

Relationships among Lifestyle Attributes and Attitudes toward Pedestrian Facilities

Yoshiyuki TAJIMA ^a, Hiroshi TSUKAGUCHI ^b, Upali VANDEBONA ^c, Hao-Ching HSIA ^d

^a *Railway Planning Dept., Railway Division, NIPPON KOEI CO., LTD, Tokyo 102-8539, Japan*

^a *E-mail: tajima-yh@n-koei.jp*

^b *Department of Civil Engineering, Ritsumeikan University, Shiga 525-8577, Japan*

^b *E-mail: tsukaguc@se.ritsumei.ac.jp*

^c *School of Civil and Environmental Engineering, University of New South Wales, Sydney 2052, Australia*

^c *E-mail: u.vandebona@unsw.edu.au*

^d *College of Planning and Design, National Cheng Kung University, Tainan 70101, Taiwan*

^d *E-mail: spacemake@yahoo.com.tw*

Abstract: This study investigates the influence of lifestyle of individuals on their walking behavior and their expectations from pedestrian infrastructure. This project is part of a series of studies looking into region specific characteristics of pedestrian behavior. Part of the challenge during this project has been to identify attributes that relate to lifestyle of individuals and collection of relevant data. Large part of the data collection has been carried out over five urban areas in Japan and a supplementary survey has been carried out in Sydney, Australia. The survey has focused on eight lifestyle indicators and ten attitudinal questions related to walking and experience with pedestrian facilities. Statistical analysis and correspondence analysis technique applied in this project have revealed that lifestyle attributes and regional characteristics both have to be considered to obtain an accurate picture of pedestrian attitudes. Some implications of relevance to the planning community have been mentioned.

Keywords: Pedestrian attitudes, Pedestrian behavior, Lifestyle, Public transport, Pedestrian survey, EASTS IRG05

1. INTRODUCTION

Walking is arguably the most environmentally friendly transport mode as it has a minimal impact on non-renewable resources. Walking is an unavoidable element in personal travel thus making pedestrian infrastructure responsible for serving almost every member of the community. Potential health benefits have been widely promoted by some to further improve participation rates in non-motorised transport modes including walking. Usefulness of incorporating health-enhancing physical activities such as walking and cycling for personal mobility during daily journeys to work have been investigated by Pekka et al. (1998). From transport planning point of view, such personal health related lifestyle selections of individuals have an influence on pedestrian traffic volumes and reliance on relevant infrastructure. The focus in this paper is not limited to health related lifestyle issues as the interest here is the general connection between broader lifestyle attributes and needs and attitudes of pedestrians toward walking.

Planning pedestrian facilities to be compatible with the lifestyle of the users is the challenge

accepted in this project. In addition to conventional engineering specifications related to strength, road safety, size and type of construction material, this project has set out to find out what the users have to say about the form of suitable pedestrian environment. This has been approached through a sample survey of user attitudes and their lifestyle indicators.

It is not intended here to include a lengthy discussion as to what is meant by the term lifestyle. A deep discussion from the viewpoint of sociology and anthropology is available in publications such as Giddens (1991). In its simplest form, lifestyle is reflected by the activity set of the individual. Alternatively, the lifestyle is related to the mindset of the individual in how he or she carries out activities.

A useful body of research of research to describe “lifestyle” to transport related research work has been documented by Kitamura (2009). An acceptable definition for lifestyle is it is an activity structure to assist households in their resource allocation. This involves elements of collective attitudes, behavioral responses and societal influence. Hu et al. (2002) have pointed out that it is not only the activities the individual performs, it is also the activities that person avoids or shuns from that determines the lifestyle. In the current project and the earlier work by this research team (Tsukaguchi et al., 2011) public transport usage level has been adopted as a lifestyle indicator suitable for analysis of transport related activity and attitude measurements. This is based on the direction provided by Golob and Hensher (2007) who have identified different lifestyles of senior citizens according to their ways of travel and travel arrangements.

This project work entails measurement of lifestyle and corresponding attitudes toward pedestrian infrastructure. A questionnaire survey has been adopted to facilitate the data collection. Eight lifestyle related questions and 10 attitude related questions formed the heart of this survey.

2. QUESTIONNAIRE SURVEY

2.1 Data Collection Method

The survey objective is to provide quantitative measurements of lifestyle of individuals and their personal needs and attitudes in relation to walking and pedestrian facilities. Tsukaguchi et al., 2007, 2009 and 2011 have described the broader research framework under the heading of pedestrian travel culture where interactions among regional characteristics and attitudes are investigated. In the project reported here, the primary focus is on lifestyle patterns of residents in a particular region. To provide for sufficient amount of regional differences, five different urban centers of different size and city characteristics have been selected. An identical questionnaire survey was conducted concurrently in five Japanese cities, i.e. Tokyo, Osaka, Sapporo, Matsuyama and Urazoe. Additionally a city is selected from outside Japan as well. Sydney in Australia is the sixth city where the survey was repeated.

