

ID 1582 | RESEARCH OF TRAVEL BEHAVIOR INFLUENCE FACTORS OF THE AGED AND SUGGESTIONS OF THE SENILE APARTMENT SITING

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ABSTRACT: This article aims to discuss the siting of the senile apartment from the perspective of travel behavior of the aged. The aged spend much more time on the indoor activities in the apartment than the travel behavior. However, travel behavior, an important component of human life, can energize the aged and motivate their socialization. Currently the siting of the senile apartment from the view of travel behavior remains to be studied. To select the proper siting of the apartment based on the physical and psychological characteristics of the aged as well as their transportation will energize them and promote them to participate in more social activities. Their social identification will thus be lifted. Their ability of independent living can be largely preserved and their life quality in the apartments be improved. This article is summarized into four parts. First of all, it proposes that the proper outing is significant for the health of the aged in the apartments by analyzing the outgoing characteristics of the aged from the physical, psychological, and social attribute perspectives. Second, the types of outgoing of the aged are analyzed. According to the outgoing purpose, the travel behavior of the aged can be categorized into four types: shopping, medical, leisure, and cultural pursuits. The outgoing types have different promotion on the aged and require different siting. Then it proposes the influence factors for the outgoing of the aged include the internal factors such as age, gender, financials, and the external factors such as distance and scale. Different outgoing purposes are influenced by different factors. The travel for shopping, for example, is influenced by the internal factor of financials and the external factor of scale. The travel for medical care is influenced by the age and the scale. The travel for leisure is influenced by the age and the distance. The travel for cultural pursuits is influenced by the age, scale, and distance. In the end, this article exhibits that the site selection of the senile apartment should be based on the reachability of the travel behavior for the aged. This article builds an evaluation system for the indices based on the influence factors. Some suggestions for the siting are proposed: 1) small business should be enough near the siting; 2) general hospitals should be easily reached; 3) nearby leisure and entertainment venues, and 4) cultural facilities should be considered. This article discusses the four types of outing and proposes the corresponding site selection strategies. However, problems still exist. Firstly, individual difference will lead to different effects. Secondly, a perfect siting for the apartment of the aged that satisfy all the requirements does not exist. Moreover, more factors including the scale of the apartment, the ground rent, and the planning, should be considered. Thereby, the most proper siting scheme should be planned in terms of the evaluation system of the indices. Proper siting will help the aged to merge into the society, identify with themselves, and enjoy their twilights years in the apartments.

1 INTRODUCTION

Population of the aged has reached 230 million in China by the end of 2016, consisting of 16.7% of the total population. The government provides income support for the aged as well as social, welfare and health services, meanwhile the old man will also be a significant opportunity for social products and services (eg Golledge and Stimson, 2013) 1 There will be a trend of development for the senile apartment from welfare towards aspects of professional, comprehensive, high-end, profitability, etc., and the senile need to focus more on high-level requirements of the aged.

Travel behavior is of great significance to the aged, which can promote the energy of the aged and stimulate their socialization. Further, Menec has shown that the higher the overall level of activity of the aged is, the stronger the sense of happiness will be, the greater the positive function of activity can reach, and the lower the rate of mortality will become (eg Menec, 2003). 2 However, at present, the majority of the senile apartments are located in the remote areas between the urban and rural with the advantage of the cheap rent, good environment, and large areas, which leads to serious problems such as no convenient transportation, inconvenient visit, and lacking of travel behavior. Especially some senile

apartments are closed, and the aged activities are limited within the old apartment. Compared with other time, the old man travel behavior time is very short.

The research on the aged travel behavior in the senile apartment is rare. Existing research is majorly performed from the perspective of maximizing the equity to meet the survival needs of the aged, failing to give full consideration to their physical and psychological needs. This article, based on humanization, attempts

to make the aged from making a living to enjoying their life from the perspective of outing actives. This article proposes advices of senile apartment siting, according to the physiological and psychological characteristics of the aged, the travel behavior influencing factors, and the influence of the facilities configuration space model over the travel behavior of the aged (eg Chai, 2010)³.

2 TRAVEL BEHAVIOR CHARACTERISTICS OF THE AGED

This paper studies on the people aged 60 and above, according to the actual circumstance and the retiring age of China. Stepped into the old age, the aged travel behavior will be affected by the changes of their physical, psychological and social attributes. The phenomena are specific to their group.

