The Relationship Between Environment Characteristics and Old Citizen’s Physical Activates in Residential Area, Harbin, China

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Abstract: Walking is one of the main travel mode for old citizen (over 60 years old) in their daily life, so understanding how the environment characteristics of residential area could effect the old citizen’s physical activities could help the designer to work better on old citizen friendly urban plan. This study attempts to comprehensively and objectively research on the relationship between environment characteristics and old citizen’s physical activities in Harbin residential areas. Spatial feature and traffic management have been thought as the main determinate of walkability of urban space, however physical features and urban design details have been rarely mentioned. Old citizen’s perception has been examined in this study: 15 environment characteristics problems have been identified in the studied residential areas based on the understanding of pervious researches. Through observations and questionnaire surveys, the environment characteristics of each case study were evaluated and the physical problems were discovered. Additionally, old citizen’s perception on the identified problems and their effects on their physical activities of the studied areas were found and defined, in both high and low walkability residential area.

1. Introduction
Although people own more and more cars in the past 20 years in China, walking is still one of the main travel mode for old citizen (over 60 years old) in their daily life, and it is might still be the most important one because it brings not only physical actives which is necessary for physical healthy and social life which is crucial for old citizen’s mental healthy, so understanding how the environment characteristics of residential area could effect the old citizen’s physical activities could help the designer to work better on old citizen friendly urban plan.

A paper presented to the 2004 USA Transport Research Board AGM (Ewing & Cervero 2010) [1]summarized other research approaches including ‘...localities of interest regarding how ‘friendly’ they are to pedestrians’. It is the inclusion of ‘friendliness’ that probably correlates with the TfL description and later they mention other research involved with Walkability including ‘...some aspects are objective, and therefore easily measurable, but others are subjective’. Ewing & Cervero also mention other friendliness terms including, ‘functional’, ‘safety’, ‘aesthetic’ and ‘destination’ as well as ‘security’, ‘comfort’ and ‘convenience’, ‘continuity’, ‘system coherence’, and ‘attractiveness’.

It is from the last decade of the 20th century when different evaluations took place based on walkable street agenda. Boarnet[2] (2001) examined people’s choice of walking or biking in Bay area. By analyzing the data from Bay Area Travel Survey, two-day activity diary survey, they find density,
trip distance, land use diversity, existing of sidewalk and bike lane could affect people’s choice of walk or bike. Further more, the studies by Forsyth[3](2008) and De Bourdeaudhuij[4] (2003) illustrated the effects of space proportion, size of block and traffic congestion on user’s choice of travel mode. These studies showed that street’s walkability were influenced by spatial and traffic characteristics.

Furthermore, Sallis[5](2003) illustrated the visual damage and negative influence of commercial signage in traditional urban area. Saute[6] (2008) argued about the influences of seats, sculpture and planting on the walkability of an area and indicated that physical actives increase with increasing of streetscape elements. Also, Troped[7] (2001) showed how friendly environmental design could enhance the walkability in six neighborhoods in Austin, TX. In addition, Park[8] (2008) illustrated how the public services and maintenance and facilities for disabled people in a public space, as well as other environmental factors can support interactions between people and surroundings. Overall, having sustainable ecology or a good quality environment is considered a major factor of walkability in cities.

Yet, it is important to note that each research has only examined some of the affective factors of environment characteristics. This study attempts to identify the environment characteristics that affect old citizen’s physical activities, and try to examine how these environment characteristics influence old citizen’s physical activities in high and low walkability residential areas.

2. Research method

2.1. The studied streets

This study selected six residential areas located in Harbin city, 3 of them located in the old city center, which included smaller blocks and narrower road, which are represented high walkability area, and the other 3 are located in newly developed urban areas, which feature is big lock and wide road, take them as the low-walkability areas. Because of the limitation of time and fund, this study cannot choose more cases. The six cases studied in this research are representative, to a certain extent, could represent the residential area environment of Harbin urban center, so the research results can be applied to other area in Harbin. The research includes the investigation of the space and environmental characteristics in the six areas, and finds the existing problems in them. This study attempts to find evidence for ‘urban space problem can affect the old citizen’s physical activities’. In conclusion, we will study the impact of the problems bring, and make contribution to our understanding of residential areas space problems and solving these problems from the perspective of old citizen.