An identical questionnaire survey was conducted concurrently in five Japanese cities, i.e. Tokyo, Osaka, Sapporo, Matsuyama and Urazoe. These centers provided a sample from urban areas of different sizes in Japan. They were spread out in different regions of Japan as well. Tokyo and Osaka have well developed railway system with a loop line. Sapporo and Matsuyama also have railway system, however, they do not have loop lines. Urazoe don't provide rail system. Only bus system can be available to travel

in Urazoe. In addition a city is selected from outside Japan as well. Sydney in Australia is the sixth city where the survey was repeated. This is the largest city in Australia, somewhat larger in population size compared to Osaka but much smaller than Tokyo. A city from a different culture has been selected here to understand the possible range of variation of results when observations are carried out in a completely environment.

There are some differences about survey administration method between surveys in Japan and Australia because of administrative and resource considerations. Questionnaires in Japan were mailed to 500 households randomly selected from corresponding city telephone directories. Two questionnaire sheets were sent in one envelop to each household, resulting in a target sample size of 1000 per city. On the other hand, direct interview method was adopted for data collection in Sydney. 177 randomly chosen respondents have participated at roads adjacent to the University of New South Wales in Sydney. Randomness of selection was incorporated by picking the 5th person walking past the survey location when the investigator becomes available. It took approximately three weeks for the single investigator to complete the field survey in Sydney. Number of respondents, and for comparison the population in each city are shown in Table 1.

Questionnaire forms were prepared in official national languages, i.e. Japanese and English. The original questionnaire was prepared in Japanese and number of passes of translations was carried out to refine the English version. In both countries, pilot surveys were conducted before the main surveys.

Table 1 Population values and number of respondents in cities surveyed

Country	City	Population	Response Sample Size
Japan*	Tokyo	8,945,965	210
	Osaka	2,665,314	205
	Sapporo	1,913,545	239
	Matsuyama	517,231	249
	Urazoe	110,351	208
Australia**	Sydney (the Sydney Statistical Division)	4,119,190	177
Total			1,288

Note – Sources: *: 2010 Japan Census, **: 2006 ABS Census

2.2 Contents of the Questionnaire

As mentioned earlier, eight statements related to lifestyle and ten questions related to pedestrian attitudes toward walking were presented in the questionnaire survey. Attitude questions required respondents to provide their agreement (or disagreement) to ten statements in a 5 point Likert scale. Completely disagreement was selected as 0 point and completely agreement was selected as 4 point in this study. The first four statements addressed the attitude toward walking in general; the next four addressed preferences about pedestrian paths and the last two statements addressed personal reflections of the individual. The complete list of statements presented in the questionnaire was;

- (a) I like walking,
- (b) Walking is smart (clever),

- (c) I am willing to walk for a short distance in daily life,
- (d) I like to walk and stroll,
- (e) I prefer a street with good scenery for walking,
- (f) I prefer a street with good surroundings (neighborhood), even if a little detour is necessary,
- (g) I prefer a street with some people, even if a little detour is necessary,
- (h) I prefer the shortest route when the surroundings (neighborhood) are not pleasant,
- (i) I walk faster than others,
- (j) I usually cross a road during a red signal if there is no traffic.

'Lifestyle' has various meanings as mentioned in the previous section. This project draws from concepts presented by Kitamura (2009) in relation to indicators that reveal a person's lifestyle. For transport research purposes, lifestyle is a reflection of income, expenditure, employment, car ownership and availability of a valid driving license. Lifestyle questions were classified into three broad areas in this study. The first two questions in the following list focused on transport mode usage, the next three questions covered living preferences and the last three questions involved non-transport activity patterns of respondents.

- (1) Frequency of public transport usage in a month
- (2) Frequency of private car usage in a month
- (3) Preference to conduct an environmentally friendly life
- (4) Preference to live in city center
- (5) Preference to live in a convenient location (that has an acceptable living environment)
- (6) Participation in activities for maintaining good health
- (7) Participation in volunteer activities
- (8) Participation in out-door activities.

Respondents were asked to state "More than once a month" or "Less than once a month" for questions (1) and (2), "Yes" or "No" for questions (3) through (8). Frequency of more than once a month was sufficient to classify the level of use of the particular mode as high. Frequency less than once a month was referred to as a low level usage.

3. SOME RELATIONSHIPS BETWEEN LIFESTYLE AND ATTITUDES

3.1 Average Scores for Pedestrian Opinions

Average scores for opinion statements of the five cities in Japan are illustrated in Figure 1. There is not much visible difference among the five graphs according to this spider web chart. Approximately the same pattern is observed in different cities indicating there is potentially little difference in attitude patterns investigated in different regions in Japan. A statistical analysis related to this comparison is presented in section 3.3.

Comparison of average scores collectively for all five cities in Japan and the single city in Australia is shown in Figure 2. It is seen that average scores in Sydney are larger than those in Japanese cities. All four statements about general attitude toward walking have been regarded as more positive by Sydney respondents. Two of the preference statements (statements e and f) do not show a large difference between respondents from the two countries although two other questions (statement g and h)

related to preferences show a large gap between the graphs.

