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Dimensions Underlying Local People's Preference of Street Characteristics for Walking

Jenny Ernawati*

Department of Architecture, Faculty of Engineering, University of Brawijaya, Jl. MT Haryono 167, Malang 65145, Indonesia

Abstract

This study aims to explore underlying dimensions of local people's preference of street characteristics for walking, with the town of Malang Indonesia as the case study. This study employed survey research method using a set of instruments consisting of a self-administered questionnaire applying multiple rating scale technique. Three hundred respondents were randomly selected using multistage random sampling method. Descriptive statistics and factor analysis were employed to answer the research questions. Results indicated that there are five underlying dimensions of street characteristics for walking i.e. the Quality of Pedestrian Facilities, Neighborhood Aesthetics, Green Space, The Presence of Human Activities, and Neighborhood Safety. The five factors account for 51.7% of the variance in local people's preference of street characteristics for walking.

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1. Introduction

A growing body of literature indicates that the physical environment has a significant role in generating physical activities (Northridge et al., 2003). Results of the previous research also have found some aspects of the physical environment that influence physical activity. However, although there is some evidence found that support for the

* Corresponding Author. Tel.: +0 000 000 0000 ; fax: +0 00 0000 0000.

E-mail address: jny23ern@gmail.com

association between environmental factors and physical activity, the influence of built environment on physical activity are still not well understood (Owen et al., 2004). The evidence is still very limited. Therefore, more investigations are necessary to reveal the relations between built environment and the physical activity.

One of the most common physical activity performs by people of all ages is walking. Walking is a physical activity that most people do. In Western countries, walking is not only for the purpose of the exercise, but it is also one mode of transportation. In this sense, walking is the most frequently performed activity.

Walking is the only mode of transport that produces no emissions. It is readily available, requiring no special equipment, safe, and cost-free. So it is sustainable. In line with this notion, the current urban design approach leads to the concept of "city life takes place on foot", a concept of a more sustainable and livable city. Besides this comfortable habitation, reducing the number of motor vehicle usage significantly reduce air pollution. This situation, in turn, supporting the sustainability of the city and a high quality of life for the people.

Walking is also necessary to deal with health issues. The previous study found that people who regularly walk about 1.5 miles per day will decrease their possibilities of losing their physical functions (Borst, H. et al., 2008; Mor, et al., 1989). Previous studies also found that people who physically inactive can have health problems such as heart disease, obesity and so on (Borst, H. et al., 2008; Wannamethee & Shaper, 1999, 2001). Therefore, walking is an activity that is necessary to keep people healthy. In this sense, to generate interest in the walking behaviour of people can be one of the efforts to help preserve the health of the community (Borst, HC, 2008).

Therefore, the relationship between the physical environment and walking behaviour has attracted many researchers. Understanding of how environmental attributes can influence physical activities, such as walking, has become a focus for a broad range of research to improve the quality of life in the built environment. The results of previous studies have shown a link between the physical environment and walking activity (Owen, N. et al., 2004). More specifically, previous studies found an association between the characteristics of the environment, physical activity, and health aspects (Borst, HC et al., 2008). Findings from some previous research showed that improving the physical environment may cause the increasing rate of walking (Ariffin and Zahari, 2013). Some previous studies proved that people living in a walkable neighborhood spent more time for walking compared to residents in a low walkable neighborhood.

Some researchers (such as Ball et al., 2001; Borst et al., 2008; Owen et al., 2004), studied relations of the physical environment and walking activity. One of the important issues of concern to the researchers was to identify factors that influence people's participation in physical activity, particularly walking activity that is currently widely promoted to improve the quality of life (Ball, K. et al., 2001). Understanding the factors that are important to increase physical activity in an environment can be used as a theoretical basis for the design of the physical environment. Unfortunately, in conjunction with physical activity, previous studies have mainly focused on aspects of individual characteristics such as age, gender, socio-economic conditions (Ball, K. et al., 2001). While the influence of the physical environment characteristics on walking behaviour may be as important as the impact of individual characteristics. In line with this thought, the researchers are increasingly aware of the importance of physical environment influence on walking behaviour.

A typical physical environment that is essential for walking is a street. The street is one of the important space for city's functions and people's daily life (Ge & Hokao, 2005). In this context, the street can be seen as having an important role in the maintenance of public health. Therefore, the design of the street has become a major issue in urban policy and urban planning. However, the number of studies to reveal the relationship between the physical environment of the street and walking behaviour is still limited. Moreover, most of the studies conducted in Western countries (e.g. Ball, K. et al., 2001; Borst, HC et al., 2008). Meanwhile, the research in developing countries such as Indonesia is still very limited. Therefore, this study is intended to fill the gap.

