

## **Livability of Vertical Apartments: A Study of the Relationship between Environmental Psychological Satisfaction and Height of Living with Special Reference to Low Income Apartments**

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**Abstract:** This study investigates the liveability of low income vertical apartments in Colombo, by means of finding the relationship between environmental psychological satisfaction and height of living. The main objective of this study is to find out to what extent the environmental psychological satisfaction correlates with the height of living of the low-income apartments. A total of 144 individuals (36 from each apartment and 3 from each floor level) from different age groups were employed as participants among the residents of four selected low income apartments located in Colombo. The primary data were collected using a structured questionnaire and the secondary data were collected by using layouts, floor plans and photographs of the apartment buildings. A Stratified random sampling method was used to select the participants. Safety, friendship and relationship with neighbours, basic residential infrastructure, attachment of residential area, open natural spaces, privacy, personal spaces and territoriality are the determinants that were used as the basis of the questionnaire. The primary data were analysed by using SPSS (Statistical package for Social Science) and the study employed estimation methods of OLS (Ordinary Least Square) estimation. As the final outcome, the level of environmental psychological satisfaction was identified in relation to the height of living and the aspects

of design response were emphasized and impacted on it.

**Keywords:** Liveability, environmental psychological satisfaction,, low income vertical apartments, Colombo

### **Introduction**

Colombo is the commercial capital of Sri Lanka. Since 2015, 555031 inhabitants have been occupying 103408 housing units and 13928 slums in Colombo (Colombo Municipal Council, 2015). The urban population of Colombo city has risen from 21% to 32% in the period from 1971 to 2001. Since 2001, the urban population of Colombo city has not increased in considerable numbers (Statistical Hand Book-2018, Department of census and statics). Thus, during the time period of 1971 to 2001, excessive population has created irregular constructions and informal environment in the city.

According to the Urban Development authority records, a total number of 68812 families live in 1499 community clusters. Thus, the government has attempted to find a solution for this underserved settlement. As a solution, the government has introduced vertical apartments for the low income category. "Sahaspura" is the first attempt of introducing low-income high-rise apartments launched by the government in

2001. Wijesinghe (2010) has emphasized that among the 651 families which were relocated in Sahaspura, 161 families refused to live and about 100-150 families have sold their houses and gone back to their previous places. According to his study, he has implied that reasons for the failure of Sahaspura is, social fabric factors which are not considered in resettlement process and loss of their income opportunities.

After the Sahaspura low income project, the government decided to launch a program for construction of 60,000 housing units for low-income people. (UDA, 2011). UDA has launched vertical low-income apartments in three phases. In the first phase there were fourteen projects including 400sqm units in each apartment and the second phase consisted of eleven projects including 500sqm units in each apartment. Third phase consisted of eight projects.

The government has launched many low-income vertical apartments to acquire the high valuable lands in Colombo city. Before moving into vertical apartments, those people lived-in single-story houses. After the resettlement programs, they had to live in vertical apartments. According to the previous research, some residents left their new vertical living environment. Thus, there is a problem of the height of living and environmental psychological satisfaction of the low-income category.

Thus, the primary objective of this study is to find out to what extent that environmental psychological satisfaction is correlated with height of living in the low-income apartment buildings. The secondary objective is to find out how architectural implications impact on environmental psychological satisfaction and height of living, using the architectural layout and design response of the apartments. Identified case studies are constructed after the failure of the first low income apartment named "Sahaspura". Most low income apartments are going to be

constructed in future and these selected case studies will be a directory samples.

The study was focused on only low income apartments. Further, the social, economic and political impact on livability of those vertical apartments was not focused. The research was based on environmental psychological satisfaction of residents. Environmental Psychological determinants are limited to which show a relationship with height of living in the building.

### **Background and Literature Review**

A "house" is one of the place that fulfil the physiological needs and it can be transformed into a "home" with fulfillment of the physiological needs as well as psychological needs. At present, the home concept has become more complex in urban areas with vertical apartments. In the Sri Lankan context, low income vertical apartment complexes are emerging in urban areas as resettlement projects specially in the Colombo district.

Livability is the environmental psychological aspect of spaces. Mitchell (2000) has emphasized six livability qualities including health, safety, personal development, community development, natural resources, goods and services, and the physical environment. Concept of home has a deep relationship with its spaces and livability. It has a cognitive relationship with the environment. "Home is our corner of the world, our first universe a real cosmos in every sense of the world, home is the "territorial core" preferred space and fixed point of our daily activities." (Gaston Bashlard. 1969, p.4) House became home with its livable spaces.