2.2. Research process

This study combined a variety of research methods. In order to answer the main questions, both qualitative and quantitative approach were taken. The environment characteristics of the studied residential areas were considered as variables. Observation is the most commonly used and most effective method in the research of all famous research on urban space, so in this study, the first step was to identify environment problems of the study areas through observation.

As the ultimate environment characteristics assessment was from the user's point of view, so it was impossible to examine the walkability of urban space without consideration of user’s – in this study, the old citizen’s experience. Therefore, the study also used questionnaire. The purpose of the questionnaire was to explain user’s viewpoint about existing environment problems of the residential areas, and how these problems affect old citizen’s physical activities. The questionnaire includes both questions about old citizen’s view on existing environment problems and the questions about what characters create high quality urban space and could raise they willing to do physical activities. Then use the Likert scale, from strongly agree to strongly disagree, to measure user’s attitude.

In this study, the sample size is 150 per area, this amount is due to the minimum sample size for data analysis, which is based on the study of Dooley in 2001, which should be 100-150 data. And, in the questionnaire, the respondents will be asked whether they are familiar with the area, if get a
positive answer, the next step will let them fill in the questionnaire. Therefore, 150 respondents were randomly selected, 60 or above years old, very familiar with the study residential areas.

The reliability test used to measure the survey’s internal consistency was obtained by Alpha Cronbach Vakye examination[9] (Coakes&steed, 2009). After two phase of examining, the findings are presented as follows:

2.3. Questionnaire survey
In high-walkbility residential areas survey, the respondents included 54% of male and 46% of female, 60% of them live nearby, and over 38% of physical activities are for shopping or public services, 42% for excises, 15% for public transportation and 5% for other reason. Respondents of the low-walkbility residential areas consisted of 43% of male and 48% of female, 48% physical activities are for shopping or public services, only 14% for excises, 25% for access to public transportation and 13% for other aims.

2.3.1 Reliability and validity test. The result indicated the result of the reliability and validity test of the surveys in 6 areas studies. The reliability test’s result of high-walkbility residential areas showed 0.812 in summer, 0.786 as Cronbach’s Alpha in low-walkbility residential areas. The results were both higher than the coefficients of minimum acceptable values (0.7), so they are acceptable. Similarly, the validity tests’ results showed that Bartlett’s test of sphericity is significant in the studied areas, in both high and low walkbility residential areas are showing a significant result. In addition, the KMO Measure of Sampling Adequacy’s value were 0.808 for high-walkbility residential areas, and 0.867 for low-walkbility residential areas, therefore, both acceptable for this test.

2.3.2 Correlation analysis: environment problems and physical activities. Table 1 shows the findings of Spearman correlation analysis for both low and high-walkbility residential areas. The results indicate that there is a negative correlation between old citizen’s physical activates and of the studied residential areas and their environment problems. These results are shown in Table 3, which implies that the old citizen’s physical activates of the studied residential areas are deteriorated by the increase of these environment problems.

| Table 1. Findings of correlation coefficient analysis: environment problems and old citizen’s physical activates |
|---------------------------------------------------------------|
| The identified environment problems | Physical activities of old citizen |
|                               | High-walkbility residential areas | Low-walkbility residential areas |
| Inadequate parking space | -0.123, \( P(0.370)<0.05 \) | -0.152, \( P(0.250)>0.05 \) |
| Heavy traffic congestion | -0.278, \( P(0.054)<0.05 \) | — |
| Narrow sidewalk | -0.458**, \( P(0.000)<0.01 \) | -0.512*, \( P(0.011)<0.05 \) |
| Inadequate of bike lanes | -0.104*, \( P(0.270)>0.05 \) | -0.081*, \( P(0.181)>0.05 \) |
| Inappropriate space proportion | — | -0.555*, \( P(0.022)<0.05 \) |
| Long block | — | -0.487*, \( P(0.000)<0.05 \) |
| Inadequate facilities for disabled people | -0.658*, \( P(0.021)<0.05 \) | -0.581*, \( P(0.034)<0.05 \) |
| Inadequate public services and maintenance | -0.560*, \( P(0.023)<0.05 \) | -0.629*, \( P(0.039)<0.05 \) |
| Inadequate street furniture | -0.386**, \( P(0.008)<0.01 \) | -0.598**, \( P(0.000)<0.01 \) |
| Inadequate shelter on transit station | -0.121, \( P(0.087)>0.05 \) | -0.592*, \( P(0.031)<0.05 \) |
| Inadequate shelter on sidewalk | -0.256, \( P(0.058)>0.05 \) | -0.301**, \( P(0.000)<0.01 \) |
| Inadequate lighting | -0.384, \( P(0.057)>0.05 \) | -0.470*, \( P(0.033)<0.05 \) |
| Irregular signs | -0.578*, \( P(0.023)<0.05 \) | -0.282, \( P(0.066)>0.05 \) |
| Inadequate planting | -0.578*, \( P(0.018)<0.05 \) | -0.305, \( P(0.031)>0.05 \) |
| Inadequate streetscape elements | -0.735*, \( P(0.091)<0.05 \) | -0.422**, \( P(0.000)<0.01 \) |

