25923	0.07106	0.29317	0.24003	0.06615	0.18614	0.29148	0.26909
VAR012	0.35169	0.27976	0.28787	0.16857	0.31749	0.29653	0.19920	0.39022	0.28493	0.20016
VAR013	0.37439	0.27131	0.29088	0.17619	0.35525	0.24546	0.24364	0.34657	0.19412	0.03227
VAR014	0.63726	0.52049	0.29910	0.32241	0.50090	0.47887	0.39772	0.25552	0.16073	0.02939
VAR015	0.28414	0.35440	0.13234	0.24369	0.34219	0.18725	0.35017	0.26095	0.09790	-0.40881
VAR016	0.35045	0.54956	0.16536	0.16789	0.54256	0.27856	0.44572	0.31535	0.16444	-0.21458
VAR017	0.41385	0.49394	0.24150	0.24887	0.55345	0.34097	0.40055	0.37399	0.15980	-0.02611
VAR018	0.27093	0.22529	0.30723	0.15982	0.23251	0.11379	0.13677	0.38277	0.32581	0.29235
VAR019	0.18373	0.17219	0.19334	0.10929	0.15923	0.09522	0.16357	0.20367	0.30451	0.31697
VAR020	0.37696	0.31949	0.22345	0.20054	0.34103	0.24289	0.26592	0.12587	0.11698	0.16599
VAR021	1.00000	0.55493	0.35360	0.21315	0.50873	0.54399	0.42073	0.21632	0.18046	0.08403
VAR022	0.55493	1.00000	0.22527	0.27126	0.72988	0.42098	0.60357	0.30040	0.18001	-0.02980
VAR023	0.35360	0.22527	1.00000	0.11987	0.18523	0.23395	0.11445	0.22608	0.24859	0.21202
VAR024	0.21315	0.27126	0.11987	1.00000	0.32350	0.19427	0.28021	0.14996	0.06633	-0.01259
VAR025	0.50873	0.72988	0.18523	0.32350	1.00000	0.42522	0.62945	0.28567	0.14190	-0.24174
VAR026	0.54399	0.42098	0.23395	0.19427	0.42522	1.00000	0.37256	0.13796	0.15279	0.06853
VAR027	0.42073	0.60357	0.11445	0.28021	0.62945	0.37256	1.00000	0.18663	0.10045	-0.06702
VAR028	0.21632	0.30040	0.22608	0.14996	0.28567	0.13796	0.18663	1.00000	0.34348	0.29681
VAR029	0.18046	0.18001	0.24859	0.06633	0.14190	0.15279	0.10045	0.34348	1.00000	0.31712
VAR030	0.08403	-0.02980	0.21202	-0.01259	-0.24174	0.06853	-0.06702	0.29681	0.31712	1.00000
VAR031	0.50959	0.51677	0.21485	0.25424	0.50523	0.33242	0.44759	0.49888	0.28786	0.11352

	VAR031
VAR001	-0.22024
VAR002	0.23384
VAR003	0.02585
VAR004	0.42155
VAR005	0.14536
VAR006	-0.04605
VAR007	0.59664
VAR008	0.32026
VAR009	0.47955
VAR010	0.04915
VAR011	0.23462
VAR012	0.41265
VAR013	0.44628
VAR014	0.52271
VAR015	0.34935
VAR016	0.46066
VAR017	0.65336
VAR018	0.30467
VAR019	0.22145
VAR020	0.25325
VAR021	0.50959
VAR022	0.51677
VAR023	0.21485
VAR024	0.25424
VAR025	0.50523
VAR026	0.33242
VAR027	0.44759
VAR028	0.49888
VAR029	0.28786
VAR030	0.11352
VAR031	1.00000

TABLE 8. PEARSON PRODUCT-MOMENT CORRELATION CO-EFFICIENTS OF 31 ADJECTIVE PAIRS FOR THE NOT-SPACIOUS INTERIORS.

FACTOR ANALYSIS OF ALL DATA FOR 2 TO 6 FACTORS 06/25/74 PAGE 5

FILE NONAME (CREATION DATE = 06/25/74)

CORRELATION COEFFICIENTS..

	VAR001	VAR002	VAR003	VAR004	VAR005	VAR006	VAR007	VAR008	VAR009	VAR010
VAR001	1.00000	-0.17743	0.22391	-0.21257	-0.20097	-0.20412	-0.45649	-0.24305	-0.23683	0.18489
VAR002	-0.17743	1.00000	0.11407	0.45511	0.26406	0.38549	0.47706	0.43539	0.52422	0.42433
VAR003	0.22391	0.11407	1.00000	0.07874	0.06229	0.05413	0.00007	0.09969	0.05466	0.16952
VAR004	-0.21257	0.45511	0.07874	1.00000	0.28956	0.18674	0.44388	0.43748	0.58218	0.27399
VAR005	-0.20097	0.26406	0.06229	0.28956	1.00000	0.07167	0.36603	0.32604	0.32555	0.17142
VAR006	-0.20412	0.38549	0.05413	0.18674	0.07167	1.00000	0.24498	0.37002	0.25267	0.35171
VAR007	-0.45649	0.47706	0.00007	0.44388	0.36603	0.24498	1.00000	0.44431	0.49567	0.18274
VAR008	-0.24305	0.43539	0.09969	0.43748	0.32604	0.37002	0.44431	1.00000	0.57558	0.12932
VAR009	-0.23683	0.52422	0.05466	0.58218	0.32555	0.25267	0.49567	0.57558	1.00000	0.27154
VAR010	0.18489	0.42433	0.16952	0.27399	0.17142	0.35171	0.18274	0.12932	0.27154	1.00000
VAR011	-0.24455	0.47247	0.04287	0.29791	0.15772	0.55918	0.34362	0.53438	0.49175	0.34686
VAR012	-0.12515	0.42346	0.18567	0.35649	0.24462	0.18413	0.38454	0.34601	0.38672	0.32995
VAR013	-0.03672	0.25640	0.12526	0.20428	0.14351	0.02343	0.20356	0.01674	0.21191	0.27421
VAR014	-0.21531	0.47964	0.12148	0.51285	0.33944	0.33649	0.48557	0.61129	0.64546	0.29117
VAR015	0.00632	0.17263	0.02189	0.20605	0.11494	-0.04199	0.10763	0.20543	0.14718	0.31455
VAR016	-0.34325	0.20452	-0.12592	0.24958	0.16262	0.21283	0.33287	0.21731	0.25795	0.07415
VAR017	-0.10937	0.41945	0.20497	0.42367	0.24989	0.29039	0.45708	0.39912	0.42597	0.25456
VAR018	-0.01349	0.45537	0.15390	0.31019	0.19834	0.23946	0.29722	0.29588	0.34658	0.32493
VAR019	0.08340	0.38763	0.29818	0.25821	0.14251	0.20808	0.22243	0.20065	0.23039	0.39592
VAR020	0.08544	0.21729	0.61584	0.23642	0.16629	0.11202	0.16264	0.22288	0.23758	0.22385
VAR021	-0.25407	0.42181	0.07415	0.44224	0.30268	0.34864	0.46004	0.65499	0.55781	0.11855
VAR022	-0.45718	0.51322	-0.01954	0.39378	0.26236	0.43780	0.64373	0.49313	0.47717	0.13032
VAR023	-0.23373	0.01259	0.01222	0.46285	0.25591	0.40448	0.44931	0.44432	0.45403	0.00742
VAR024	-0.26120	0.24659	-0.03031	0.28422	0.20877	0.10041	0.33767	0.28142	0.32949	0.05923
VAR025	-0.46271	0.47041	0.03949	0.41589	0.36165	0.28838	0.65579	0.44331	0.47654	0.10415
VAR026	-0.25130	0.45467	0.08438	0.46267	0.32384	0.26403	0.46616	0.59663	0.54632	0.21359
VAR027	-0.51069	0.42763	-0.13287	0.43230	0.31711	0.31517	0.59320	0.44628	0.45628	0.26935
VAR028	0.20720	0.37277	0.03286	0.24175	0.12544	-0.02361	0.24425	0.06180	0.21977	0.57541
VAR029	-0.21078	0.52319	0.09266	0.33771	0.17715	0.57905	0.37164	0.46335	0.42935	0.21183
VAR030	0.12782	0.41546	0.11968	0.22135	0.17257	0.01698	0.17548	0.27929	0.25422	0.67418
VAR031	-0.25389	0.47498	0.13277	0.45260	0.29932	0.14576	0.43480	0.38732	0.46925	0.29323

TABLE 8. (Cont'd.) PEARSON PRODUCT-MOMENT CORRELATION CO-EFFICIENTS OF 31 ADJECTIVE PAIRS FOR THE NOT-SPACIOUS INTERIORS.