A series of changes take place in shape and the function of the body of the aged, and the sensory system are aging and declining. The psychological of the aged changed. On the one hand, they are prone to depression and loneliness, and to reduce travel behavior. On the other hand, the aged are easy to produce negative emotions including emptiness, wayward, restlessness and anxiety without good social activities and interests. The social attributes of retired old man change as they are turned into the role of bystanders and consumers from participants and organizers. The social network established through the jobs is lost, as well as the commuter travel and part of the social travel. They are becoming less sociable and have less living space.

Overall, the aged have less frequency, less time and shorter distance of travel behavior compared with the young (eg Feng and Yang, 2015).⁴ The way of travel behavior for the aged reduces, with the main way by walking and by bus. The range of travel behavior is more onefold, and the frequency is relatively fixed.

3 CLASSIFICATION OF TRAVEL BEHAVIOR OF THE AGED

Travel purpose of the aged gradually changes from the survival travel to consumer travel (eg Feng and Yang, 2015).⁵ This paper focuses on the aged residing in the senile apartment, who have less family fetter but more self-pursuit. According to the travel purpose, the travel behavior of the aged can be categorized into four types: leisure, shopping, medical needs, and cultural pursuits. The travel types have different promotion on the aged and require different sitings.

3.1 THE TRAVEL FOR LEISURE

Compared with the aged living in past who are only living for their families, the aged of contemporary era has more leisure time, and their leisure area radius is expanding. The leisure preferences are personalized and the recreational consumption is more diversified (eg Wang et al, 2011).⁶ In accordance with the extent of leisure activities, they can be divided into the home leisure and the outdoors leisure. In accordance with the contents of leisure activities, leisure activities can be classified as leisure for delight and leisure for fitness. Leisure activities of the urban aged are mainly for physical exercise and walking in the park. In this paper, the object of study mainly includes urban public green space at all levels.

3.2 THE TRAVEL FOR SHOPPING

The travel for shopping of the old man is different with the general consumers, mainly for the following reasons: 1. Less outing. The declining of the body function leads to the decrease of outing ability. 2.

Purchasing power decline. Most of the old man discourage consuming as their income falls. 3. Particular family role. Compared to the old man living at home, the aged in the senile apartment have thinner relationships with their children, and narrower range of the objects they need to buy as well as lower purchasing power. on the other hand, objectively, the elderly has more discretionary time, and their transportation cost is low; Subjectively, the demand for daily shopping of the urban aged is increasing, and their shopping intention is more abundant (eg Han, 2015). 7 In this paper, the object of study not only includes large business such as various shopping centers and supermarkets, but also includes convenience stores and street stores.

3.3 THE TRAVEL FOR MEDICAL

The travel for medical is a negative but necessary travel for the old. If we equip the senile apartment with enough medical devices, the old man can check-up, solve minor illness within the senile apartment, and can reduce the travel for medicals. However, there are only less than sixty percent of the senile apartment equipped with simple medical equipment, and up to twenty percent of the senile apartment have neither professionals, nor the basic medical devices (eg Wang, 2016)8. The smoothness of the travel for medical will reduce the worries of the aged, and it should be a factor to be considered in the siting of the senile apartment. In this paper, the research objects are mainly general hospitals and community hospitals.

3.4 THE TRAVEL FOR CULTURE PURSUIT

Among the five demands proposed by Maslow that will accompany a person's whole life, the emotional needs, the demands of belonging, esteem and value realization will not reduce with the aging body. Religious beliefs can provide relief for elderly people, eliminate the worry and fear of death, and eliminate their loneliness. The senile apartment should give them concern and support (eg Lei and Ban, 2014). 9In this paper, the objects of study are mainly all kinds of religious facilities.

4 ANALYZE THE FACTOR INFLUNCE FOR TRAVEL BEHAVIOR OF THE AGED

The main influence factors of the aged travel behavior include the individual social and economic attributes (internal factor) and the environmental factors (external factor). Individual social and economic attributes (internal factor) include social attribute, economic attribute, family attribute, and personal property; the environmental factors (external factor) include urban services, facilities supply and so on. This paper discusses the influence of the internal factors on all kinds of outside activities with qualitative descriptions, from the aspects such as age and gender. The analysis of the characteristics of different kinds of facilities space structures in quantitative ways is emphasized. The degree of influence is measured using the frequency of travel behavior as a positive index.