The research mains to explore underlying dimensions of local people's preference of street characteristics for walking, which operationalized through community's appraisal of the attractiveness of the street for walkers. The results of this study are expected to provide a fundamental contribution to environmental design field of studies such as architecture, urban planning and design in creating an environment that is conducive to attract people to walk to improve the quality of life.

2. Research method

This research conducted in the city of Malang, Indonesia. Malang is known as a historic town, which designed by Thomas Karsten in the Dutch Colonial Era. Nowadays the city grows as a densely populated city (around 7,429 people per square kilometres), so it becomes the second biggest city in East Java. Malang is located around 440-667 metres above sea level with coverage area around 110.06 Km². It consists of five districts (*Kecamatan*) i.e. Blimbing, Klojen, Sukun, Kedungkandang and Lowokwaru.

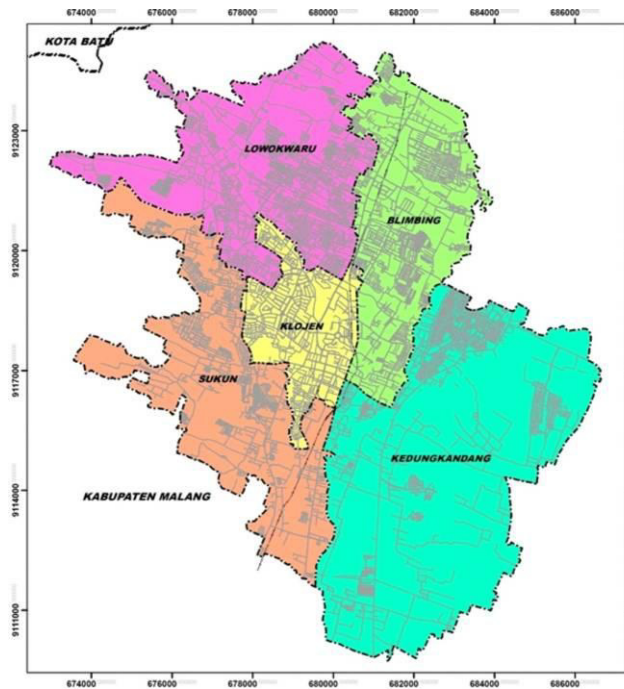


Fig. 1. The districts in the city of Malang
(Source: BPP Malang, 2014)

Since this research based on the subjective response, it used mainly a quantitative approach. A qualitative approach through field observation was conducted to obtain physical data of street corridors. The quantitative approach employed to explore people's evaluation of the characteristics of the street, based on the attractiveness of the street for walking, using five-scale multiple rating scales measurement techniques.

Three hundred respondents were selected using multistage probability sampling method. Three of five districts in Malang City selected randomly. They were districts of Klojen (consists of 11 sub-districts), Sukun (11 sub-districts) and Kedungkandang (12 sub-districts). Four sub-districts of each district then randomly selected. The sub-districts of Klojen chose in this phase were Gadingkasri, Rampal Celaket, Klojen and Sama'an; the sub-districts of Sukun selected were Bandulan, Pisang Candi, Bandungrejosari, and Gadang; the sub-districts of Kedungkandang selected were Buring, Kedungkandang, Cemorokandang, and Lesanpuro. This technique is done continuously until reached data of household where respondents were chosen. The selection of respondents used research randomizer (www.randomizer.org). There are 300 participants in the study, one hundred respondents for each district.

A field survey was conducted during the period of August-October 2013. Respondents were asked to fill out a self-administered questionnaire to explore respondents' evaluation of the characteristics of the physical environment of the street they usually pass for walking in the context of its attractiveness for a walk. Variables of the street characteristics evaluated in this study based on the previous research invented by Ball et al. (2001), Borst et al. (2008), and Owen et al. (2004). There are 30 variables of street characteristics for walking adopted in this study.

Respondents assessed the characteristics of the street using multiple rating scales consisting of five-scale from "very unpleasant to walk" (value = 1) to "very pleasant to walk" (value = 5).