	VAR011	VAR012	VAR013	VAR014	VAR015	VAR016	VAR017	VAR018	VAR019	VAR020
VAR001	-0.24455	-0.12515	-0.03672	-0.21531	0.02632	-0.34828	-0.16937	-0.01349	0.08340	0.08544
VAR002	0.47247	0.42346	0.25843	0.47964	0.17203	0.29452	0.41945	0.45537	0.38763	0.21729
VAR003	0.04287	0.18567	0.12526	0.10148	0.02189	-0.12692	0.20497	0.15390	0.29818	0.61584
VAR004	0.29791	0.35649	0.20428	0.51285	0.27605	0.24958	0.42367	0.31019	0.25821	0.23642
VAR005	0.15772	0.24462	0.14351	0.33944	0.11494	0.16262	0.24989	0.19804	0.14251	0.16809
VAR006	0.55918	0.18413	0.02343	0.30649	-0.04199	0.21283	0.29039	0.23946	0.20808	0.11202
VAR007	0.34362	0.38454	0.20356	0.48557	0.10760	[illegible]	0.45708	0.29722	0.22043	0.16254
VAR008	0.53438	0.34601	0.01674	0.61129	0.06643	0.21701	0.39912	0.29588	0.20055	0.22285
VAR009	0.49175	0.38672	0.21191	0.64646	0.14718	0.25998	0.42997	0.34858	0.23029	0.23758
VAR010	0.04686	0.30995	0.27421	0.29117	0.31455	0.07415	0.25456	0.32490	0.39592	0.22385
VAR011	1.00000	0.26370	0.02623	0.46841	-0.02483	0.18109	0.32101	0.21400	0.14815	0.16488
VAR012	0.26372	1.00000	0.28702	0.41557	0.28282	0.15662	0.31609	0.51647	0.27248	0.21913
VAR013	0.02623	0.29772	1.00000	0.20110	0.32683	0.02581	0.31944	0.27073	0.31729	0.12067
VAR014	0.46841	0.41557	0.20110	1.00000	0.09168	0.26479	0.54846	0.32739	0.25491	0.29614
VAR015	-0.02483	0.28282	0.32683	0.09168	1.00000	0.08164	0.15051	0.29952	0.25343	0.09517
VAR016	0.18109	0.15662	0.02581	0.26479	0.08164	1.00000	0.18541	0.11317	0.09388	0.16681
VAR017	0.32101	0.31609	0.31944	0.54846	0.15051	0.18541	1.00000	0.32844	0.36309	0.32625
VAR018	0.21400	0.51847	0.27073	0.32739	0.29952	0.11317	0.32844	1.00000	0.47224	0.22481
VAR019	0.14515	0.27248	0.31729	0.25491	0.25743	0.09388	0.36539	0.47224	1.00000	0.35353
VAR020	0.15488	0.21913	0.12067	0.29614	0.09517	0.16681	0.32606	0.22481	0.35583	1.00000
VAR021	0.52661	0.27545	0.10304	0.63030	0.03434	0.22969	0.50487	0.26993	0.20628	0.27034
VAR022	0.47391	0.31622	0.07652	0.49277	0.02541	0.44764	0.39295	0.27273	0.18531	0.16387
VAR023	0.43703	0.36262	0.14150	0.49594	0.14528	0.32217	0.42612	0.36452	0.19784	0.21116
VAR024	0.14521	0.19228	0.02583	0.37083	0.22936	0.20716	0.22628	0.13190	0.08077	0.13525
VAR025	0.32055	0.32397	0.12823	0.52983	0.10933	0.42834	0.47452	0.26189	0.20635	0.21145
VAR026	0.30772	0.37093	0.15025	0.56712	0.15490	0.22025	0.46435	0.28267	0.21539	0.22034
VAR027	0.36261	0.35734	0.11813	0.49492	0.13314	0.34050	0.41402	0.26634	0.12687	0.12030
VAR028	-0.02930	0.27718	0.23430	0.19477	0.28586	0.10625	0.14952	0.25277	0.25412	0.24333
VAR029	0.54756	0.22504	0.11615	0.40204	0.02770	0.22105	0.36600	0.27931	0.26425	0.15953
VAR030	0.32272	0.27116	0.31323	0.24612	0.27385	0.07419	0.25088	0.29733	0.34957	0.14311
VAR031	0.28276	0.35220	0.32077	0.53534	0.16776	0.22156	0.53806	0.25982	0.30146	0.23250

	VAR021	VAR022	VAR023	VAR024	VAR025	VAR026	VAR027	VAR028	VAR029	VAR030
VAR001	-0.25427	-0.46718	-0.23373	-0.26128	-0.48271	-0.25130	-0.51069	0.02700	-0.21078	0.12782
VAR002	0.42181	0.51322	0.61259	0.24699	0.47041	0.45457	0.42768	0.37277	0.52219	0.41545
VAR003	0.07415	-0.31954	0.01222	-0.03001	0.03949	0.08438	-0.13287	0.03286	0.09266	0.11963
VAR004	0.44224	0.39373	0.46285	0.28422	0.41569	0.46287	0.43230	0.24175	0.33771	0.22135
VAR005	0.33268	0.26236	0.25591	0.20877	0.36165	0.32384	0.31711	0.12544	0.17715	0.17457
VAR006	0.34564	0.43780	0.42448	0.10031	0.28838	0.26403	0.31517	-0.02361	0.57925	0.01598
VAR007	0.46024	0.64373	0.44931	0.33767	0.65579	0.46816	0.59320	0.24425	0.37154	0.17548
VAR008	0.65499	0.49313	0.44432	0.29142	0.44331	0.58660	0.44628	0.26180	0.46335	0.07929
VAR009	0.58781	0.47717	0.45408	0.32949	0.47854	0.54880	0.48628	0.21977	0.42936	0.25432

TABLE 8. (Cont'd.) PEARSON PRODUCT-MOMENT CORRELATION CO-EFFICIENTS OF 31 ADJECTIVE PAIRS FOR THE NOT-SPACIOUS INTERIORS.

	VAR021	VAR022	VAR023	VAR024	VAR025	VAR026	VAR027	VAR028	VAR029	VAR030
VAR010	0.11856	0.13082	0.30792	0.05923	0.15015	0.21369	0.06938	0.57541	0.21183	0.67418
VAR011	0.52661	0.47391	0.43703	0.14521	0.32055	0.38772	0.36261	-0.02930	0.54756	0.02272
VAR012	0.27545	0.31622	0.36262	0.19228	0.32397	0.37093	0.35734	0.27718	0.22504	0.27116
VAR013	0.10304	0.07652	0.14150	0.02580	0.12623	0.15305	0.11813	0.23430	0.11515	0.31323
VAR014	0.63030	0.49277	0.49594	0.37083	0.52983	0.56712	0.49492	0.19477	0.40224	0.24612
VAR015	0.03434	0.02541	0.14528	0.02935	0.10933	0.15490	0.13314	0.28586	0.02770	0.27335
VAR016	0.22969	0.44764	0.30217	0.22716	0.42834	0.20025	0.34650	0.10625	0.22105	0.07419
VAR017	0.50487	0.39295	0.42612	0.22628	0.47462	0.46405	0.41402	0.14952	0.36620	0.25283
VAR018	0.26993	0.27273	0.36452	0.13190	0.28189	0.28267	0.26834	0.25277	0.27931	0.29733
VAR019	0.20688	0.18501	0.19784	0.08077	0.20635	0.21539	0.12687	0.25412	0.26425	0.34967
VAR020	0.27034	0.16387	0.21116	0.13626	0.21145	0.23904	0.10630	0.04333	0.18960	0.14011
VAR021	1.00000	0.57892	0.50993	0.31364	0.48568	0.64847	0.44615	0.10747	0.45580	0.09555
VAR022	0.57392	1.00000	0.57695	0.30452	0.67647	0.47689	0.63202	0.17974	0.51403	0.09225
VAR023	0.50990	0.57695	1.00000	0.27039	0.52615	0.46218	0.50985	0.31625	0.49950	0.31928
VAR024	0.31364	0.30452	0.27039	1.00000	0.40370	0.32520	0.41090	0.12792	0.17695	0.11749
VAR025	0.46568	0.67647	0.52615	0.40370	1.00000	0.49099	0.69321	0.19752	0.38023	0.16749
VAR026	0.64847	0.47839	0.46218	0.32520	0.49099	1.00000	0.49969	0.18659	0.38652	0.22494
VAR027	0.44615	0.63202	0.50985	0.41090	0.69321	0.49969	1.00000	0.10819	0.35783	0.11344
VAR028	0.10747	0.17974	0.31625	0.12792	0.19752	0.18659	0.13819	1.00000	0.11605	0.63098
VAR029	0.45583	0.51403	0.49950	0.17695	0.38023	0.38652	0.35783	0.11605	1.00000	0.22718
VAR030	0.09555	0.09225	0.31928	0.11749	0.16749	0.22494	0.11344	0.63398	0.22718	1.00000
VAR031	0.41736	0.44202	0.39844	0.29491	0.49374	0.45254	0.44870	0.26937	0.31645	0.33978

	VAR031
VAR001	-0.25389
VAR002	0.47408
VAR003	0.13077
VAR004	0.45260
VAR005	0.29922
VAR006	0.14576
VAR007	0.48460
VAR008	0.38732
VAR009	0.46325
VAR010	0.29323
VAR011	0.28276
VAR012	0.35220
VAR013	0.32077
VAR014	0.53534
VAR015	0.16776
VAR016	0.22156
VAR017	0.53826
VAR018	0.25982

	VAR031
VAR019	0.30146
VAR020	0.23250
VAR021	0.41735
VAR022	0.44202
VAR023	0.39844
VAR024	0.29491
VAR025	0.49374
VAR026	0.45254
VAR027	0.44870
VAR028	0.26937
VAR029	0.31645
VAR030	0.33978
VAR031	1.00000

TABLE 9. SIX-FACTOR SOLUTION — SPACIOUS INTERIORS.