3. Discussion
In order to further understand the impact of the environment characteristics of Harbin residential areas
on old citizen’s physical activities, the researchers make a comparison of the results of low and high residential areas case studies.

In the survey results, among all the identified problems, 6 of them had negative correlation with the walkability in the both high and low walkability residential areas: heavy traffic congestion, narrow sidewalk, inadequate facilities for disabled people, inadequate public services and maintenance, inadequate street furniture and inadequate street streetscape elements (such as sculpture, fountain, etc.).

When the researchers classified all the identified problems into different categories, they also find difference on impact of walkability of each category. Table 1 that old citizen are not sensitive on traffic conditions and parking issues, the reason might be related to their physical activities are more concern about the nearby destination such as local grocery store rather than related to traffic, although through our observation the vehicle parking on sidewalks, occupied the pedestrian space, so the sidewalk get narrower and visually more mess, and does block people who walking on sidewalk, but the result in both high and low residential areas survey, narrow sidewalks show strongly correlation. In addition, inadequate of bike lanes also shows insignificant result, the reason is obvious related to the low rate use of bike among old citizens. Meanwhile, inappropriate space proportion also strongly affect physical activities in this area. The effect of inappropriate space proportion and long block on physical activities could be attribute to old citizen’s visual and psychological feelings, lacking visual focus and losing interest and willing to walk when stay in such area.

In the facilities and streetscape problems categories, old citizen perceive that the inadequate public services and maintenance, inadequate streetscape elements, inadequate street furniture are important factors which affect the deterioration of physical activates in both high and low walkability residential areas. In general, in the results of the comparative study of the high and low walkability residential areas, the researchers find six major and common problems of the studied areas which reveals poor environment characteristics are the main reason of the deterioration of the physical activities of old citizen in Harbin residential areas. The findings of this research reinforce the results of former studies, especially the research about walkability city (Wagner, 2012[10]), which revealed traffic effects on the deterioration of streets’ walkability. In addition, these results also confirmed the conclusions of other early studies such as Sauter and Huettenmoser2008[7]. Besides the impact of traffic condition, there are other research results shows the similar impact of physical characteristics on urban space’s walkability. For example, the significant negative correlation between walkability and planting, street furniture and streetscapes prove the result of research of Ball& Bauman [11](2001)’s study on the walkability of Town Heritage area in Australia, also revealed similar findings.

Despite the above-mentioned pervious researches have different approaches, but the comparison to them and discussion still revealed common results that verify the findings of this study. Although researchers found the relationship between physical activities and environment characteristics in urban space half-century ago, the current residential areas are still suffering from environment problems which unfriendly to especially old citizen.

4. Conclusion and suggestions

The main purpose of this research was to examine whether the environment problems could influence old citizen’ physical activities, with a special focus on high and low walkability residential areas. The findings of this research prove that most identified problems deteriorate the old citizen’ physical activities. In 50 years China will goes into old aged society. Over the past 30 years, some progress has been made in the research of old-age friendly cities in western developed countries. The case of building old-age friendly cities in various countries shows that the planning of old-age society is not a single aspect, but requires the whole planning system to solve the old-citizen problems at different levels from top to bottom. That is to say, urban planning and urban design is the theoretical starting point of most elderly friendly actions. Although centralized and diverse cities are the best means to meet the needs of the elderly at the urban level, urban environment details on small scale are the same important for old citizen’s perception of friendly environment.
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