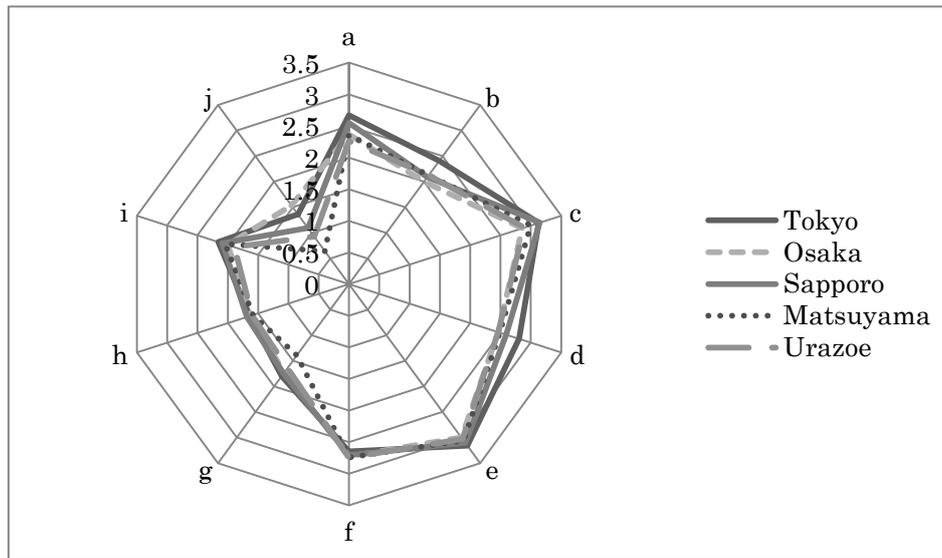


Figure 1 Average scores for attitude statements in Five Japanese cities

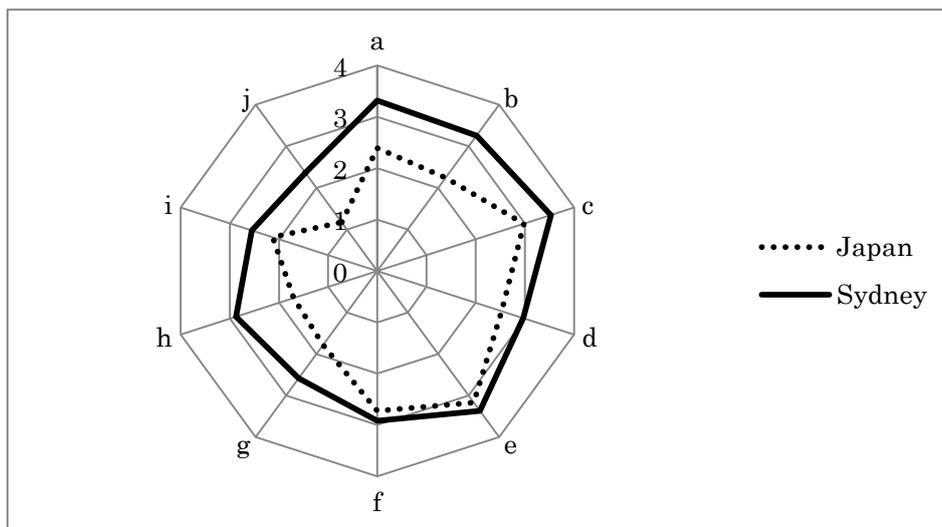


Figure 2 Comparison of average scores for attitude statements between samples from Japan and Australia

3.2 Relationship among Lifestyle Indicators

As mentioned before, this study has adopted eight indicators to measure lifestyle. This section explores relationships among these eight indicators of lifestyle. A methodology known by the names of “Hayashi’s quantification method type III” or “Correspondence analysis” (Hayashi (1974)) has been applied here as shown in Figure 3. The horizontal axis (also known as the first axis in relevant literature), explains transportation usage, and the vertical axis i.e. the second axis seems to be related to other lifestyle indicators including activities for maintaining good health and volunteer activities.

Scanning along horizontal axis of Figure 3, it can be seen that high usage of public transport and low usage of car are located in the positive area, the first quadrant. The opposite, low public transport

usage and high car usage are located in the negative area (the third quadrant). It is also interesting to note that high level of public transport usage and preference of living near the city center are closely located. On the other hand, scanning along the vertical axis, ‘Yes’ for activities for maintaining good health, volunteer activities and environmentally friendly life are located on the positive side of the axis, and ‘No’ for these questions are located in the negative side. Also, ‘Yes’ for out-door activities and high usage of car are located close to each other in an area where both axes are in negative values (third quadrant), and ‘No’ for the two lifestyle questions are located close to each other in the all positive quadrant. These observations inspire that inner city living is more conducive to a public transport oriented community.

Above analysis indicates three useful connections. Firstly, *frequency of public transport usage* (lifestyle indicator 1 in this survey) and *preference to live in the city center* (indicator 4) are closely related. Also, *participation in out-door activities* (indicator 8) and *frequency of car usage* (indicator 2) are related indicators. In addition, *preference for an environmentally friendly lifestyle* (indicator 3) and *participation in activities for good health* (indicator 6) are closely related. These pairs have been already identified by circles around them from the correspondence analysis output graph already shown as Figure 3. Relationships identified here will be useful later for the discussion presented in section 5 to formulate recommendations for planning of pedestrian facilities.