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6
VAR001	-0.60567	0.33387	-0.14361	0.03853	-0.11057	-0.03464
VAR002	0.03150	0.59422	0.04144	0.26877	0.12716	0.25967
VAR003	-0.14358	0.14974	0.11544	0.03047	0.11411	0.77559
VAR004	0.47580	0.00582	0.42592	0.05309	0.43036	0.03277
VAR005	0.07417	0.05452	0.25633	-0.00034	0.79321	0.08760
VAR006	-0.41698	0.32317	-0.07194	0.27155	0.04600	-0.10444
VAR007	0.79158	0.03100	0.29058	0.21034	0.09442	0.02811
VAR008	0.20416	0.08199	0.73941	0.10881	0.20620	0.15965
VAR009	0.52728	0.00652	0.47568	0.12693	0.30348	0.07566
VAR010	-0.26987	0.73976	0.01693	-0.04775	0.01777	0.10984
VAR011	-0.09908	0.29587	0.49440	0.49733	-0.17627	0.12542
VAR012	0.19610	0.21857	0.27077	0.67832	-0.04782	0.09014
VAR013	0.25609	0.01573	0.22074	0.63256	0.19746	-0.10326
VAR014	0.48657	0.04357	0.50423	0.23279	0.25970	0.04940
VAR015	0.36946	-0.10443	-0.08764	0.50385	0.20149	0.19176
VAR016	0.68608	0.10234	0.06759	0.16669	-0.01698	-0.09517
VAR017	0.64346	0.08006	0.08847	0.37648	0.00899	-0.03430
VAR018	0.13852	0.37934	0.02877	0.61608	0.08166	0.10154
VAR019	0.15442	0.47377	0.07800	0.19269	-0.07952	0.41662
VAR020	0.34832	0.17303	0.14967	0.00588	0.05146	0.64512
VAR021	0.46906	0.07112	0.60027	0.15045	0.27854	0.06061
VAR022	0.80229	0.04787	0.21520	0.08211	0.05703	0.07786
VAR023	0.34715	0.28714	0.30737	0.22893	0.47398	0.02390
VAR024	0.29610	-0.08223	-0.12244	0.24944	0.37484	0.32793
VAR025	0.50395	-0.02996	0.18205	0.14562	0.06105	0.12675
VAR026	0.35856	0.03542	0.65165	0.03715	0.05558	0.04655
VAR027	0.72368	-0.05920	0.09147	0.05137	0.10786	0.16808
VAR028	0.38986	0.55114	-0.15215	0.33194	0.18761	-0.22233
VAR029	0.14138	0.55824	0.13298	0.20927	-0.02537	-0.03697
VAR030	-0.06734	0.76621	0.09875	-0.06416	0.05357	0.12620
VAR031	0.62184	0.25693	0.15189	0.36786	0.06840	-0.07386

TABLE 10. FIVE-FACTOR SOLUTION — SPACIOUS INTERIORS

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
VAR001	-0.59115	-0.20200	0.34455	0.01102	-0.06824
VAR002	0.01710	0.10166	0.59930	0.26447	0.25355
VAR003	-0.15664	0.16400	0.21094	-0.02028	0.74759
VAR004	0.43713	0.59854	-0.02576	0.09582	0.07822
VAR005	-0.00285	0.61737	-0.33799	0.10931	0.21566
VAR006	-0.42314	-0.05344	0.31713	0.26996	-0.10489
VAR007	0.77938	0.32732	0.03558	0.21889	0.03263
VAR008	0.19696	0.75404	0.13530	0.05050	0.09900
VAR009	0.56043	0.56462	0.00352	0.14264	0.09039
VAR010	-0.26170	0.00698	0.73665	-0.06361	0.07221
VAR011	-0.07702	0.34689	0.40264	0.37840	0.00458
VAR012	0.19265	0.22681	0.28248	0.62057	0.04220
VAR013	0.23571	0.30701	0.02299	0.64208	-0.07721
VAR014	0.46376	0.58572	0.05488	0.22942	0.04775
VAR015	0.32986	0.04841	-0.11201	0.54111	0.25671
VAR016	0.68326	0.07161	0.09067	0.18721	-0.08479
VAR017	0.63321	0.13538	0.08316	0.38752	-0.02281
VAR018	0.11885	0.07791	0.39510	0.61033	0.10620
VAR019	0.16112	0.23793	0.52328	0.14370	0.36476
VAR020	0.34142	0.17503	0.22128	-0.02950	0.61896
VAR021	0.44850	0.67626	0.08604	0.13940	0.04708
VAR022	0.79481	0.24200	0.04814	0.09401	0.08261
VAR023	0.20254	0.50343	0.24998	0.27130	0.07223
VAR024	0.24304	0.09894	-0.11911	0.31744	0.42676
VAR025	0.79259	0.21519	-0.02483	0.15744	0.13852
VAR026	0.37592	0.63586	0.08682	-0.02109	-0.02312
VAR027	0.70721	0.15953	-0.05849	0.07923	0.19671
VAR028	0.36379	-0.23238	0.48122	0.40771	-0.15887
VAR029	0.14772	0.18363	0.56602	0.19164	-0.07333
VAR030	-0.06158	0.10161	0.76027	-0.07530	0.08979
VAR031	0.50942	0.18711	0.25915	0.38383	-0.06446

TABLE 11. FOUR-FACTOR SOLUTION — SPACIOUS INTERIORS

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
VAR001	-0.59062	-0.23157	0.33221	0.03067
VAR002	0.05448	0.08815	0.61259	0.34330
VAR003	-0.10473	0.16547	0.10613	0.71933
VAR004	0.42984	0.61274	0.00504	0.05287
VAR005	0.03033	0.62562	0.02736	0.13924
VAR006	-0.36554	-0.26933	0.45522	-0.09332
VAR007	0.75270	0.34996	0.09711	0.00629
VAR008	0.17007	0.75373	0.12797	0.13539
VAR009	0.55833	0.60194	0.04337	0.26394
VAR010	-0.32977	-0.03541	0.56627	0.34030
VAR011	-0.01869	0.33952	0.55730	0.01536
VAR012	0.32460	0.24334	0.57607	-0.07084
VAR013	0.38151	0.33331	0.38647	-0.27323
VAR014	0.48202	0.60106	0.14840	0.02942
VAR015	0.49835	0.08711	0.18306	0.00412
VAR016	0.68090	0.08642	0.13571	-0.07112
VAR017	0.69495	0.12956	0.24590	-0.09473
VAR018	0.25300	0.08677	0.65735	0.02320
VAR019	0.17850	0.02896	0.45779	0.46082
VAR020	0.35105	0.18299	0.07981	0.64165
VAR021	0.43636	0.68605	0.12339	0.25287
VAR022	0.77555	0.26078	0.02623	0.09812
VAR023	0.24266	0.50215	0.36287	0.06207
VAR024	0.37037	0.13107	0.03579	0.22215
VAR025	0.00470	0.24424	-0.00[illegible]	0.29626
VAR026	0.31776	0.62653	0.04035	0.04598
VAR027	0.71433	0.10434	-0.05048	0.15495
VAR028	0.39795	-0.03576	0.62624	-0.08882
VAR029	0.12808	0.08449	0.56159	0.08367
VAR030	-0.14705	0.06187	0.56221	0.37955
VAR031	0.54836	0.20339	0.38543	-0.06842

TABLE 12. THREE-FACTOR SOLUTION — SPACIOUS INTERIOR

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3
VAR001	-0.52879	-0.26681	0.39493
VAR002	0.08198	0.15713	0.66566
VAR003	-0.24673	0.46388	0.28471
VAR004	0.44995	0.58591	-0.02288
VAR005	0.05510	0.60971	0.06754
VAR006	-0.24785	-0.18450	0.46087
VAR007	0.79412	0.34754	0.00622
VAR008	0.21779	0.71536	0.14930
VAR009	0.57466	0.58549	0.20081
VAR010	-0.37051	0.03858	0.66456
VAR011	0.10828	0.23294	0.55053
VAR012	0.44972	0.12882	0.50498
VAR013	0.52940	0.13633	0.27207
VAR014	0.51476	0.54103	0.09885
VAR015	0.51075	0.08844	0.11581
VAR016	0.69462	0.06977	0.03338
VAR017	0.73757	0.08341	0.13440
VAR018	0.35852	0.02228	0.61071
VAR019	0.13686	0.19836	0.52712
VAR020	0.20132	0.47570	0.18623
VAR021	0.48381	0.63558	0.39203
VAR022	0.73784	0.32117	-0.04118
VAR023	0.13469	0.42449	0.36949
VAR024	0.31288	0.23962	0.04341
VAR025	0.75975	0.31104	-0.07081
VAR026	0.35128	0.56553	0.02313
VAR027	0.63964	0.29059	-0.12512
VAR028	0.50421	-0.12168	0.51731
VAR029	0.20774	0.05241	0.54742
VAR030	-0.12932	0.15431	0.64942
VAR031	0.71760	0.13735	0.28131

TABLE 13. TWO-FACTOR SOLUTION — SPACIOUS INTERIOR

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2
VAR001	-0.61980	0.34941
VAR002	0.13354	0.68317
VAR003	0.00086	0.37337
VAR004	0.68483	0.07823
VAR005	0.35072	0.18091
VAR006	-0.34193	0.42315
VAR007	0.85755	0.05343
VAR008	0.53762	0.27729
VAR009	0.78091	0.09847
VAR010	-0.28999	0.66668
VAR011	0.16834	0.58244
VAR012	0.41245	0.50952
VAR013	0.50371	0.28094
VAR014	0.72555	0.18719
VAR015	0.47452	0.11643
VAR016	0.62939	0.02965
VAR017	0.66537	0.13838
VAR018	0.27203	0.59520
VAR019	0.17722	0.55183
VAR020	0.39931	0.26840
VAR021	0.73016	0.19956
VAR022	0.79953	0.00320
VAR023	0.33199	0.44012
VAR024	0.38636	0.08064
VAR025	0.81551	-0.02832
VAR026	0.58620	0.12185
VAR027	0.72619	-0.08268
VAR028	0.33150	0.47275
VAR029	0.16263	0.54236
VAR030	-0.06319	0.66977
VAR031	0.66415	0.28528

TABLE 14. EIGENVALUES, PERCENTAGES OF VARIANCE AND CUMULATIVE PERCENTAGES FOR SPACIOUS INTERIORS.