4.1 ANALYZE THE FACTOR INFLUENCE FOR THE TRAVEL FOR LEISURE OF THE AGED

4.1.1 INTERNAL FACTORS

Crawford and Godbey proposed the leisure constraint hierarchy theory, where constraints are divided into three levels including the personal internal restraint, the interpersonal constraints, and the structural constraints (Han, 2015). 10 As the age increases, the frequency of travel for leisure of the aged living in the senile apartment is reduced to an average of 3.02 times per week, which is lower than the aged outside; the range of travel for leisure of them shrinks. The leisure space distance of people over 75 years of age is most concentrated within 0.5 km, while the leisure space of people between 55 and 75 years of age is larger and concentrated within 3 km.

Genders have few influence on the travel for leisure. Travel frequency of the old woman living in the senile apartment is slightly higher than the males of the same age; leisure activity of the aged in the senile apartment is mainly concentrated within distance of 1 km. Within the scope of the leisure activity distance

experiences and habits, the process of making consume decision becomes simpler, and the consumer behavior becomes the daily repeated activities (eg Chai, 2010).

With the growth of the age, the frequency of travel for shopping of the aged decreases gradually. Especially after 75 years old, most old people don't go out for shopping; The space of consumer behavior is shrinking. The way of travel for shopping is simplified. And travelling on foot becomes the vast majority way to shopping for the aged.

Gender differences in: the shopping frequency of the old women is higher than the old man. The old women prefer the accompanied shopping, while more than half of the old men prefer to shopping alone. From the view of spatial distance, due to the discrepancy in trip modes, shopping space dimension of the old men is broader compared to the old women.

4.2.2 EXTERNAL FACTORS

The completeness of the commercial space layout has a direct impact on the characteristics of the space of the consumer behavior. For the aged, the spatial distribution affects their frequency of travel for shopping. The configuration of the community-level commercial facilities affects the lower-level commodity consumption activities. The configuration of the city-level commercial facilities affects the high-grade commodity consumption activities.

According to the spatial distances of shopping of the aged in the senile apartment, there is a rule that with the expanding of distance the shopping frequency declines. 65% of the shopping activities take place within distance of 0 – 1.0km to the senile apartment, and the drop rate of the frequency of the travel for shopping basically remains the same, but further than 1.0 km the frequency of the travel for shopping decreases much faster.

The spatial structure pattern of shopping of the aged live in the senile apartment can be summarized as follows:

- I. the first concentrated shopping circle (circle range of the distance from the senile apartment is 0 ~ 0.5 km). 35% of the shopping activities of the aged live in the senile apartment are concentrated in this circle. This circle brings together the low level of business services, such as convenience stores, small supermarkets, small fruit shop, etc.
- II. the second concentrated shopping circle (circle range of the distance from the senile apartment is 0.5 ~ 1.0 km). 30% of the shopping activities of the aged live in the senile apartment are concentrated in this circle, and the attenuation rate is 5%. This circle is the zone of transition for the commercial service facilities from low-level to senior, and it has brought together some medium-sized supermarkets and a small number of large supermarket.
- III. the first dispersed shopping circle (circle range of the distance from the senile apartment is 1.0 ~ 1.5 km). 18% of the shopping activities of the aged live in the senile apartment are concentrated in this circle, and the attenuation rate is 12%. In this circle distributed large-scale supermarkets, shopping plaza, fruit supermarket, etc.
- IV. the second dispersed shopping circle (circle range of the distance from the senile apartment is 1.5 ~ 2.0 km). 10% of the shopping activities of the aged live in the senile apartment are concentrated in this circle, and the attenuation rate is 8%. There are usually a number of senior business services, such as a large supermarket, markets, shopping plaza, etc.

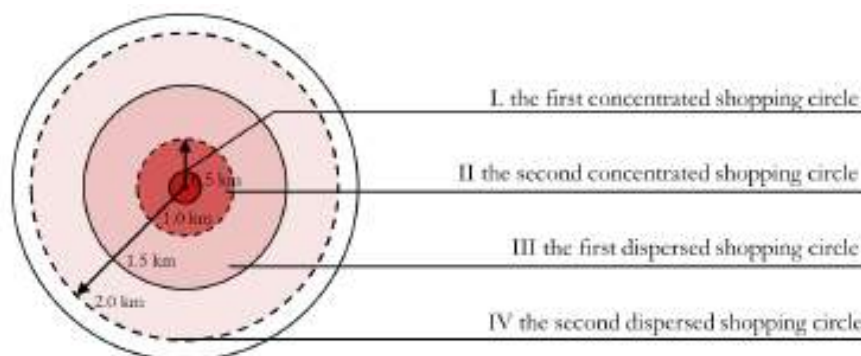


Figure 2 – the shopping Space structure of the aged in the senile apartment

Source: draw by author

Figure 2 – the shopping Space structure of the aged in the senile apartment
Source: draw by author