Environmental Psychology can be defined as the core relationship between physical environment and human behaviour. Height of living has become one of the most effective factors with urban settlements. "The conquest of the horizontal transformed into

vertical, according to the normal process of evolution. Finally wrenched us away from earth's gravity to hurl us into planetary space. Perhaps, we are suffering from vertigo." (Marc. 1972, p.89).

Environmental psychological satisfaction can be demonstrated according to the spaces in building with its qualitative aspect and behaviour of occupants. "Environmental psychological satisfaction in building studies involves the subjective appraisal of the objective qualities of a given environment, indicating how much the given environment meets the expectations and needs of the inhabitants" (Ibemet. al, 2013, p.179). As cited by Reser et.al (2010) residential satisfaction is based on many determinants, and values, including stage of life, socioeconomic status, hopes for the future, norms for one's peers, and relationships with neighbours which belongs to the Environmental Psychological Satisfaction.

Building heights are directly impacted on fresh air, light, sun, a view and quiet because of distance from the ground (Jephcott, 1971; Adams and Conway 1975; Cooper-Marcus and Hogue, 1976). According to above the surrounding can have peaceful area with pure air which shows a lovely environment background.

Churchman (1984) has cited that main disadvantages of height are commonly accepted to be dependent on the elevator. The restrictions which as a result are placed on children's outdoor play worry about children falling-out of windows (Jephcott, 1971). Having very high buildings will be a problem for the safety of people.

Sommer (1959) has described the term "personal space"(PS) as an emotionally tinged zone around the human body that people feel is "their space" according to the social psychological literature. "As environmental psychologists have begun to study the natural as distinct from the human-

made environment, the heuristic value of evolutionary explanations has become more evident" (Kaplan,1992).

Namazian1 et.al (2013) has mentioned that territories provide social interaction and help to stabilizing the social system. He has explained that homes are the primary territories where this function well. Environmental design needs to focus on ways to create and define secondary and public territories because it is difficult to recognize in clear terms. It will help to identify the different levels of territory that can correctly viewed by users and visitors. Thus, territoriality emphasizes the feeling of ownership of the place.

Wood et al (2007) has cited that people prepare in any environment if they have a need for social contacts. In some environments, this action is done easily. There are many reasons for desirable social interaction. The main reason is there should be mutual social interaction and sense of belonging.

Namazian1et.al (2013) has explained that the environment emphasizes only either very little interaction or a great deal of interaction is too static. It will not be responsive to changing privacy needs, so environmental designers should try to create environments that permit different degrees of control over contact with others.

Golant (2012) has described characteristics of the environment which explain the attachment to the place. Those factors are, specific to housing, both inside and outside the dwelling, the socio-demographic characteristics of the residents, psychological factors linked to the inhabitants' past housing situation, needs and expectations of living space, how the available space is lived in, Past and present experience of the place. These characteristics emphasized that attachment to a place

depends on personal experience, fulfilment of needs and features of the place.

The field of environmental psychology also studies the natural contents that contribute to the aesthetic qualities of settings, namely (calm) water features and vegetative elements. There is a significant amount of overlap between environmental psychology and biophilic design. Joye (2007) has described that there is psychological relation with natural environment and natural elements (e.g., vegetation and water features) are also found to contribute to the restoration.

Safety is denoted as one of the fundamental issues that the liveable environment should have. “high-rise housing is a distinct residential form that most people are living off the ground, so there are some special safety problems”. (Gifford,2007).

Raw.G et al. (2001) shows the infrastructure system of high-rise housing is directly related with residents’ essential living needs and is a necessity for the liveable residential environment. For high-rise housing, the water supply system consists of domestic water supply and fire water supply.

**Methodology**

The government has launched low income vertical apartments according to three phases (400sqm units, 500sqm units) and study focused on first phase apartments namely Siyapathsewana housing apartments at Dematagoda, Sisirauyana housing apartments at Wanathamulla, Lakmuthisewana housing apartments at Mayuraplace, Methsandasewana housing apartments at Henamulla.