VARIABLE	EST COMMUNALITY	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
VAR001	1.00000	1	9.23098	29.8	29.8
VAR002	1.00000	2	3.68252	11.9	41.7
VAR003	1.00000	3	1.86178	6.0	47.7
VAR004	1.00000	4	1.36434	4.4	52.1
VAR005	1.00000	5	1.14367	3.6	55.6
VAR006	1.00000	6	1.00637	3.2	58.9
VAR007	1.00000	7	0.95290	3.1	61.9
VAR008	1.00000	8	0.86492	2.8	64.7
VAR009	1.00000	9	0.84101	2.7	67.4
VAR010	1.00000	10	0.77081	2.5	69.9
VAR011	1.00000	11	0.71770	2.3	72.2
VAR012	1.00000	12	0.69943	2.3	74.5
VAR013	1.00000	13	0.65567	2.1	76.6
VAR014	1.00000	14	0.61650	2.0	78.6
VAR015	1.00000	15	0.60099	1.9	80.5
VAR016	1.00000	16	0.59515	1.9	82.5
VAR017	1.00000	17	0.54445	1.8	84.2
VAR018	1.00000	18	0.49942	1.6	85.8
VAR019	1.00000	19	0.47229	1.5	87.4
VAR020	1.00000	20	0.43412	1.4	88.8
VAR021	1.00000	21	0.42261	1.4	90.1
VAR022	1.00000	22	0.40967	1.3	91.4
VAR023	1.00000	23	0.39020	1.3	92.7
VAR024	1.00000	24	0.37803	1.2	93.9
VAR025	1.00000	25	0.35444	1.1	95.1
VAR026	1.00000	26	0.31370	1.0	96.1
VAR027	1.00000	27	0.29318	0.9	97.0
VAR028	1.00000	28	0.27194	0.9	97.9
VAR029	1.00000	29	0.24565	0.8	98.7
VAR030	1.00000	30	0.21992	0.7	99.4
VAR031	1.00000	31	0.18635	0.6	100.0

TABLE 15. SIX-FACTOR SOLUTION — NOT SPACIOUS INTERIORS

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6
VAR001	-0.18179	0.23626	-0.08150	-0.70109	-0.04563	0.24261
VAR002	0.34283	0.40518	0.48469	0.26678	0.25786	0.08451
VAR003	0.06244	0.02259	0.01952	-0.15776	0.07990	0.84057
VAR004	0.59239	0.17958	0.11421	0.19928	0.22526	0.05811
VAR005	0.47092	0.07000	-0.11055	0.22844	0.14122	0.07739
VAR006	0.06700	-0.05303	0.81821	0.17849	0.04259	0.06009
VAR007	0.45310	0.09103	0.14817	0.59675	0.20007	0.02311
VAR008	0.71863	-0.04836	0.39033	0.08509	0.03366	0.05581
VAR009	0.72066	0.15488	0.24856	0.14713	0.16249	0.00548
VAR010	0.14528	0.78662	0.07801	-0.06478	0.24366	0.15849
VAR011	0.41802	-0.10208	0.70896	0.06528	0.01236	-0.00143
VAR012	0.34341	0.12436	0.15256	0.12722	0.55845	0.08732
VAR013	0.09152	0.13518	-0.05873	0.04099	0.68527	0.07916
VAR014	0.74544	0.13816	0.23185	0.17919	0.11457	0.12778
VAR015	0.05257	0.19255	-0.10598	0.01716	0.67034	-0.07551
VAR016	0.02489	0.10828	0.16260	0.67845	-0.01998	0.06358
VAR017	0.48414	0.07546	0.19345	0.22737	0.29768	0.30455
VAR018	0.18320	0.15881	0.30382	0.05095	0.62528	0.13928
VAR019	0.05654	0.25757	0.23528	0.03758	0.47963	0.44245
VAR020	0.20331	0.05127	0.05813	0.09209	0.05797	0.84012
VAR021	0.73664	-0.01431	0.35772	0.14823	-0.03283	0.09244
VAR022	0.37547	0.06665	0.43816	0.62780	0.03314	0.01995
VAR023	0.39095	0.33428	0.46549	0.34137	0.09924	0.00387
VAR024	0.44452	0.11162	-0.10513	0.39173	-0.10636	0.04001
VAR025	0.43553	0.08684	0.15618	0.70572	0.10807	0.10372
VAR026	0.72648	0.09425	0.20408	0.15265	0.12712	0.02589
VAR027	0.46663	-0.02146	0.19052	0.62635	0.17467	-0.11242
VAR028	0.09161	0.81096	-0.02828	0.12115	0.17616	-0.06293
VAR029	0.26521	0.15722	0.71905	0.16061	0.03802	0.08875
VAR030	0.13071	0.83632	0.02883	-0.00454	0.21459	0.07527
VAR031	0.52503	0.22980	0.03056	0.32659	0.24886	0.16137

TABLE 16. FIVE-FACTOR SOLUTION — NOT SPACIOUS INTERIOR

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
VAR001	-0.20250	0.16073	-0.07696	-0.73668	0.17639
VAR002	0.34637	0.46581	0.50910	0.22974	0.09797
VAR003	0.07128	0.03512	0.01832	-0.22410	0.80231
VAR004	0.59136	0.25405	0.13751	0.18790	0.10532
VAR005	0.48461	0.13241	-0.09300	0.21170	0.10429
VAR006	0.03487	-0.03799	0.81344	0.19637	0.10058
VAR007	0.47768	0.18754	0.16452	0.58255	0.06785
VAR008	0.59347	-0.04015	0.41306	0.07524	0.09673
VAR009	0.70931	0.20528	0.27780	0.13108	0.04890
VAR010	0.17597	0.78075	0.11762	-0.16738	0.07756
VAR011	-0.37516	-0.09759	0.71620	0.08399	0.05252
VAR012	0.30555	0.40291	0.14399	0.22467	0.26277
VAR013	0.04948	0.48894	-0.08325	0.18034	0.29066
VAR014	0.74424	0.16170	0.26404	0.13745	0.14466
VAR015	0.01168	0.53422	-0.12786	0.16005	0.13174
VAR016	0.08267	0.08134	0.17602	0.60641	0.00658
VAR017	0.47710	0.21029	0.20233	0.23206	0.37570
VAR018	0.13210	0.46522	0.28622	0.16698	0.33138
VAR019	0.03920	0.46122	0.22692	0.06765	0.52894
VAR020	0.23225	0.04710	0.06723	-0.00459	0.78039
VAR021	0.72481	-0.03186	0.38586	0.11298	0.10655
VAR022	0.40255	0.06627	0.45846	0.57902	0.01275
VAR023	0.40680	0.32201	0.49668	0.27810	-0.02364
VAR024	0.49463	0.03360	-0.07149	0.29683	-0.03486
VAR025	0.47970	0.12783	0.17788	0.65149	0.10049
VAR026	0.71703	0.13555	0.23201	0.13526	0.06565
VAR027	0.48157	0.07865	0.20235	0.63796	-0.04353
VAR028	0.14322	0.77523	0.01609	0.00818	-0.16465
VAR029	0.25313	0.13320	0.73562	0.15269	0.08217
VAR030	0.17215	0.81041	0.07306	-0.11955	-0.02299
VAR031	0.54409	0.31996	0.05440	0.29358	0.18805

TABLE 17. FOUR-FACTOR SOLUTION — NOT SPACIOUS INTERIORS

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
VAR001	-0.64368	0.18548	-0.09079	0.33364
VAR002	0.36434	0.47794	0.53928	0.06254
VAR003	-0.10401	0.09055	0.02501	0.80314
VAR004	0.54554	0.28450	0.20729	0.19072
VAR005	0.50375	0.14746	-0.03442	0.16735
VAR006	0.09145	-0.03206	0.80592	0.00115
VAR007	0.72987	0.19039	0.21166	-0.00779
VAR008	0.52113	-0.01088	0.49957	0.26363
VAR009	0.58122	0.22917	0.36431	0.19563
VAR010	0.00139	0.79482	0.13463	0.11972
VAR011	0.27070	-0.07994	0.75833	0.11255
VAR012	0.36147	0.42132	0.17203	0.21686
VAR013	0.16362	0.50007	-0.09742	0.17933
VAR014	0.61208	0.19213	0.35482	0.29268
VAR015	0.12616	0.53515	-0.13530	0.03273
VAR016	0.45840	0.06695	0.17160	-0.18732
VAR017	0.48633	0.24164	0.25355	0.37938
VAR018	0.18388	0.48414	0.28982	0.23176
VAR019	0.05321	0.49105	0.21912	0.41335
VAR020	0.15855	0.10030	0.09031	0.75708
VAR021	0.57186	-0.00230	0.47581	0.26993
VAR022	0.64889	0.06558	0.49471	-0.08271
VAR023	0.44298	0.32820	0.53715	-0.02866
VAR024	0.56783	0.03880	-0.01132	0.02500
VAR025	0.77734	0.13078	0.22404	0.00196
VAR026	0.59370	0.16046	0.32048	0.21837
VAR027	0.76787	0.07406	0.25060	-0.11745
VAR028	0.10612	0.76833	0.02812	-0.15918
VAR029	0.22634	0.14584	0.75717	0.05956
VAR030	0.03500	0.81676	0.08953	0.01333
VAR031	0.58974	0.33973	0.11509	0.21248

TABLE 18. THREE-FACTOR SOLUTION — NOT SPACIOUS INTERIORS

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3
VAR001	-0.66247	0.17040	0.30752
VAR002	0.55070	0.41163	0.32220
VAR003	-0.21019	0.15935	0.68376
VAR004	0.54528	0.31311	0.21019
VAR005	0.40628	0.21588	0.05619
VAR006	0.42914	-0.16474	0.44427
VAR007	0.74189	0.21725	0.02498
VAR008	0.63570	-0.02074	0.43028
VAR009	0.64356	0.23544	0.29700
VAR010	0.04701	0.76305	0.19426
VAR011	0.54920	-0.17387	0.48387
VAR012	0.36372	0.43768	0.23866
VAR013	0.08275	0.53722	0.08872
VAR014	0.65086	0.21435	0.36573
VAR015	0.05276	0.56062	-0.05202
VAR016	0.51163	0.05892	-0.11235
VAR017	0.48241	0.27767	0.39636
VAR018	0.25524	0.46257	0.34181
VAR019	0.07953	0.48860	0.46656
VAR020	0.05847	0.17762	0.64985
VAR021	0.65949	-0.00264	0.41570
VAR022	0.80345	0.02994	0.13118
VAR023	0.63263	0.26414	0.23242
VAR024	0.49513	0.09698	-0.05769
VAR025	0.78727	0.16262	0.03228
VAR026	0.63141	0.17990	0.28732
VAR027	0.80912	0.08905	-0.05019
VAR028	0.13860	0.73642	-0.10717
VAR029	0.51984	0.03629	0.45166
VAR030	0.07466	0.78428	0.07840
VAR031	0.54160	0.38975	0.17154