4.3 ANALYZE THE FACTOR INFLUENCE FOR THE TRAVEL FOR MEDICAL OF THE AGED

4.3.1 INTERNAL FACTORS

Age has significant effects on travel for medical needs of the aged. The nature law of gradual recession of the body leads to that with the increasing of the age, the monthly frequency of travel for medical needs increases gradually. Medical travel behavior differs significantly among individuals. The frequency of travel for medical needs is related to the aged body quality and the concepts of healthcare, and more importantly affected by distances, technology, prices, waiting time and other factors. In addition, whether the hospital is a health care fixed-point units also affects the choice of the aged. They would rather go to the further hospital if nearby hospitals are not healthcare fixed-point units. Therefore, the influence of this factor should also be considered. Compared to travel for shopping and leisure activities, the influence of distances on travel for medical is not so obvious within a certain distance.

Gender also plays an important role in the health function of the aged. Senile pathology and sociological studies have shown that women's health functions are inferior to men in many aspects. However, from the points of the statistical results, the difference in the frequency of travel for medical is not very obvious. But there are differences in the spatial structure of medical needs for the aged. More men than women tend to go further for medical services.

4.3.2 EXTERNAL FACTORS

Taking 30%, 60% as indicators, different circles of regions are divided into basic medical activity circle, expanding medical activity circle and senior medical activity circle, according to the proportion of activities focused. The circle where the aged medical activity concentration accumulates to 95% is regarded as the boundary of leisure activity space.

The spatial structure pattern of medical needs for the aged live in the senile apartment can be summarized as follows:

- I. Basic medical activity circle (circle range of the distance from the senile apartment is 0 ~ 0.5 km). Within this circle, the aged mainly utilize the medical service of the community health service stations, as well as the medical service of the clinics inside the senile apartment. Excluding the activity of using the medical facility within the senile apartment, 20% of the medical activities of the aged live in the senile apartment are concentrated in this circle.
- II. Expanding medical activity circle (circle range of the distance from the senile apartment is 0.5 ~ 1.0 km). The distance of this circle is also the limit range of travel for medical on foot. In addition to community health service centers, this circle has some high-grade hospitals.

III. Senior medical activity circle (circle range of the distance from the senile apartment is 1.0 ~ 3.0 km). This circle is far from the senile apartment, and the frequency of travel for medical tends to decline. But the decline rate is not obvious. This is because that the travel for medical taken within the circle mostly is seeking for senior hospital or municipal hospital. With the increasing of distance, the level of medical facilities is higher.

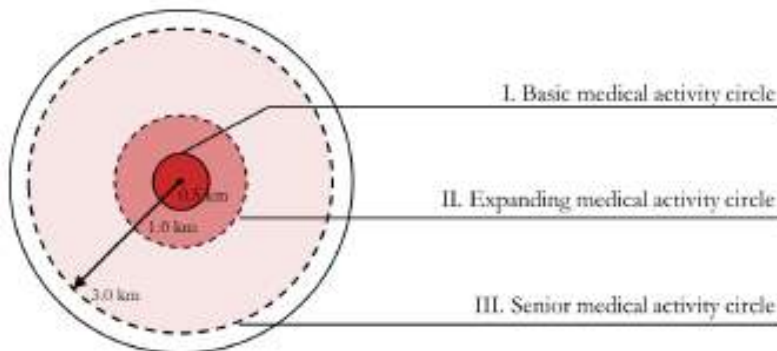


Figure 3 – the medical Space structure of the aged in the senile apartment
 Source: draw by author

4.4 ANALYZE THE FACTOR INFLUENCE FOR THE TRAVEL FOR CULTURE PURSUIT OF THE AGED

4.4.1 INTERNAL FACTORS

During 2000 to 2010, the proportion of the aged who have religions remain between 14% and 17% (eg Huang et al, 2015)¹². The religious participation rate of the aged in China is comparatively high, and it gradually increases with age increasing. Gender have great influences on religious travels. The percentage of women participating in religious activities is twice as much as the men. The believers among the aged living in the senile apartment at least take up more than 15%, where most have beliefs in Buddhism or Christianity. As a result, the distance of the religious buildings also needs to be considered for siting of the senile apartments.