Table 1. Variables of street characteristics employed in the research

Number	Variables
1	The presence of sidewalk
2	Ramps on/off sidewalk
3	Slopes
4	Stairs
5	Quality of sidewalk
6	Width of sidewalk
7	Obstacles
8	Zebra crossings
9	Vegetation and trees along route
10	Waste terrain
11	Green strips
12	Front gardens
13	Blind walls
14	Fences
15	Bus stop
16	Houses
17	Shops
18	Business buildings
19	Vacant buildings
20	Building density
21	Park
22	Graffiti
23	Street vendors
24	Pedestrian density
25	Traffic volume
26	Street attractions
27	Litter on street
28	Crimes
29	Traffic accidents
30	Personal accidents

(Source: Ball et al., 2001; Borst et al., 2008; Owen et al., 2004)

A factor analysis employed to determine the underlying dimensions of local people's appraisal of the street characteristics, which is operationalised through the appeal of the street corridor to walk. In the preliminary analysis performed, the variable "waste terrain" found to be irrelevant. Therefore, this variable excluded from the analysis so that the factor analysis conducted on 29 variables. Preliminary analysis of the 29 variables obtained determinant value > 0.0005 which met the requirement for a factor analysis. KMO value was 0.925, which indicates that the sample size is sufficient for factor analysis. In addition, Bartlett's test showed a significance value of <0.001 which shows that in overall the 29 variables is appropriate for factor analysis. The factor analysis applied principal axis factoring with varimax rotation.

Participants in this study consisted of 70% male and 30% female. Most aged 21-50 years (80%) with education level, at least, graduated from high school (79%). Most of the respondents work in the private sector (66.7%) in the

middle-low socioeconomic level (88%). Most of the participants (81.3%) have lived in the city of Malang more than 15 years. Sixty-four percent of respondents used to walk 1-3 times per day while only 36% of respondents walk 1-3 times per week. Participants used to walk 5-20 minutes for each walk (82.4% of respondents).

3. Results and discussions

The research found there are six streets most preferred by local people for walking. These are Ijen Street, Tugu Street, Langsep Street, Bandung Street, Kawi Street, and Dieng Street. Picture 1 shows the appearance of those streets.



Fig. 2. The streets most preferred by local people for walking

The study also identified streets that people do not like most to walk. These are Muharto Street, Pasar Besar Street, Kyai Ageng Gribig Street, MT Haryono Street, and Zainul Zache Street. Picture 3 shows the appearance of those streets.





Fig. 3. The streets most unpreferred by local people for walking

Results in Table 2 show there are five dimensions underlying people's evaluation of the street characteristics in the context of its appeal for walking. The first factor consists of eight items that refer to the quality of pedestrian facilities. This dimension consists of the quality of ramps on/off the sidewalk, the stairs, the quality of pavement, sidewalk width, the presence of sidewalk, the slope of the street, obstacles such as pots, trash bin, trees, and zebra crossings. Therefore, the first Factor was named as The Quality of Pedestrian Facilities.

The second factor consisted of eight items. This second dimension composed of the scenery of shops row, the appearance of the business/commercial buildings, views of houses row, fences between the pavement and the vehicles flow, blind walls, front gardens, the scenery due to the vacant buildings, the presence of the stop point of public transportation. The eighth item refers to the aesthetic aspects of the environment so this factor named as Neighborhood Aesthetics Factor.

The third factor underlying people's preference for the street characteristics for walking consisting of six items. These six items include variables traffic volume, the pedestrian density, the atmosphere due to the attractions of the community or another group, the environment due to the presence of street vendors, landscape due to graffiti and building density. Thus, the third factor dominated by the activity of the people who appear visually on the street. Therefore, this factor named as Human Visual Activity Factor.

The fourth factor consists of four items that include a sense of security against the possibility of a traffic accident, and personal accidents caused by the condition of the sidewalk, a sense of security against crime, and the atmosphere of cleanliness in the street corridor. The result shows that the fourth factor is dominated by a sense of safety, against accident as well as a crime. Although this sense was subjective, in the context of the physical environment of the street, it is closely related to aspects of the physical design. Furthermore, the variable of cleanliness whether it is positive or negative give the impression of a sense of safety of health in the neighborhood. Henceforth, the fourth factor is named Environmental Safety Factor.

The fifth factor underlying people's evaluations of the street characteristics in the context of the attractiveness of the street to walk consists of three items. This last factor refers to the greenery quality that includes the atmosphere with the presence of vegetation or trees, the presence of the green line on the street, and the quality of the park. Therefore, this fifth factor named Greenery Quality Factor.

The five dimensions explain 51.7% of the diversity that exists in society. In other words, 51.7% of people gave the same assessment of the attractiveness of the road corridor for walking, which is determined by these five dimensions.