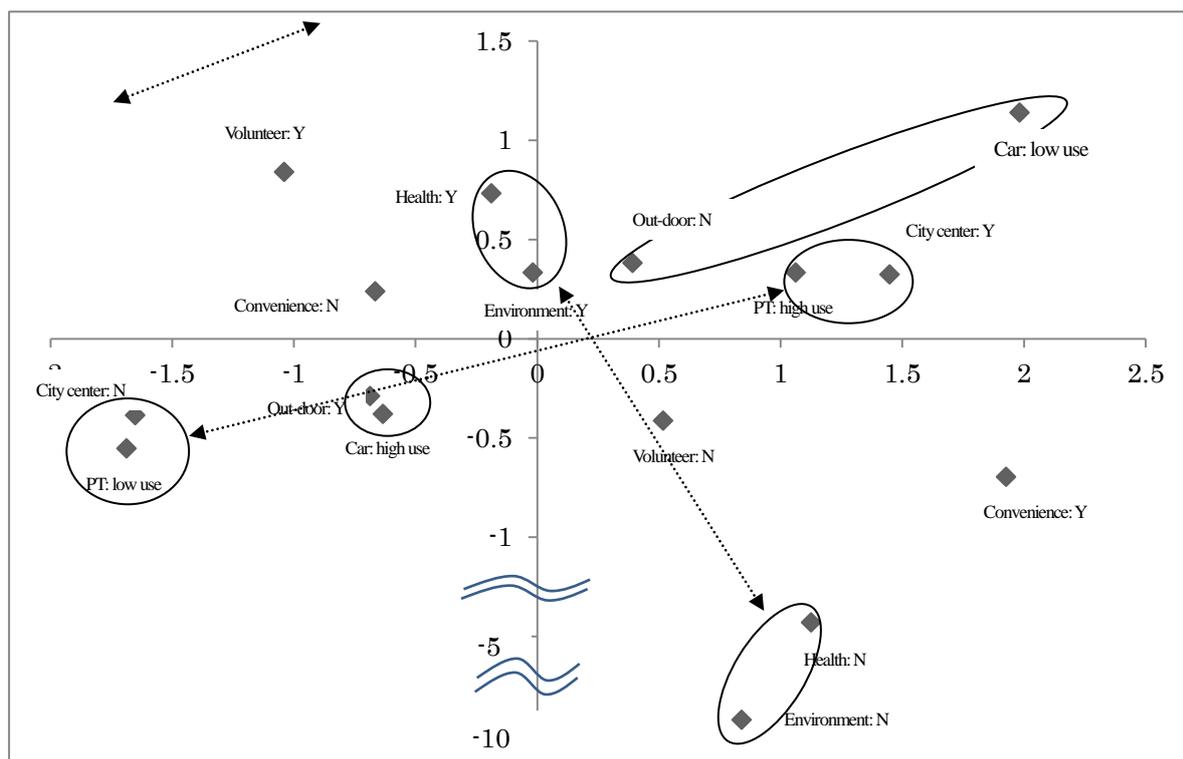


Figure 3 Relationship among lifestyle indicators

3.3 Relationship among Lifestyle and Pedestrian Attitudes

This section presents the statistical analysis performed to support the visual observations made in preceding analysis work. Table 2 summarizes results from standard statistical analysis using Kruskal-Wallis test and Bonferroni method (Siegel and Castellan (1988)). In this tabulation, the eight

lifestyle indicators are in columns and the 10 attitude statements are in rows. JPN refers to the sample containing all respondents from the five cities in Japan. SYD refers to sample containing Sydney responses. In many SYD columns there are no entries indicating a lack of statistically significant relationship. For Sydney, only index (3) which refers to environmentally friendly lifestyle has provided results of statistical merit. For Japan data, lifestyle indicators 1, 6, 7 and 8 has yielded statistically valid differences to differences particularly with pedestrian attitudes (a) to (f).

Table 2 Relationship between attitude statements and lifestyle indicators

Opinion statements	Lifestyle indicators															
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	JPN	SYD	JPN	SYD	JPN	SYD	JPN	SYD	JPN	SYD	JPN	SYD	JPN	SYD	JPN	SYD
(a)	M											Y		Y		Y
(b)			L			Y						Y		Y		Y
(c)	M								N			Y		Y		Y
(d)	M					Y						Y		Y		Y
(e)					Y							Y		Y		
(f)					Y	Y						Y		Y		
(g)	M		L			Y	Y		Y							
(h)					N				Y			N				
(i)	M*													Y		Y
(j)	M				N		Y					N		N		

Note) JPN: Japan, SYD: Sydney

M: Frequency above once a month is significantly greater than frequency below once a month

L: Frequency below once a month is significantly greater than frequency above once a month

L and M are applicable to lifestyle indicators (1) and (2) only.

Y and N are applicable to lifestyle indicators (3) through to (8).