TABLE 19. TWO-FACTOR SOLUTION — NOT SPACIOUS INTERIORS

VARIMAX ROTATED FACTOR MATRIX

	FACTOR 1	FACTOR 2
VAR001	-0.58069	0.30330
VAR002	0.59056	0.47718
VAR003	-0.05372	0.41404
VAR004	0.56399	0.34413
VAR005	0.39783	0.20255
VAR006	0.52731	-0.00489
VAR007	0.71672	0.17689
VAR008	0.71816	0.11378
VAR009	0.68315	0.30043
VAR010	0.05523	0.77714
VAR011	0.65356	-0.00388
VAR012	0.38835	0.47835
VAR013	0.07604	0.52683
VAR014	0.70710	0.30642
VAR015	0.01331	0.49694
VAR016	0.46855	-0.01086
VAR017	0.54753	0.38416
VAR018	0.30559	0.54508
VAR019	0.16244	0.62401
VAR020	0.19871	0.40604
VAR021	0.74679	0.12353
VAR022	0.80975	0.04066
VAR023	0.65633	0.30321
VAR024	0.46339	0.04566
VAR025	0.76504	0.12701
VAR026	0.67168	0.24594
VAR027	0.77064	0.02693
VAR028	0.07586	0.63503
VAR029	0.60786	0.17984
VAR030	0.05436	0.75198
VAR031	0.54794	0.40070

TABLE 20. EIGENVALUES, PERCENTAGES OF VARIANCE AND CUMULATIVE PERCENTAGES FOR NOT SPACIOUS INTERIORS

VARIABLE	EST COMMUNALITY	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
VAR001	1,00000	1	10,30230	33,2	33,2
VAR002	1,00000	2	3,15547	10,2	43,4
VAR003	1,00000	3	1,92586	6,2	49,6
VAR004	1,00000	4	1,50738	4,9	54,5
VAR005	1,00000	5	1,21035	3,9	58,4
VAR006	1,00000	6	1,13141	3,6	62,0
VAR007	1,00000	7	0,93844	3,0	65,1
VAR008	1,00000	8	0,80485	2,6	67,7
VAR009	1,00000	9	0,79798	2,6	70,2
VAR010	1,00000	10	0,72033	2,3	72,6
VAR011	1,00000	11	0,67620	2,2	74,7
VAR012	1,00000	12	0,67032	2,2	76,9
VAR013	1,00000	13	0,59622	1,9	78,8
VAR014	1,00000	14	0,58052	1,9	80,7
VAR015	1,00000	15	0,53070	1,7	82,4
VAR016	1,00000	16	0,48388	1,6	84,0
VAR017	1,00000	17	0,46438	1,5	85,5
VAR018	1,00000	18	0,44424	1,4	86,9
VAR019	1,00000	19	0,41983	1,4	88,3
VAR020	1,00000	20	0,40750	1,3	89,6
VAR021	1,00000	21	0,38563	1,2	90,8
VAR022	1,00000	22	0,36702	1,2	92,0
VAR023	1,00000	23	0,34953	1,1	93,2
VAR024	1,00000	24	0,32623	1,1	94,2
VAR025	1,00000	25	0,30752	1,0	95,2
VAR026	1,00000	26	0,28526	0,9	96,1
VAR027	1,00000	27	0,27491	0,9	97,0
VAR028	1,00000	28	0,26136	0,8	97,8
VAR029	1,00000	29	0,24036	0,8	98,6
VAR030	1,00000	30	0,22736	0,7	99,4
VAR031	1,00000	31	0,19937	0,6	100,0

TABLE 21 INTERCORRELATIONS BETWEEN THE ITEMS OF SPACIOUSNESS FACTOR 1

Item No.										
7	inviting-rep.	x								
25	comfort.-unc.	.7309	x							
22	restful-dist.	.7330	.7298	x						
17	imaginat.-un.	.6060	.5500	.4900	x					
31	impressive-un.	.6000	.5100	.5200	.6500	x				
16	soft lig-ha.	.5212	.5425	.5495	.4600	.4600	x			
27	livable-unli.	.6000	.6294	.6035	.4000	.4500	.4457	x		
13	dynamic sp-	.4490	.3552	.2713	.4200	.4500	.2844	.2436	x	
1	cozy-monumen.	.4829	.5178	.4896	.3100	.2200	.3377	.4737	.1976	x
16	multiple pur.	.3703	.3422	.3544	.3200	.3500	.2984	.3581	.3137	.2000

TABLE 22 RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS SPACIOUSNESS FACTOR I

Item No	Multiple Purpose 15	Dynamic Space 13	Cozy 1	Soft Light 16	Livable 27	Impressive 31	Imaginative 17	Restful 22	Comfortable 25	Inviting 7
n	10	9	8	7	6	5	4	3	2	-
r^*_{ij}	.3200	.3300	.3600	.4300	.4700	.4700	.4700	.5300	.5500	.5700
r_{ij}	.4500	.4800	.5200	.5600	.5900	.6100	.6400	.7300	.7305	-
ALPHA	.8900	.8920	.8990	.8990	.8911	.8875	.8773	.8908	.8440	-

TABLE 23 INTERCORRELATIONS BETWEEN THE ITEMS OF SPACIOUSNESS FACTOR II

Item No.									
8									
21	.5565	21							
5	.3685	.3847	5						
4	.4886	.5612	.3871	4					
9	.4982	.6538	.3460	.6400	9				
26	.4835	.5440	.2332	.4050	.5648	26			
14	.5128	.6373	.3073	.5856	.6306	.4789	14		
20	.2923	.3070	.1638	.2734	.3562	.2429	.3110	20	
3	.1990	.1174	.1778	.0374	.0572	.0622	.0694	.3945	3
23	.3545	.3536	.3617	.2668	.2752	.2340	.2991	.2235	.1476

TABLE 24 RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS OF SPACIOUSNESS FACTOR II

	Light Dark	Area Size	Good Lighting	Finct.	Coordi.	W. Scaled	Organized	W. Planned	W. Balanced	W. Organized
Item No.	3	23	20	5	26	4	8	14	9	21
n	10	9	8	7	6	5	4	3	2	1
r^*_{ij}	.1400	.2800	.2800	.3000	.3600	.4100	.4200	.4300	.4500	.4600
r_{ij}	.3500	.4000	.4400	.4900	.5500	.5800	.5800	.6400	.6500	-
ALPHA	.8400	.8600	.8600	.8700	.8800	.8700	.8400	.8400	.7800	-

TABLE 25 INTERCORRELATIONS BETWEEN THE ITEMS OF SPACIOUSNESS FACTOR III

Item No.										
2	2									
10	.3600	10								
30	.3857	.5500	30							
18	.3890	.2100	.2923	18						
11	.3585	.2600	.2691	.3706	11					
29	.3394	.2000	.3171	.3258	.2915	29				
19	.3993	.2700	.3190	.4054	.2818	.3045	19			
28	.3445	.2500	.2968	.3829	.1861	.3435	.2037	28		
12	.3500	.1000	.2000	.5200	.4200	.2800	.2500	.3900	12	
6	.1821	.2900	.1796	.1000	.1810	.1869	.0773	.0773	.0773	6

TABLE 26 RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS OF SPACIOUSNESS FACTOR III

	Empty	Wide	Huge	Open	Unrestricted	Uncrowded	Uncluttered	Large	Free space	Roomy
Item No.	6	28	10	19	12	29	11	30	18	2
n	10	9	8	7	6	5	4	3	2	-
r^*_{ij}	.1500	.2700	.2800	.2800	.2900	.2900	.2900	.3100	.3300	.3500
r_{ij}	.2800	.3200	.3200	.3400	.3400	.3400	.3500	.3600	.3900	-
ALPHA	.7900	.8000	.7900	.7800	.7500	.7100	.6700	.6200	.5600	-

TABLE 27 INTERCORRELATIONS BETWEEN THE ITEMS OF CRAMPEDNESS

FACTOR I

Item No										
14	14									
21	.6303	21								
26	.5671	.6485	26							
9	.6465	.5878	.5488	9						
8	.6113	.6550	..5866	.5756	8					
4	.5129	.4422	.4629	.5822	.4375	4				
31	.5353	.4174	.4505	.4693	.3826	.4526	31			
24	.3708	.3136	.3052	.3295	.2814	.2842	.2949	24		
5	.3394	.3027	.3238	.3256	.3260	.2895	.2990	.2088	5	
17	.5485	.5049	.4641	.4100	.3991	.2050	.5381	.2263	.2499	17
	4.7621	4.5024	4.3575	4.4753	4.2598	3.6690	3.8444	2.6147	2.6647	3.5459
	.52912	.50026	.48416	.49725	.47331	.40766	.42715	.29052	.29607	.39398

TABLE 28 RELIABILITY AFTER DISCARDING SUCCESSIVE ITEMS OF CRAMPEDNESS FACTOR I

	Poor Acoustics	Non-Function.	Unimaginative	Poorly scaled	Unimpressive	Disorganized-Organized	Uncoordinated	Poorly balanced-Well balanced	P. Organized-Well organized	Poorly planned Well planned
Item No	24	5	17	4	31	8	26	9	21	14
n	10	9	8	7	6	5	4	3	2	1
r^*_{ij}	.2905	.2961	.3940	.4077	.4272	.4733	.4841	.4973	.5003	.5291
r_{ij}	.4299	.4648	.5099	.5336	.5545	.6058	.6048	.6215	.6303	-
ALPHA	.8829	.8866	.8927	.8890	.8819	.8848	.8596	.8312	.7732	-