A total of 144 individuals (36 from each apartment) from different age groups were used as participants among the residents who lived in each level of apartment. Primary data were collected using a researcher made questionnaire regarding the factors related

to environmental psychological satisfaction as mentioned below.

**Safety**

1. Friendship and Relationship with Neighbours
2. Basic residential Infrastructure
3. Attachment of residential area
4. Open natural spaces
5. Privacy
6. Personal spaces
7. Territoriality

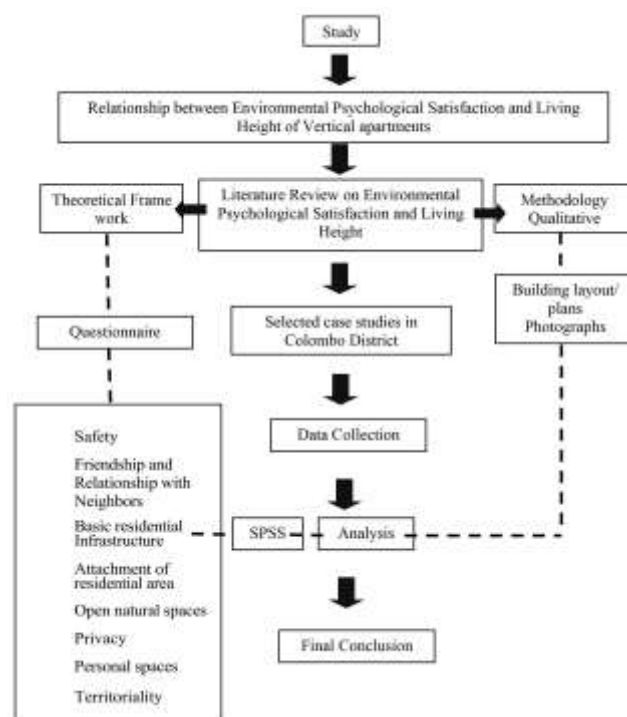


Figure 11: Framework of the Study  
Source: by Author

The primary data analysed by using SPSS (Statistical package for Social Science) and the study used estimation methods of OLS (Ordinary Least Square) estimation. In the regression, used the dependent variable as floor level and set of Environmental psychological satisfaction as independent variables that mention as follows:

1. Floor level = Friendship and Relationship between Neighbours

- (Level of communication + friendliness + Level of exchanging help + Satisfaction of common gathering Spaces)
- 2. Floor level = Open and Natural Spaces  
 (Satisfaction with open spaces (windows, doors) + Satisfaction with natural Light and ventilation + Satisfaction with natural environment + Satisfaction with outside view)
- 3. Floor level = Basic residential Infrastructure  
 (Infrastructure facilities + Satisfaction with using elevators)
- 4. Floor level = Safety  
 (Feeling of safety + Safety about children falling from upper level)
- 5. Floor level = Attachment to Residential Area  
 (Attachment to previous living place + Attachment to present living place)
- 6. Floor level = Privacy  
 (Feeling of isolation + Privacy)
- 7. Floor level = Personal Space  
 (Feeling of space area + Opportunity of changing Interior)
- 8. Floor level = Territoriality  
 (Ownership + Impression of living floor level)

The secondary data were collected by analysing case studies using layout and plans, photographs of four apartments. The data were collected from the following criteria.

*Table 1: Secondary Data Collection Method  
 Source: by Author*

Social Determinants	Related Building Spaces
Friendship and Relationship with Neighbors	Semi public and public spatial level/ Common place
Open natural spaces	Door/Window positioned Vegetation/ Green space
Safety	Handrails and space boundary
Basic residential Infrastructure	Elevators facilities and other

The secondary data were analysed descriptively by using layout plans, and photographs of case studies.

Conclusion and recommendation were obtained from using both primary and secondary data analysis.

**Results and Discussion**

The data were analysed according to the eight determinants as shown in Table 2.

**Friendship and Relationship between neighbours.**

According to the results, most residents in lower level are satisfied with friendship and relationship between neighbours. Level of communication (95%), friendliness between neighbours (95%) and satisfaction of common gathering spaces (99%), is significantly vary with floor level and level of exchanging help is not significantly dependent on floor height. Overall results shows that residents are satisfied with friendship and relationship between neighbours who live near to the ground floor than upper floors.