Table 2. Dimensions (factors) of street characteristics for walking (Pattern Matrix ^{a)})

No	Factor					
		1	2	3	4	5
1	Ramps on/off sidewalk	.751				
2	Stairs	.697				
3	Quality of sidewalk	.687				
4	Width of pavement	.658				
5	The presence of sidewalk	.656				
6	Slopes	.633				
7	Obstacles such as pots, trash bin, trees	.433				
8	Zebra crossings	.413				
1	The scenery of shops row		.719			
2	The appearance of the business/commercial buildings		.645			
3	View of houses row		.618			
4	Fences between the pavement and the vehicles flow, and fences between pavement and building site.		.581			
5	Blind walls		.566			
6	The scenery of front gardens		.504			
7	Vacant buildings		.436			
8	Bus stops		.433			
1	Traffic volume			.672		
2	Pedestrian density			.653		
3	The atmosphere due to the attractions of the community or another group			.586		
4	The atmosphere due to the presence of street vendors			.518		
5	Graffiti			.473		
6	Building density			.455		
1	Traffic accidents				.876	
2	A sense of security against the possibility of personal accidents caused by the condition of the sidewalk				.811	

3	A sense of security against crime	.790
4	The atmosphere of cleanliness in the street corridor	.480
1	The atmosphere with the presence of vegetation or trees	.732
2	the presence of the green line on the street	.610
3	the quality of the park	.574

Extraction Method: Principal Axis Factoring, Rotation Method: Varimax with Kaiser Normalization.

^a. Rotation converged in 7 iterations.

Therefore, five dimensions are underlying local people's preference of street characteristics for walking. These dimensions are The Quality of Pedestrian Facilities, Neighborhood Aesthetics, Human Visual Activity, Neighborhood Safety, and Greenery Quality. Results indicated a consistency to the previous studies. Many research findings, in Britain for example, underlines the importance of safety to increase the attractiveness of the physical environment as a place for people's activities (Harrison et al., 2007). Even for the elderly, high insecurity against crime in particular environments causes a decreased desire to walk in these areas (Michael et al., 2006). Some people also reported avoiding the street with heavy traffic because they feel unsafe (Mitchael et al., 2006). Booth et al. (2000) also found that neighborhood safety was a significant predictor of being active. The neighborhood that perceived as unsafe is usually to cause inactivity.

Previous research shows that convenient facilities, which refer to the quality of sidewalk facilities, the presence of shops, the presence of park nearby, and a safe environment are variables that found correlates with the physical activity. These qualities of street characteristics influence the rate of walking. Previous studies found that sidewalk coverage, the density of trees along the pavement are significant as predictors of walking activities (Larsen & Gilliland, 2014). Campos et al. (2003) also found that pavement width and slopes of pavement are importance in encouraging people to walk. Some of these factors may relate to the Quality of Pedestrian Facilities, Aesthetics and Safety dimensions of the environments.

Street Greenery also found as a factor that influences walking behaviour. The previous studies (e.g. Ball et al. 2001; Borst et al., 2008; Owen et al., 2004; and Sepe, M., 2007) found urban greenery is part of the aesthetic concept of the environment. However, in this study, people evaluated the aesthetic aspect of the environment and the green system separately. These results show an improvement in the grouping variable, the development of the measurement scale, that found in the previous studies.

Another study found that Neighborhood Aesthetics might influence walking behaviour. However, the importance of Neighborhood Aesthetics dimension varies, depends on the people, because it depends on the subjective response. Previous studies have found that certain aspects of environmental aesthetics can make a neighborhood, a street, more pleasant (Larsen et al., 2009; Owen et al., 2004; Saelens et al., 2003).

In sum, to create a friendly street to attract people to walk, the design of a street should consider the Quality of Pedestrian Facilities, the Aesthetics dimension, the presence of Human Visual Activity, Neighborhood Safety, and the Greenery Quality. However, the environmental designer should be aware of the importance of perception in encouraging people to walk. Walking behaviour depends on how people perceive the environment. Therefore, a study based on a subjective response like this research will much help to reveal people's preference of physical environment for walking.

4. Conclusions and recommendation

This study found five dimensions underlying local people's preference of street characteristics for walking i.e. The Quality of Pedestrian Facilities, Neighborhood Aesthetics, Human Visual Activity, Neighborhood Safety, and Greenery Quality. The five factors account for 51.7% of the variance in local people's preference of street characteristics for walking. These findings are consonant with the previous studies and make a contribution to

improving the street design that can attract more people to walk. However, many factors might affect walking behaviour. This research has a limitation in variables under study. Therefore, more variables need to explore, and further study is necessary to elaborate each dimension in more detail.

Further study is also required to reveal the specific contribution of each factor to street appeal for walking. Furthermore, since walking behaviour depends on people's preference which is personal, more studies like this research need to be conducted elsewhere to make a generalisation of the findings.

In term of the research method, although this study has also found measurement scale of street characteristics related to walking behaviour, further study is necessary to test the consistency of the scale in various studies of the street characteristic for walking.

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