Y: 'Yes' response is significantly greater than 'No' response

N: 'No' response is significantly greater than 'Yes' response

Blank: no significant difference, *: 5% significance, others: 1% significance

4. RELEVANCE TO LIFESTYLE FAVORING PUBLIC TRANSPORT USE

4.1 Public Transport Usage

Figure 3 in section 3.1 shows the ability to pair transport mode focus lifestyle measures with other lifestyle measures. This suggests that the preference of transport mode is a reliable indicator of the lifestyle of a person. This section presents the analysis of pedestrian opinions based on the individual's lifestyle which has been revealed by the person's preferred transport mode. It needs to be clarified that the following analysis is based on those who stated that they have used public transport at least once during the last month. It is acknowledged that selection of once a month as the cutoff is arbitrary and

coarse, but the decision to select that cutoff was made to reduce the complexity of the survey and the associated unacceptable level of workload to the respondents. Anyhow, this conservative classification is based on the argument that it is impossible to call someone a public transport user if that person has not used public transport at least once during last month.

Figure 4 shows the public transport user and non-user proportions in the cities surveyed. According to this graph, majority of citizens in Tokyo, Osaka, Sapporo, and Sydney can be termed as public transport users. On the other hand, majority of citizens in Matsuyama and Urazoe are non-users of public transport even with the conservative criterion of naming users as those who use public transport at least once a month. Henceforth, we call the former group as cities with high usage of public transport, and the latter two as cities with low usage of public transport. A characteristic of high usage cities is that they all have well developed public transport systems. In comparison, cities with low usage of public transport have only a rudimentary public transport system at early stages of evolving into a useful transport solution to public needs. Based on that observation, it is possible to view Figure 4 as a diagram indicating the level of service provided by existing public transport arrangements of cities covered during the survey.

Previous studies on pedestrian travel culture by the project team have revealed the difference between citizens who use public transport more than once a month and those who use public transport less than once a month. According to those studies, residents in a city where public transportation is well developed have a positive image toward walking. On the other hand, those who live in a city with poor public transportation do not have positive image toward walking (Tsukaguchi, et al., 2011).

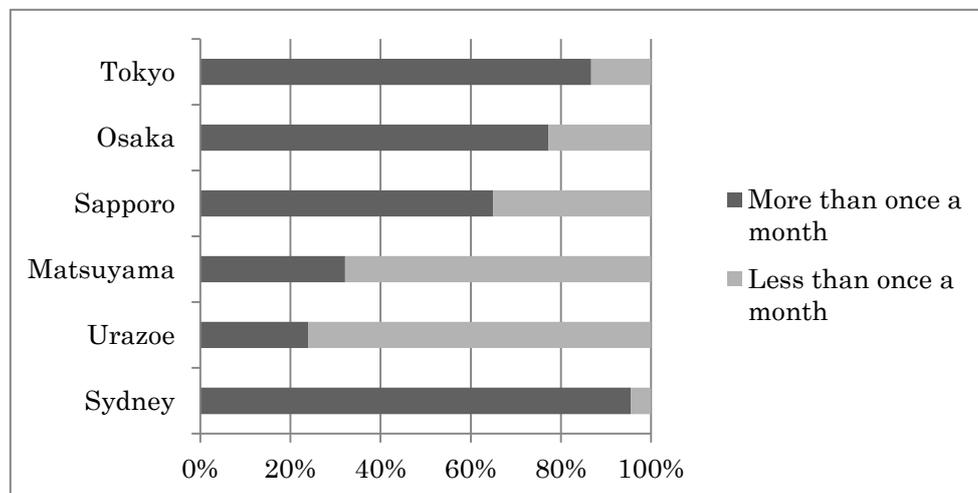


Figure 4 Public transport usages in surveyed cities

Figure 5 compares average scores of pedestrian opinions by high usage and low usage cities of public transport. In general, the average scores in high usage cities of public transport are higher than those of low usage cities. In particular, average scores for statements (a) through (d) in high usage cities of public transport are higher than those in the low usage cities. This means that the residents in cities with the high usage of public transport have a more favorable view about walking than citizens in the other group of cities. It may be interesting to note that in the former group, citizens are often traffic signal violators. Scores for statements (e) and (f) related to walking environment have a trend different

from the other opinion statements. Scores in the low public transport usage cities are larger than in cities with good public transport.

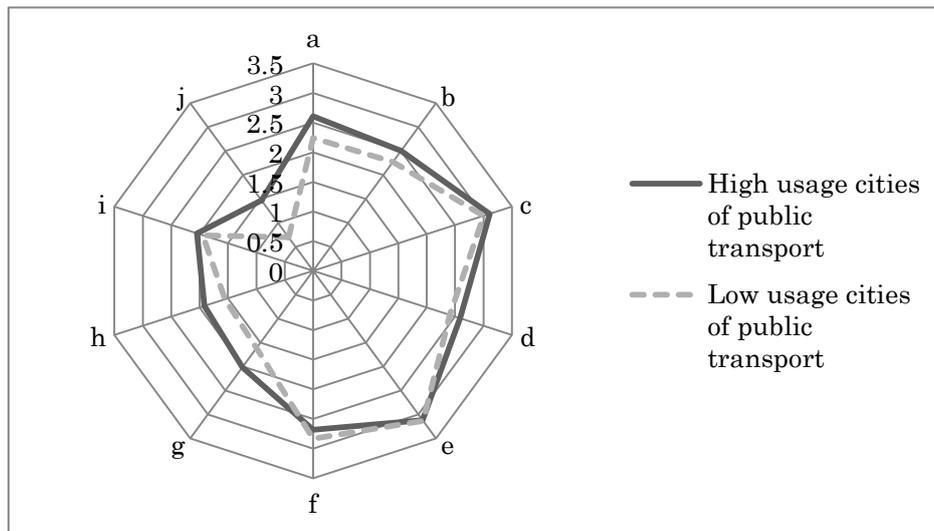


Figure 5 Comparison of average scores for attitude statements based on the usage of public transport