*Table 2: Regression Results  
 Source: By Author*

Dependent variable: Floor level	Sample Lower level	Sample Upper level
<b>1. Friendship and Relationship between Neighbours</b>		
Level of Communication	0.85 ** (2.24)	0.14 (0.25)
Friendliness	-0.68 ** (-2.29)	0.69 (1.30)
Level of Exchanging Help	-0.43 (-1.47)	-0.97 ** (-2.28)
Satisfaction of Common gathering spaces	-0.59 *** (-3.91)	-0.33 (-1.04)
<b>2. Open and Natural Spaces</b>		
Satisfaction with Openspaces (windows, doors)	-0.15 (-1.22)	-0.60 (-0.17)
Satisfaction with natural Light and ventilation	0.55 *** (4.77)	0.92 *** (3.73)
Satisfaction with Natural environment	-0.51 *** (-4.47)	-0.43 (-1.28)
Satisfaction with Outside View	0.01 (0.10)	0.14 (0.72)
<b>3. Basic Residential Infrastructure</b>		
Infrastructure facilities	-0.59 (-0.90)	-0.06** (-3.26)
Satisfaction with using Elevators	0.05 (0.17)	-0.13 (0.73)
<b>4. Safety</b>		
Feeling of safety	-0.09 (-0.64)	0.06 (0.35)
Safety about children falling from upper level	-0.82*** (3.71)	-0.62*** (-3.07)
<b>5. Attachment to residential area</b>		
Attachment to the previous living place	-1.10 *** (-2.42)	-1.10 *** (-2.42)
Attachment to the present living place	0.53 (0.91)	-1.20 ** (-2.30)
<b>6. Privacy</b>		
Feeling of isolation Privacy	-1.90 (-1.41)	-1.52*** (0.37)
Privacy	1.64 *** (-2.64)	-3.87 *** (-2.14)
<b>7. Personal Space</b>		
Feeling of space area	-0.42** (-2.62)	-0.59** (-3.19)
Opportunity of changing Interior	-0.21 (-0.81)	0.05 (-0.24)
<b>8. Territoriality</b>		
Ownership	0.73** (-3.05)	-0.25 (-1.49)
Impression of living Floor level	-0.43* (-1.68)	-0.64 (-0.27)
R squared	0.8	0.03
Observations	80	84

Note: Dependent variable is floor level: Ground Floor to 11th floor  
 Figure in bracket represent t: \*\*\* Significant at 99%, \*\* Significant at 95%, \*Significant at 90%  
 Lower level : Ground Floor + 1st Floor to 4th Floor  
 Higher level : 5th Floor to 11th Floor

### Open and Natural Spaces

In the second factor, which is open and natural spaces shows that level of natural light and ventilation (99%) is significantly satisfied with both lower and higher levels. Satisfaction with the natural environment (99%) is significant only at a lower level. Upper level residents are not significantly satisfied with the natural environment. According to the results, satisfaction of open space (windows and doors) and outside view

is not at satisfactory level in both lower and upper floors.

### Basic Residential infrastructure

In upper level residents are satisfied with basic infrastructure facilities (95%) than lower level residents. According to the response of residents, most lower level residents complain about the garbage disposal problem and garbage stored at ground level which make a bad smell to people who live near to the ground floor. Both lower level and higher-level residents are not satisfied with using elevators. The situation which has no electricity, waiting time in the morning (School days) are the complaints that are presented by them.

### Safety

Both lower and upper level residents are significantly (99%) satisfied with safety of children (possibility of falling from upper floors). The feeling of safety is at insignificant level in both lower and upper floor levels.

### Attachment to the residential area

Two questions were presented to identify the attachment of the residential area as mentioned in the below.

- No worry about moving from your previous place

- Worry to move out from your present place

According to the results, most lower level residents are not attached with their previous house. Their response is 99% significant. Upper level residents are not attached with the present living place and their response is 95% significant.

### Privacy

In the factor of privacy, most residents in both levels have more privacy (99% significant) than previous living places. According to results, the feeling of isolation is significantly (99%) increased in the upper floor level. This implies that feeling of isolation does not impact lower level residents.

### Personal Space

Feeling of personal space is significantly (95%) influenced to both levels and they are satisfied with it. the opportunity to change the interior does not significantly vary with living height.

### Territoriality

In a case of territoriality, lower level people are satisfied (95%) with the ownership of the house. upper level residents are not satisfied with it. Also, Lower level residents are satisfied (90%) with their living current floor level.