TABLE 29 INTERCORRELATIONS BETWEEN THE ITEMS OF CRAMPEDNESS FACTOR II

Item No.							
30	30						
10	.6742	10					
28	.6310	.5754	28				
15	.2739	.3146	.2859	15			
13	.3132	.2742	.2343	.3268	13		
18	.2973	.3249	.2528	.2995	.2707	18	
12	.2712	.3100	.2772	.2828	.2870	.5185	12
	2.4680	2.4733	2.2566	1.7835	1.7062	1.9637	1.9467
	.41013	.41221	.37610	.29725	.28436	.32728	.32445

TABLE 30 INTERCORRELATIONS BETWEEN THE ITEMS OF CRAMPEDNESS FACTOR III

Item No					
6	6				
29	.5791	29			
11	.5592	.5476	11		
2	.3855	.5202	.4725	2	
23	.4045	.4995	.4370	.6126	23

TABLE 31 INTERCORRELATIONS BETWEEN THE ITEMS OF CRAMPEDNESS

FACTOR IV

Item No					
1	1				
25	.4827	25			
27	.5107	.6932	27		
16	.3483	.4283	.3485	16	
7	.4565	.6558	.5932	.3329	7
22	.4672	.6765	.6320	.4476	.6437

TABLE 32

SELECTED ITEMS AND THEIR RELIABILITIES FOR THE 'SPACIOUSNESS SCALE'

FACTOR I	Comfortable-uncomfortable	(APPEAL)
n=4	inviting-repelling	
alpha=.89	restful-disturbing	
	livable-unlivable	
FACTOR II	well- organized-poorly organized	(PLANNING)
n=5	well balanced-poorly balanced	
alpha=.86	well planned-poorly planned	
	well scaled-poorly scaled	
	coordinated-uncoordinated	
FACTOR III	roomy-cramped	(SPACE FREEDOM)
n=8	large-small	
alpha=.79	free space-restricted space	
	huge-tiny	
	uncrowded-crowded	
	open-closed	
	uncluttered-cluttered	
	wide-narrow	

TABLE 33

SELECTED ITEMS AND THEIR RELIABILITIES FOR THE 'CRAMPEDNESS SCALE'

FACTOR I	poorly planned-well planned	(PLANNING)
n=4	poorly blanced-well balanced	
alpha=.86	poorly organized-well organized	
	uncoordinated-coordinated	
FACOTR II	small-large	(PHYSICAL SIZE)
n=3	tiny-large	
alpha=.83	narrow-wide	
FACTOR III	crowded-uncrowded	(CLUTTEREDNESS)
n=5	cluttered-uncluttered	
alpha=.83	cramped-roomy	
	inadequate size-adequate size	
	full-empty	
FACTOR IV	uncomfortable-comfortable	(APPEAL)
n=3	disturbing-restful	
alpha=.86	unlivable-livable	

APPENDIX III - A

The questionnaire form used in the first stage of the scale construction. (Pairs with an asterisk are the later additions)

NAME: AGE: SEX:

Below you will find a list of adjective pairs that may be used to describe architectural spaces. What we would like you to do is to go through each one of the adjective pairs and make a judgment regarding its degree of appropriateness to describe the spaciousness of a room. You are asked to indicate your judgment for each adjective pair on an eleven point "appropriate-inappropriate" rating scale. The more appropriate you judge an adjective pair to be, the larger will be the number that you would circle; conversely, the more inappropriate you judge a pair to be the smaller will be the number you would circle; for example, if you feel that an adjective pair is extemely appropriate (to describe the spaciousness of a room), you will circle eleven; if extemely inappropriate, you will circle one; if you judge a pair to be neither appropriate nor inappropriate, i.e., neutral, then circle six; and so on. If you feel that the meaning of a pair is unclear, then indicate by putting a question mark next to it after your judgment.

Please try to make a separate and independent judgment for each adjective pair.

THANK YOU VERY MUCH.

gentle-brutal	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
good-bad	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
happy-sad	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
empty-full	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
good acoustics-poor acoustics	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
pleasing-annoying	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
contemporary-traditional	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
good colours-bad colours	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
good lighting-poor lighting	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
quiet-noisy	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
graceful-clumsy	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
private-public	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
good lines-bad lines	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
good temperature- bad temperature	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
popular-unpopular	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
distinctive-ordinary	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
imaginative-unimaginative	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
personal-impersonal	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
good ventilation-poor ventilation	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
impressive-unimpressive	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
inner directed-outer directed	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
refined-unrefined	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
human scale-inhuman scale	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* sympathetic-unsympathetic	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* suitable-unsuitable	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* expected-unexpected	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE

exciting-unexciting	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
dynamic space-static space	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
convenient-inconvenient	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
coordinated-uncoordinated	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
cozy-monumental	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
cultured-uncultured	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
dated-timeless	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
decorated-stark	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
definite volume-indefinite volume	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
depressing-exhilarating	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
diffuse lighting-direct lighting	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
dignified-undignified	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
distinctive-ordinary	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
harmonious-discordant	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
healthy-unhealthy	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
flashy colours-subdued colours	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
flexible-rigid	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
formal-informal	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
free space-restricted space	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
fresh odour-stale odour	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
friendly-unfriendly	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
functional-nonfunctional	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
gay-dreary	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* welcoming-unwelcoming	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* huge-tiny	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE

cheerful-gloomy	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
bright colours-muted colours	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
busy-calm	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
restful-disturbing	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
pleasant-unpleasant	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
uncluttered-cluttered	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
adequate size-inadequate size	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
appealing-unappealing	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
attractive-unattractive	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
beautiful-ugly	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
bright-dull	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
calming-upsetting	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
clean-dirty	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
drafty-stuffy	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
efficient-inefficient	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
elegant-unadorned	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
empty-full	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
expensive-cheap	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
fashionable-unfashionable	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
feminine-masculine	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
colourful-drab	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
comfortable-uncomfortable	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
complex-simple	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
confused-clear	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
consonant-dissonant	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
contemporary-traditional	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
comfortable temperature-uncomfortable temperature	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE

restrained-unrestrained	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
uncluttered-cluttered	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
sensitive-insensitive	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
graceful-clumsy	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
livable-unlivable	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
soothing-distracting	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
well planned-poorly planned	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
restful-disturbing	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
romantic-unromantic	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
restricted-unrestricted	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
sophisticated-unsophisticated	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* alive-dead	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* dry-humid	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* defined space-undefined space	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* hard-soft	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* heavy-light	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* mystic-nonmystic	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* secure-insecure	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* sociable-unsociable	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* urban-rustic	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* valuable-worthless	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* temporary-permanent	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* huge-tiny	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* proud-humble	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* superior-inferior	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* agreeable-disagreeable	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* clear-vague	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* enjoyable-not enjoyable	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* changeable-constant	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE

large-small	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
inspiring-discouraging	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
mechanical space-nonmechanical space	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
light-dark	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
interesting-uninteresting	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
multiple purpose-single purpose	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
livable-unlivable	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
natural-artificial	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
inviting-repelling	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
neat-messy	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
lively-dull	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
open-closed	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
modern-old fashioned	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
pleasant-unpleasant	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
nice-awful	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
sterile-filthy	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
stimulating-unstimulating	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
organized-disorganized	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
new-old	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
ornate-plain	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
strong-weak	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
pleasant odour-unpleasant odour	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
orderly-chaotic	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* commonplace-unique	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* coherent-incoherent	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* confident-hesitant	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* delicate-rugged	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE
* passive-active	APPROPRIATE	11	10	9	8	7	6	5	4	3	2	1	INAPPROPRIATE

	regular-irregular	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	relaxed-tensed	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	stylish-unstylish	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	refreshing-wearying	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	symmetrical-asymmetrical	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	tasteful-tasteless	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	rich-poor	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	soft lighting-harsh lighting	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	well kept-rundown	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	scenic-unscenic	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	wide-narrow	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	roomy-cramped	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	sparkling-dingy	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	well balanced-poorly balanced	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	unusual-usual	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	tidy-untidy	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	crowded-uncrowded	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	well sealed-poorly sealed	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	useful-useless	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	warm-cool	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	well organized-poorly organized	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
	neat-messy	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
*	rough-smooth	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
*	peaceful-ferocious	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
*	statusful-statusless	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE
*	stable-unstable	APPROPRIATE 11 10 9 8 7 6 5 4 3 2 1 INAPPROPRIATE

APPENDIX III - B

The questionnaire form used in the second stage of the scale construction.

NAME: AGE: SEX:

You will be shown a number of interiors. We want you to indicate how SPACIOUS each interior seems to you. There are no correct or wrong answers; we are only interested in your personal opinions.

First, all the slides will be shown very briefly in order to give you some idea about the interiors involved. Then, each slide will be exposed for a relatively longer period of time so that you can evaluate it in terms of its spaciousness. You will make your evaluations on the following 'spacious - not spacious' scales. If you feel that an interior is very spacious you will put a circle around number 4 ; if you feel that the interior is not spacious at all you will circle number 1. If you feel that it is just spacious or just not spacious you will circle either 3 or 2.

THANK YOU VERY MUCH.