Table 3 Statistical differences by frequency of public transport usage

Pedestrian opinions	Lifestyle	Frequency of public transport usage	
		High usage cities	Low usage cities
(a) I like walking		User>Non user	
(b) Walking is smart		User>Non user	
(c) Willing to walk a short distance daily		User>Non user	
(d) I like a leisurely walk		User>Non user	
(e) Prefer good scenery en-route		User>Non user*	
(f) Prefer good neighborhood en-route		User>Non user*	
(g) Prefer busy route		User>Non user	
(h) Prefer shortest route		User>Non user	
(i) Fast walker		User>Non user	
(j) Regular signal violator		User>Non user	

Note) Blank: no significant difference, *: 5% significance, others: 1% significance

Kruskal-Wallis test method has been applied again to investigate statistical validity of the above comparisons. The results are presented in Table 3 using the same convention as explained for Table 2. ‘User>Non user’ means that the average score given by public transport users is larger than the score given by those classified as non-users for that particular opinion statement. In high usage cities, public transport users provided higher average scores than low usage cities for all statements. This means users are more positive than non-users toward each opinion statement. For (e) and (f) the statistical significance is less strong but still acceptable at 5%. On the other hand, statistically significant differences were not found in low usage cities. Table 3 indicates that the effect of public transport usage on pedestrian opinions is significant in cities with high level of public transport usage. Numerical

values related to statistical analysis and t-statics are not shown in the tabulation to keep the focus on final outcomes.

4.2 Preference of Residential Location

This section presents analysis of responses to the questions related to preferred residential location. These were referred to as lifestyle indicators 4 and 5 in a previous section. The first indicator was whether inner city living was preferred. The second indicator was whether convenience (where the word convenience is left to the personal interpretation of the respondent) was preferred in residential location selection. Figure 6 shows that majority of citizens who live in, Tokyo, Osaka, and Sydney prefers living in the city center. Sapporo shows an even split with those who prefer and not-prefer being approximately equal in numbers. The remaining two cities Matsuyama and Urazoe have a majority not wishing to live at the city center. Note that the last two cities were previously identified to be cities with low usage level of public transport. This indicates that the preference to stay near the city center is correlated to the level of public transport usage observed in the city. It may reflect that generally speaking most low service areas of public transport are located in suburban areas, however, in the case of residents who live in suburban areas with splendid public transport service may show the different trend.

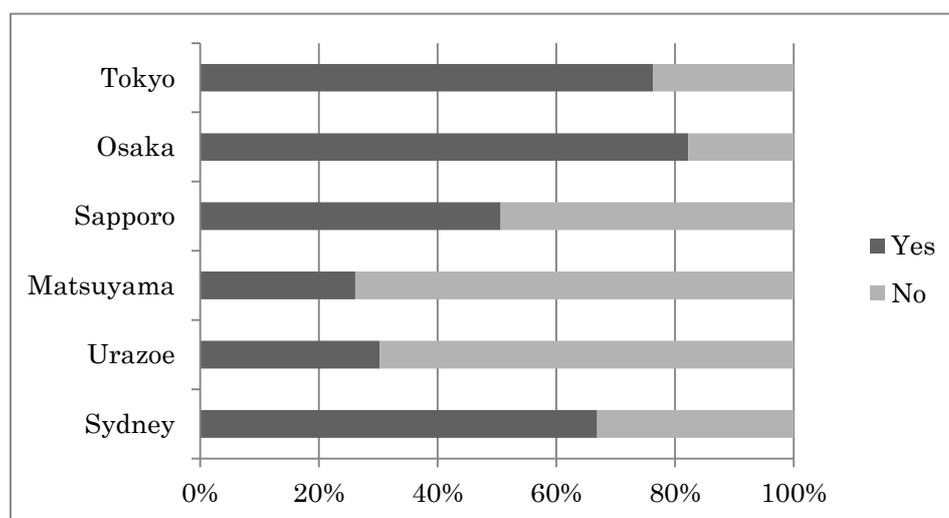


Figure 6 Percentage of preferences to live at the city center

Figure 7 shows a marked difference between Sydney and the cities in Japan about the lifestyle based on living at a convenient location. Only less than 30% of respondents in each of the five cities surveyed in Japan indicate a preference for a convenient residential location. It was not possible to articulate a generally acceptable definition in simple words in manner acceptable to the range of different cities surveyed. It is acknowledged that this research team is unable to state what respondents meant as a “convenient location”. Among these cities, the two cities with low usage of public transport have shown the corresponding value to be even lower at less than 20%. It is difficult to explain this result without follow up surveys to understand the full spectrum of considerations addressed by citizens in determination of residential location. It is speculated that this result may be an outcome of

respondents placing value on the residential location selection on other priorities such as living environment.