4.4.2 EXTERNAL FACTORS

The aged who participate in cultural activities tend to have a strong will, and their travel resistance is comparatively stronger. But it is also restricted by external conditions that, since the distance of religious places is more than half an hour's drive, the frequency of outgoing for culture pursue plummeted. The size of the religious sites has little influence on religious travel of the aged. The numbers of religious places near the senile apartments are quite different. Some senile apartments have many nearby religious places, while some have little.

5 SENILE APARTMENT SITING EVALUATION INDEX SYSTEM

Space is an important carrier of the interact of the aged and the external environment. Reasonable spatial layout and construction can promote the travel frequency of the aged (eg Wan, 1994).¹³ An evaluation index system for siting of the senile apartment is provided, that taking the aged activity space as the breakthrough point, and giving full consideration to the effects of external factors. Based on above analysis, the weights of external factors are different, mainly due to the fact that different purposes of travel behavior have different influence degree for the life of the aged, and different purposes of travel behavior have different demands on surrounding facilities. Thus, a reasonable evaluation index system will help to evaluate the location of the senile apartment intuitively and accurately.

Under the condition of a given temporal and spatial constraints, the time-space range that an individual could physically reach, is expressed in the space-time as space-time prisms or potential path area. To understand it from the angle of activity, the potential path area refers to the area an individual is able to get to, after a fixed activity, under the condition of guarantee that next fixed activity can be reached on time. It is the activity circle of the aged. The volume, the area or the number of opportunities for activity is likely to be used as measure index of accessibility (eg Chai, 2014)14.

The senile apartment siting evaluation index system is based on travel behavior of the aged from four aspects: the travel for leisure, the travel for shopping, the travel for medical, the outgoing for culture pursue. Each index can be divided into secondary indicators from the distance, radiation scope, scale and so on. Combined with literature review method, the Delphi method (invited 3 experts engaged in endowment facility from colleges, 2 experts engaged in social welfare from civil affairs bureau and 2 directors of department of the senile apartment to set up an expert panel, and determined the indicators after two rounds of feedback) and the actual situation of the senile apartment, build a hierarchical structural model of senile apartment siting evaluation index system based on outgoing activity of the aged.

goal level A	First level indicator (system level B)	Second level indicator (index level C)
main indexes of the senile apartment siting evaluation based on travel behavior of the aged	Travel for leisure	travel distance, Natural Environment
	Travel for shopping	travel distance, type
	Travel for medical	travel distance, rank
	Outgoing for culture pursue	travel distance, type

Table 1-main indexes of the senile apartment siting evaluation based on travel behavior of the aged
Source: draw by author

First of all, the secondary indicators are different in units and can't be compared directly. Thus, in the model the method of maximization of dimensionless is used to quantify the criterions. Then, we established an evaluation system with hierarchical structure, and determined the subordinate relations between the upper and lower level elements. Assuming that the upper level of element as a criterion have dominated relationship to the next level of elements, the corresponding weights are assigned according to their relative importance under the criteria. The assignment of the Criteria Importance weights based on the Intercriteria Correlation(CRITIC) method mainly includes the subjective experience method, analytic hierarchy process (AHP), principal component analysis (PCA), Delphi method, etc. The evaluation index system of the senile apartment siting evaluation based on travel behavior of the aged and the judgement matrix for comparison between every two indexes are presented by a comprehensive calculation which uses the expert method and Analytical Hierarchy Process (AHP), and the weight of each indicator were determined.

First level indicator	The primary index weight	Second level indicator	Secondary index weight	combination weight
Travel for leisure	0.28	travel distance	0.78	0.22
	0.28	Natural Environment	0.22	0.06
Travel for shopping	0.25	travel distance	0.63	0.16
	0.25	type	0.37	0.09
Travel for medical	0.35	travel distance	0.55	0.19
	0.35	rank	0.45	0.16
Outgoing for culture pursue	0.12	travel distance	0.36	0.04
	0.12	type	0.64	0.08

Table 2-weights of the main indexes of the senile apartment siting evaluation
Source: draw by author

The using of analytic hierarchy process (AHP) provides a new thought and method to evaluate the location of the senile apartment objectively and accurately. It is important to note that the demand of the index is relatively high. So, it is a tricky filter link in index, and must go through several rounds of discussions and modifications, and get the acceptance and approval of the authorities as much as possible. Only in this way, the results on the basis can have the meaning of the further promotion. Thus, this article took a more

lavish description to describe the internal and external factors, put forward the selection of quantifiable indicators, and light on expert review process and data processing.