	Very Spacious	Spacious	Not Spacious	Not Spacious at all
SLIDE 1	4	3	2	1
SLIDE 2	4	3	2	1
SLIDE 3	4	3	2	1
SLIDE 4	4	3	2	1
SLIDE 5	4	3	2	1
SLIDE 6	4	3	2	1
SLIDE 7	4	3	2	1
SLIDE 8	4	3	2	1
SLIDE 9	4	3	2	1
SLIDE 10	4	3	2	1
SLIDE 11	4	3	2	1
SLIDE 12	4	3	2	1

	Very Specious	Specious	Not Specious	Not Specious at all
SLIDE 13	4	3	2	1
SLIDE 14	4	3	2	1
SLIDE 15	4	3	2	1
SLIDE 16	4	3	2	1
SLIDE 17	4	3	2	1
SLIDE 18	4	3	2	1
SLIDE 19	4	3	2	1
SLIDE 20	4	3	2	1
SLIDE 21	4	3	2	1
SLIDE 22	4	3	2	1
SLIDE 23	4	3	2	1
SLIDE 24	4	3	2	1
SLIDE 25	4	3	2	1
SLIDE 26	4	3	2	1
SLIDE 27	4	3	2	1
SLIDE 28	4	3	2	1
SLIDE 29	4	3	2	1
SLIDE 30	4	3	2	1
SLIDE 31	4	3	2	1
SLIDE 32	4	3	2	1
SLIDE 33	4	3	2	1
SLIDE 34	4	3	2	1
SLIDE 35	4	3	2	1
SLIDE 36	4	3	2	1

APPENDIX III - C

One of the 10 pages of the form used in the pilot study of spaciousness scale construction; 31 bipolar adjectives randomly listed.

cozy	___:___:___:___:___:___:___	monumental
roomy	___:___:___:___:___:___:___	cramped
dark	___:___:___:___:___:___:___	light
poorly scaled	___:___:___:___:___:___:___	well scaled
functional	___:___:___:___:___:___:___	non-functional
empty	___:___:___:___:___:___:___	full
inviting	___:___:___:___:___:___:___	repelling
disorganized	___:___:___:___:___:___:___	organized
well balanced	___:___:___:___:___:___:___	poorly balanced
huge	___:___:___:___:___:___:___	tiny
uncluttered	___:___:___:___:___:___:___	cluttered
restricted	___:___:___:___:___:___:___	unrestricted
dynamic space	___:___:___:___:___:___:___	static space
poorly planned	___:___:___:___:___:___:___	well planned
multiple purpose	___:___:___:___:___:___:___	single purpose
harsh lighting	___:___:___:___:___:___:___	soft lighting
unimaginative	___:___:___:___:___:___:___	imaginative
free space	___:___:___:___:___:___:___	restricted space
closed	___:___:___:___:___:___:___	open
poor lighting	___:___:___:___:___:___:___	good lighting
well organized	___:___:___:___:___:___:___	poorly organized
restful	___:___:___:___:___:___:___	disturbing
adequate size	___:___:___:___:___:___:___	inadequate size
poor acoustics	___:___:___:___:___:___:___	good acoustics
uncomfortable	___:___:___:___:___:___:___	comfortable
coordinated	___:___:___:___:___:___:___	uncoordinated
unlivable	___:___:___:___:___:___:___	livable
wide	___:___:___:___:___:___:___	narrow
uncrowded	___:___:___:___:___:___:___	crowded
small	___:___:___:___:___:___:___	large
unimpressive	___:___:___:___:___:___:___	impressive

APPENDIX III - D

An example of the six types of questionnaires used in the third stage of spaciousness scale construction. (The introduction page was the same for each S, which preceeded ten pages of the same kind of one of the six types of lists)

NAME: AGE: SEX:

The purpose of this study is to understand how people perceive and evaluate certain interiors. You will be shown a number of slides and will be asked to judge them in terms of some bipolar adjectives.

Please indicate your judgement of each slide on each adjective pair using a 7-point scale. Here is how you are to use the scales:

If you feel that the slide you see, is <u>very closely related</u> to one end of the scale, you should tick as follows:

beautiful ✓ : ___ : ___ : ___ : ___ : ___ : ___ ugly

or

beautiful ___ : ___ : ___ : ___ : ___ : ___ : ✓ ugly

If you feel that the slide is <u>quite closely related</u> to one or other end of the scale (but not extremely), you should tick as follows:

beautiful ___ : ✓ : ___ : ___ : ___ : ___ : ___ ugly

or

beautiful ___ : ___ : ___ : ___ : ___ : ✓ : ___ ugly

If the slide seems only <u>slightly related</u> to one or the other side (but is not really neutral), then you should tick as follows:

beautiful ___ : ___ : ✓ : ___ : ___ : ___ : ___ ugly

or

beautiful ___ : ___ : ___ : ___ : ✓ : ___ : ___ ugly

The direction toward which you tick, of course, depends upon which of the two ends of the scale seem most characteristic of the slide you are judging.

If you consider the interior to be <u>neutral</u> on the scale, or if the scale is <u>completely irrelevant</u> to the interior you see, then you should tick the line in the middle.

Only tick one line on each bipolar adjective.
Be sure to tick every adjective pair for every slide.
Make a separate and independent judgement for each adjective pair.
Do not worry or puzzle over individual adjective pairs. It is your immediate feelings about the slides that we want.

First, all the slides will be shown very briefly in order to give you some idea about the interiors involved. Then, each slide will be exposed for a longer period of time so that you can express your impression of it in terms of the bipolar adjective lists provided.
THANK YOU VERY MUCH.

unimpressive	___:___:___: ___ :___:___:___	impressive
small	___:___:___: ___ :___:___:___	large
uncrowded	___:___:___: ___ :___:___:___	crowded
wide	___:___:___: ___ :___:___:___	narrow
unlivable	___:___:___: ___ :___:___:___	livable
coordinated	___:___:___: ___ :___:___:___	uncoordinated
uncomfortable	___:___:___: ___ :___:___:___	comfortable
poor acoustics	___:___:___: ___ :___:___:___	good acoustics
adequate size	___:___:___: ___ :___:___:___	inadequate size
restful	___:___:___: ___ :___:___:___	disturbing
well organized	___:___:___: ___ :___:___:___	poorly organized
poor lighting	___:___:___: ___ :___:___:___	good lighting
closed	___:___:___: ___ :___:___:___	open
free space	___:___:___: ___ :___:___:___	restricted space
unimaginative	___:___:___: ___ :___:___:___	imaginative
harsh lighting	___:___:___: ___ :___:___:___	soft lighting
multiple purpose	___:___:___: ___ :___:___:___	single purpose
poorly planned	___:___:___: ___ :___:___:___	well planned
dynamic space	___:___:___: ___ :___:___:___	static space
restricted	___:___:___: ___ :___:___:___	unrestricted
uncluttered	___:___:___: ___ :___:___:___	cluttered
huge	___:___:___: ___ :___:___:___	tiny
well balanced	___:___:___: ___ :___:___:___	poorly balanced
disorganized	___:___:___: ___ :___:___:___	organized
inviting	___:___:___: ___ :___:___:___	repelling
empty	___:___:___: ___ :___:___:___	full
functional	___:___:___: ___ :___:___:___	non-functional
poorly scaled	___:___:___: ___ :___:___:___	well scaled
dark	___:___:___: ___ :___:___:___	light
roomy	___:___:___: ___ :___:___:___	cramped
cozy	___:___:___: ___ :___:___:___	monumental

APPENDIX III - E

One of the four spaciousness-crampedness-scale (SCS) forms to be used in the last group of experiments, in Part IV.

NAME: DEPARTMENT: AGE: SEX:

The purpose of this study is to understand how people perceive and evaluate certain interiors. You will be shown a particular interior and will be asked to judge it in terms of some bipolar adjectives.

Please indicate your judgement of the interior on each adjective pair using a 7-point scale. Here is how you are to use the scales:

If you feel that the interior you see is <u>very closely related</u> to one end of the scale, you should tick as follows:

beautiful ✓:__:__: __ :__:__:__ ugly

or

beautiful __:__:__: __ :__:__:✓ ugly

If you feel that the interior is <u>quite closely related</u> to one or other end of the scale (but not extremely), you should tick as follows:

beautiful __:✓:__: __ :__:__:__ ugly

or

beautiful __:__:__: __ :__:✓:__ ugly

If the interior seems only <u>slightly related</u> to one or the other side (but is not really neutral), then you should tick as follows:

beautiful __:__:✓: __ :__:__:__ ugly

or

beautiful __:__:__: __ :✓:__:__ ugly

The direction toward which you tick, of course, depends upon which of the two ends of the scale seem most characteristic of the interior you are judging.

If you consider the interior to be <u>neutral</u> on the scale, or if the scale is <u>completely irrelevant</u> to the interior you see, then you should tick the line in the middle.

Tick only one line on each bipolar adjective.

Be sure to tick every adjective pair.

Make a separate and independent judgement for each adjective pair.

Do not worry or puzzle over individual adjective pairs. It is your immediate feelings about the interior that we want.