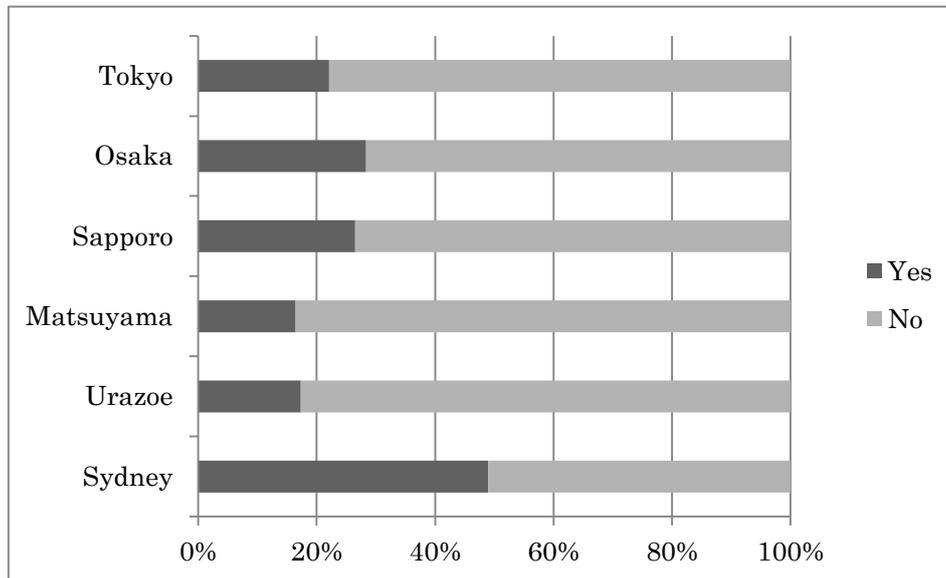


Figure 7 Percentage of preferences to live at a convenient location

In Figure 7, for Sydney, the “Yes” and “No” breakdown is approximately equal. Again it is difficult to interpret these results without follow up surveys. Clearly, there is a difference about the quantity of this lifestyle measure in the two countries. It can be only speculated that it may be a result of properties of the built environment options available to citizens. Also, the difference between the two countries may be also a manifestation of differences of the survey methods applied as explained in a previous section. Majority of respondents in Japan were in the above 60 age group whereas the bulk of Sydney sample was in the 20 - 40 age group. The questionnaire recorded the age group of respondent in three 20 year steps till 60 years of a final group containing those above 60 years of age as part of demographic information that included household, marital state and current occupation.

Public transport usage has a large effect on pedestrian opinion as mentioned relationship among lifestyle indicator. Therefore, this study has noted that public transport usage is one of the most important indicator of lifestyle. From this point of view, section 4.3 separately investigates impacts of lifestyle in high usage cities and low usage cities of public transport.

4.3 Contrasting Effects of Lifestyle on Pedestrian Opinions in Cities with High and Low Usage Levels of Public Transport

Nonparametric variance analysis is applied here using statistical methods mentioned earlier to find which lifestyle index has effects on pedestrian opinions in cities with different levels of public transport usage. Table 4 shows the results where the *High* and *Low* columns refer to level of public transport usage according to the classification mentioned in an earlier section. ‘Yes’ in these tables means that the average scores for the opinion referred to in that row from the sample that said “Yes” to the lifestyle indicator of that column is greater than the average score from “No” answers to that lifestyle statement.

This difference was statistically valid at 1% significance level. Numerical values related to the analysis have been skipped in tabulation to minimize the presentation clutter.

Comparing results shown on the tabulation, the effects of lifestyle indicators (6) through (8) on pedestrian opinions are different in high usage cities and low usage cities of public transport. In cities with high public transport activity, indicator (8) that refers to participation in out-door activities has negative effects on opinion statement (g) that refers to a preference for a busy route and statement (h) preference for the shortest route. Indicator (6) has no contribution to the first four opinion statements that referred to general attitude toward walking. On the other hand, for cities with low public transport participation, lifestyle indicator (6) that refers to maintaining good health has positive effects on pedestrian opinion statements (a), (c) and (d). It does not mean that the effect of (6) maintaining good health is not significant in cities with high usage of public transport – it is already shown in Figure 5 that the average scores are already higher than those in other cities. For the indicator (7) that refers to volunteer activities, there is a reasonable amount of similarity between the patterns that have emerged in Table 4 for the two columns for high and low usage of public transport. In both types of cities, volunteer activity has positive effects on general awareness and attitudes toward walking (i.e. the first two opinion statements).