The evaluation index system has many functions. Firstly, we can see the impact of external factors directly. For example, the distance of green space for travel for leisure from old apartment is the most important parameter that affects the travel behavior of the aged, and the distance of the culture facilities surrounding the senile apartment has the minimal influence; In addition, when other conditions are similar, the planning of site selection which is more advantageous to the aged can be evaluated by the evaluation index system, so as to provide a strong basis for site selection.

6 REFLECTION AND PROSPECT

This article discusses the four types of outing and proposes the corresponding site selection strategies.

1. There should be complete facilities around the senile apartment to stimulate the travel behavior of the aged. 2. Give priority to the demand of travel for medical of the aged. We should give priority to the most important needs of outgoing as the aged have a lot of travel behavior. Facility requirements are hard to be considered in every aspect in the selected location and the first consider is the most important requirements of the aged. Especially if the senile apartment cannot provide basic health care, the location should be near the hospital. 3. Relative to the scale and quality of green space, the distance from the senile apartments to the green space is the most important. 4. More small business should be distributed in the area close to the senile apartment. Relative to the large shopping centers, small business services surrounding the senile apartment is more important. 5. Although rarely aware of, the cultural facilities, especially the religious facility also have a strong role in promoting the travel behavior of the aged.

However, problems still exist. First, individual differences will lead to different effects. Second, a perfect siting for the apartment of the aged that satisfy all the requirements does not exist. Moreover, more factors including the scale of the apartment, the ground rent, and the planning, should be considered. Thereby, the most proper siting scheme should be planned in terms of the evaluation system of the indices. Proper siting will help the aged to merge into the society, to identify with themselves, and to enjoy their twilights years in the apartments.

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ID 1621 | MULTI-SENSORY APPROACH TO HEALTH-SUPPORTIVE AND AGEING-FRIENDLY HIGH-DENSITY URBAN ENVIRONMENTS

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1 INTRODUCTION

Design and planning actions to improve urban health and well-being are well-recognised as some of the key drivers and indicators of sustainable, inclusive and resilient urban and community development worldwide. Yet, due to rapid growth and transformation, increased densification, hybridisation and intensification, our cities continue to generate problems, stress, harsh conditions and inequality, instead of becoming healing, empathetic, inclusive and safe environments for all.

Our understanding and experience of the built environment are primarily built around multi-sensory, emotional and symbolic modes of exchange with space (Merleau-Ponty, 1962; Pallasmaa, 1996; Pérez-Gómez, 2006). Active multi-sensory and emotional dialogue with all environmental stimuli, including positive distractions, textures, materials, colours, signage, culture-specific clues, way-finding and overall aesthetic atmosphere, profoundly shape our understanding of the built environment and are vital for physical, psychological and social well-being of all ages. However, while architecture has immense potentials to engage the immediacy of people's experiences more effectively than other art forms (Holl et al., 2006), our contemporary cities are more than often either sensory overwhelming or sensory depleting, which results in physical, mental and emotional stress. Stress is the major cause of diseases, pandemic depression and death in the developed world (WHO, 2002), with more than 50% of deaths worldwide stemming from chronic non-communicable diseases that are instigated by the continuous exposure to numerous and intense stress conditions of contemporary cities (OxHA, 2008).

2 SCOPE AND OBJECTIVES

The contemporary shopping environments have long been criticised for manipulating with people's sensory and emotional reactions through employment of sometimes very sophisticated design 'strategies' (such as theming, 'total landscaping', 'mallification' and 'Disneyfication') in order to achieve higher consumption goals (Crawford, 1992; Dovey, 1999, 2010; Mitrasinovic, 2006; Pimlott, 2008-9.). Such strategies are seen as negative as they affect users' behaviour and well-being negatively as well as promote social exclusion. However, consumption represents a dominant part of our everyday practices today, and it is inscribed in almost all types of physical spaces we use. Since consumption is an inherently spatial, political, aesthetic, ethic and economic practice, "spaces of consumption are always produced as a field of forces, exchanges and interactions" (Styhre and Engberg, 2003, p. 120). Shopping malls have become influential model for various urban developments (including healthcare) and are tightly knitted into the everyday environment of many dense Asian cities, such as Singapore, Hong Kong or Tokyo. In these cities, they may arguably be seen as perpetual laboratories of "positive stress" (positive distractions), while blurring the boundaries between the indoor and the outdoor, private and public.