THANK YOU VERY MUCH.

cluttered	___:___:___: ___ :___:___:___	uncluttered
well planned	___:___:___: ___ :___:___:___	poorly planned
tiny	___:___:___: ___ :___:___:___	huge
inviting	___:___:___: ___ :___:___:___	repelling
inadequate size	___:___:___: ___ :___:___:___	adequate size
poorly balanced	___:___:___: ___ :___:___:___	well balanced
uncoordinated	___:___:___: ___ :___:___:___	coordinated
large	___:___:___: ___ :___:___:___	small
livable	___:___:___: ___ :___:___:___	unlivable
narrow	___:___:___: ___ :___:___:___	wide
poorly organized	___:___:___: ___ :___:___:___	well organized
closed	___:___:___: ___ :___:___:___	open
empty	___:___:___: ___ :___:___:___	full
restful	___:___:___: ___ :___:___:___	disturbing
uncomfortable	___:___:___: ___ :___:___:___	comfortable
roomy	___:___:___: ___ :___:___:___	cramped
uncrowded	___:___:___: ___ :___:___:___	crowded
well scaled	___:___:___: ___ :___:___:___	poorly scaled
restricted space	___:___:___: ___ :___:___:___	free space

APPENDIX IV

TABLE 1. INTERACTION BETWEEN WINDOW POSITION AND SPACIOUSNESS FACTORS

	window on	
	short side	long side
Factor I	4.70	4.55
Factor II	4.59	4.50
Factor III	4.69	5.18

TABLE 2. INTERACTION BETWEEN WINDOW POSITION, WINDOW SIZE AND SPACIOUSNESS FACTORS

	3-bay window		continuous window	
	on short	on long	on short	on long
Factor I	4.43	4.63	4.98	4.47
Factor II	4.62	4.37	4.57	4.64
Factor III	4.49	4.96	4.89	5.41

TABLE 3. SUMMARY TABLE FOR THE TWO-WAY (WINDOW POSITION AND SPACIOUSNESS FACTORS II AND III) ANOVA OF EVALUATIONS OF INTERIORS WITH 3-BAY WINDOWS

Source	SS	df	ms	F	p
A (short versus long)	3538.51	1	3538.51	.26	-
Error	832957.00	62	13434.79		
B (Factors II & III)	16448.45	1	16448.45	2.69	<.1
A X B	41796.63	1	41796.63	6.83	<.025
Error	379464.00	62	6120.39		
Total	1274200.00	127	10033.11		

TABLE 4. SUMMARY TABLE FOR THE TWO-WAY (WINDOW POSITION AND SPACIOUSNESS FACORS II AND III) ANOVA OF EVALUATIONS OF INTERIORS WITH CONTINUOUS WINDOWS

Source	SS	df	ms	F	p
A (short versus long)	27877.51	1	27877.51	1.80	<.2
Error	959494.00	62	15475.72		
B (Factors II & III)	95320.70	1	95320.70	10.48	<.005
A X B	15953.45	1	15953.45	1.75	<.2
Error	563741.00	62	9092.60		
Total	1662390.00	127	13089.67		

TABLE 5. SUMMARY TABLE FOR TWO-WAY (WINDOW POSITION AND SPACIOUSNESS FACTORS I AND III) ANOVA OF EVALUATIONS OF INTERIORS WITH CONTINUOUS WINDOWS

Source	SS	df	ms	F	p
A (short versus long)	.63	1	.63	.00	-
Error	807021.00	62	13016.47		
B (Factors I & III)	57502.88	1	57502.88	7.26	< .01
A X B	85542.82	1	85542.82	10.80	< .005
Error	491215.00	62	7922.82		
Total	1441280.00	127	11348.68		

TABLE 6. SUMMARY TABLE FOR THE TWO-WAY (WINDOW SIZE AND SPACIOUSNESS FACTORS I AND II) ANOVA OF EVALUATIONS OF INTERIORS WITH WINDOWS ON SHORT SIDE

Source	SS	df	ms	F	p
A (3-bay versus contin. window)	19875.20	1	19875.20	.91	-
Error	1351510.00	62	21798.51		
B (Factors I & II)	3883.01	1	3883.01	.58	-
A X B	29859.57	1	29859.57	4.45	< .05
Error	415695.00	62	6704.76		
Total	1820820.00	127	14337.17		

TABLE 7. SUMMARY TABLE FOR THE TWO-WAY (WINDOW SIZE AND SPACIOUSNESS FACTORS I &III) ANOVA OF EVALUATIONS OF INTERIORS WITH WINDOWS ON SHORT SIDE

Source	SS	df	ms	F	p
A (3-bay versus contin. window)	73057.53	1	73057.53	5.80	<.025
Error	780376.00	62	12594.77		
B (Factors I & III)	84.50	1	84.50	.02	-
A X B	1891.13	1	1891.13	.26	-
Error	445349.00	62	7183.05		
Total	1301260.00	127	10246.13		

TABLE 8. SUMMARY TABLE FOR THE TWO-WAY (WINDOW SIZE AND SPACIOUSNESS FACTORS II & III) ANOVA OF EVALUATIONS OF INTERIORS WITH WINDOWS ON LONG SIDE

Source	SS	df	ms	F	p
A (3-bay versus contin. window)	56.45	1	56.45	.00	-
Error	853900.00	62	13772.58		
B (Factors II & III)	147357.00	1	147357.00	17.29	<.001
A X B	70.51	1	70.51	.00	-
Error	528265.00	62	8520.41		
Total	1529650.00	127	12044.48		

TABLE 9. SUMMARY TABLE FOR THE TWO-WAY (WINDOW SIZE AND SPACIOUSNESS FACTORS I & III) ANOVA OF EVALUATIONS OF INTERIORS WITH WINDOWS ON LONG SIDE

Source	SS	df	ms	F	p
A (3-bay versus contin. window)	5711.13	1	5711.13	.53	-
Error	472495.00	62	10846.69		
B (Factors I & III)	126442.00	1	126442.00	14.65	$<.001$
A X B	5578.32	1	5578.32	.65	-
Error	535108.00	62	8630.77		
Total	1345330.00	127	10598.18		

TABLE 10. SUMMARY TABLE FOR THE TWO-WAY (WINDOW POSITION AND CRAMPEDNESS FACTORS III & IV) ANOVA OF EVALUATIONS OF INTERIORS

Source	SS	df	ms	F	p
A (short versus long)	31862.25	1	31862.25	2.54	.2
Error	1578810.00	126	12530.21		
B (Factors III & IV)	173056.00	1	173056.00	15.75	$<.001$
A X B	82082.25	1	82082.25	7.47	$<.01$
Error	1384610.00	126	10988.98		
Total	3250420.00	255	12746.74		

TABLE 11. SUMMARY TABLE FOR ANOVA FOR 2 (WINDOW POSITION) X 2 (CRAMPEDNESS FACTORS I & III) FACTORIAL DESIGN WITH REPEATED MEASURES ON THE LATTER VARIABLE

Source	SS	df	ms	F	p
A (short versus long)	34642.52	1	34642.52	2.29	-
Error	1908360.00	126	15145.75		
B (Factors I & III)	357903.00	1	357903.00	34.25	<.001
A X B	77771.27	1	77771.27	7.44	<.01
Error	1316630.00	126	10449.57		
Total	3695310.00	255	14491.43		

TABLE 12. SUMMARY TABLE FOR ANOVA OF THE EVALUATIONS OF INTERIORS AS A FUNCTION OF WINDOW POSITION AND CRAMPEDNESS FACTORS II & III

Source	SS	df	ms	F	p
A (window position)	93903.94	1	93903.94	7.43	<.01
Error	1591520.00	126	12631.10		
B (Factor II versus III)	309623.00	1	309623.00	75.60	<.001
A X B	25142.07	1	25142.07	6.14	<.025
Error	516012.00	126	4095.33		
Total	2536200.00	255	9945.88		

TABLE 13. SUMMARY TABLE FOR ANOVA OF THE EVALUATIONS OF INTERIORS IN TERMS OF CRAMPEDNESS FACTOR II, AS A FUNCTION OF ROOM PROPORTION, WINDOW SIZE AND WINDOW POSITION

Source	SS	df	ms	F	p
A (room proportion)	5214.76	1	5214.76	.65	-
B (window size)	41941.32	1	41941.32	5.26	$<.025$
C (window position)	10933.51	1	10933.51	1.37	-
A X B	1.76	1	1.76	.00	-
A X C	4336.13	1	4336.13	.54	-
B X C	8662.57	1	8662.57	1.09	-
A X B X C	4406.26	1	4406.26	.55	-
Error	956792.00	120	7973.27		
Total	1032290.00	127	8128.25		

TABLE 14. SUMMARY TABLE FOR ANOVA OF THE EVALUATIONS OF INTERIORS IN TERMS OF CRAMPEDNESS FACTOR III, AS A FUNCTION OF ROOM PROPORTION, WINDOW SIZE AND WINDOW POSITION

Source	SS	df	ms	F	p
A (room proportion)	112.50	1	112.50	.01	-
B (window size)	31250.00	1	31250.00	3.56	$<.1$
C (window position)	108113.00	1	108113.00	12.33	$<.001$
A X B	800.00	1	800.00	.09	-
A X C	12.50	1	12.50	.00	-
B X C	200.00	1	200.00	.02	-
A X B X C	1800.00	1	1800.00	.21	-
Error	1052000.00	120	8766.67		
Total	1194290.00	127	9403.84		

TABLE 15. SUMMARY TABLE FOR ANOVA OF THE EVALUATIONS OF THE INTERIORS IN TERMS OF CRAMPEDNESS FACTOR IV, AS A FUNCTION OF ROOM PROPORTION, WINDOW SIZE AND WINDOW POSITION

Source	SS	df	ms	F	p
A (room proportion)	1682.00	1	1682.00	.12	-
B (window size)	18240.50	1	18240.50	1.27	-
C (window position)	5832.00	1	5832.00	.41	-
A X B	47432.00	1	47432.00	3.30	$<.1$
A X C	7750.13	1	7750.13	.54	-
B X C	58140.50	1	58140.50	4.05	$<.05$
A X B X C	21736.13	1	21736.13	1.51	-
Error	1722260.00	120	14352.19		
Total	1883080.00	127	14827.37		

TABLE 16 MEAN SPACIOUSNESS EVALUATIONS OF THE POSTGRADUATE LOUNGE AS A FUNCTION OF THE TIME OF THE DAY AND THE POSITION OF THE CURTAINS

	DAY		NIGHT	
	Open	Closed	Open	Closed
Factor I	5.40	5.63	5.53	5.88
Factor II	4.67	4.48	4.99	4.52
Factor III	3.86	3.36	3.86	3.61

TABLE 17. MEAN CRAMPEDNESS EVALUATIONS OF THE POSTGRADUATE LOUNGE AS A FUNCTION OF THE TIME OF THE DAY AND THE POSITION OF THE CURTAINS

	DAY		NIGHT	
	Open	Closed	Open	Closed
Factor I	3.28	3.48	2.94	3.33
Factor II	4.13	4.69	4.59	4.48
Factor III	4.39	4.52	3.79	4.37
Factor IV	2.64	2.24	2.46	2.00