The secondary data were analysed descriptively as below. (Table 03).

*Table 3: Descriptive Data Analysis*

*Source: by Author*

Social Determinants	Related Building Space	Design Response
Friendship and relationship between neighbours	Semi public and public spatial level/ Common place	According to the layout plans, there are no proper public places for gathering outdoors.  Courtyards are benefited to the residents who living near to ground level.  Linear passage is provided access to housing units and do not create gathering pockets in upper levels.

Open natural spaces	Door/Window positioned Vegetation/ Green space	There are no any trees in courtyard areas. Size of the windows are not enough for see outside views. Balcony floor area is not enough as a viewpoint. Residents use it as a place to dry their clothes. In some cases, introverted orientation of the windows makes darkness to the inside.
Safety	Handrails and space boundary	Height of the handrails and boundaries are enough for their safety
Basic residential Infrastructure	Elevators and Other facilities	There is no any proper garbage disposal system. Elevators are not enough for peak time. (school days)

### Conclusion and Recommendation

This study revealed that there are environmental psychological determinants which are highly impact on living height. Those determinants are, Friendship and relationship between neighbours, Open and natural spaces, Privacy, Attachment to the residential area, Territoriality. According to the results, other determinants did not significantly impact on the height of the living low-income category. Under the friendship and relationship between neighbours, lower level residents are significantly satisfied with level of communication, friendliness and common gathering spaces. Upper level residents are only satisfied with the level of exchanging help. When considering the open and natural spaces, lower level residents are significantly

satisfied (99%) with the natural environment. In privacy, most upper level residents are felt in isolation (99%). According to the attachment of residential areas, upper level residents are worried about previous living and lower level residents are not worrying about it. Lower level residents are attached to the present residence rather than upper level residents. Lower level residents are satisfied with ownership and impression. of living height. Upper floor level residents are not satisfied with it. Therefore, lower level residents are satisfied in territoriality.

*Table 4: Summary of quantitative and qualitative results  
Source: By Author*

Social Determinants	Lower level	Upper level	Design Response
<b>1. Friendship and Relationship between Neighbours</b>			Ground level courtyards are near to lower floor level range. There are no any gathering spaces in upper floors. Narrow passages are used to provide access to the housing units.
Level of Communication Friendliness	✓	X	
Level of Exchanging Help	X	✓	
Satisfaction of Common gathering spaces	✓	X	
<b>2. Open and Natural Spaces</b>			Size of the windows are not enough when considered the eye level. No enough space for balcony. Most of lower level residents are spend their time in courtyard area.
Satisfaction with Openspaces (windows, doors)	X	X	
Satisfaction with natural Light and ventilation	X	X	
Satisfaction with Natural environment	✓	✓	
Satisfaction with Outside View	✓	X	
<b>3. Basic Residential Infrastructure</b>			Lower level residents are suffering from improper garbage disposal system. (all garbage stored in ground level) Elevators are not enough for peak time
Infrastructure facilities	X	✓	
Satisfaction with using Elevators	X	X	
<b>4. Safety</b>			Enough height of handrails and boundaries
Feeling of safety	X	X	
Safety about children falling from upper level	✓	✓	
<b>5. Attachment to residential area</b>			✓ Satisfied X Unsatisfied
Attachment to the previous living place	X	✓	
Attachment to the present living place	✓	X	
<b>6. Privacy</b>			
Feeling of isolation Privacy	✓	X	
Privacy	✓	✓	
<b>7. Personal Space</b>			
Feeling of space area	✓	✓	
Opportunity of changing Interior	✓	✓	
<b>8. Territoriality</b>			
Ownership	✓	X	
Impression of living Floor level	✓	X	

When considering all these determinants, quantitative survey results show that residents who live in ground

level and up to 4th floor level (lower level) are psychologically satisfied. Upper level (5th floor to 11th floor) residents are not psychologically satisfied. The qualitative survey was conducted to identify the design response which related to the environmental psychological determinants.

The qualitative results are overlapping with the quantitative results. Table 4 shows the conclusion of both quantitative and qualitative results.

Thus, it is highly recommended to limit vertical low income apartments up to G + 4<sup>th</sup> floor level wherever possible. Further it is recommended that there should be greenery spaces, common gathering spaces, enough space to see outside views, enough size of building elements etc. in every floor when the number of floors exceeds four (4).

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