Table 4 Statistical differences of pedestrian opinions from those with a lifestyle of personal activity

Pedestrian opinions	Lifestyle		(6) maintain good health		(7) volunteer activity		(8) out-door activity	
	High	Low	High	Low	High	Low	High	Low
(a)I like walking		Yes*	Yes					Yes
(b)Walking is smart			Yes	Yes				
(c)Willing to walk a short distance daily		Yes	Yes	Yes				
(d)I like a leisurely walk		Yes	Yes*	Yes				Yes
(e)Prefer good scenery en-route		Yes	Yes*	Yes*				
(f)Prefer good neighborhood en-route	Yes*	Yes	Yes					
(g)Prefer busy route							No*	
(h)Prefer shortest route	No	No*					No*	
(i)Fast walker			Yes				Yes*	
(j)Regular signal violator	No	No						

Note) Blank: no significant difference, *: 5% significance, others: 1% significance

As indicated in Figure 5, average scores in cities with low usage of public transport are lower than those with high usage. Nevertheless, lifestyle indicator (6) through (8) have effects on general attitude toward walking in cities with low usage of public transport as shown in Table 5. Therefore, to encourage citizens in those cities to enjoy walking, planners need to take advantage of relationships of pedestrian opinion relationships with lifestyle indicators (6) through (8).

5. DIRECTIONS FOR PEDESTRIAN FACILITY PLANNING

Figure 5 has shown that cities where majority of citizens use public transport have higher scores for pedestrian opinion statements (a) *I like walking*, (b) *Walking is smart (clever)*, (c) *I am willing to walk for a short distance in daily life* and (d) *I like to walk and stroll*, than other cities. This observation implies that pedestrians and public transport users have beneficial experience when either of the systems (pedestrian or public transport) is improved. The current work has not yet attempted to quantify the benefit. What is relevant for now is that the surveys conducted during this project encourage planners to develop public transport and pedestrian-centered policy as the urban transport strategy.

Table 2 has indicated that pedestrian awareness indicator (a) *I like walking*, (b) *Walking is smart (clever)*, (c) *I am willing to walk for a short distance in daily life* and (d) *I like to walk and stroll*, have relationships with lifestyle indicators (6) *Participate in activities for maintaining good health*, (7) *Participate in volunteer activities* and (8) *Participate in out-door activities*. As expected, the analysis has shown that citizens who participate in activities to maintain good health, join volunteer activities, and regard themselves as out-door type, have a general preference for walking. This suggests that transport planners can have a reasonable basis to collaborate with professionals of health and welfare, volunteer activities, and outdoor activities.

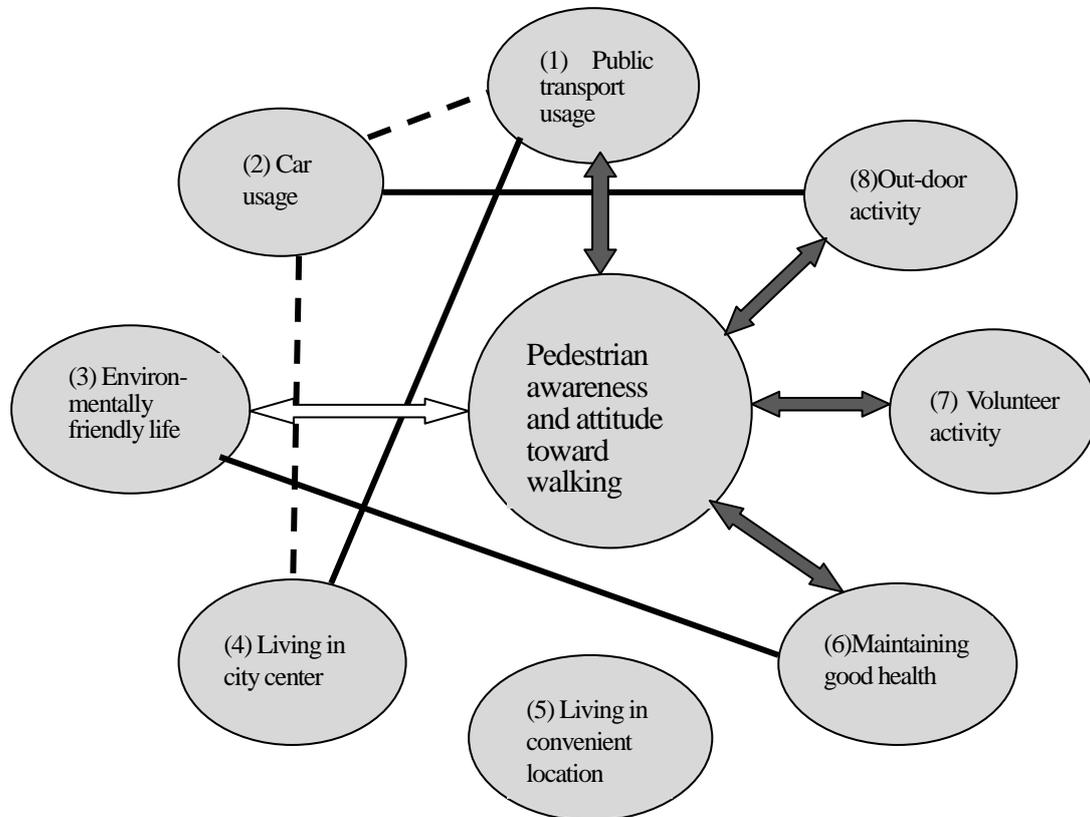
Table 2 also indicated that citizens who (3) *practice environmentally friendly life*, (6) *maintaining good health* and (7) *participate in volunteer activities* agree to pedestrian opinion statements (e) *I prefer a street with good scenery for walking* and (f) *I prefer a street with good surroundings (neighborhood), even if a little detour is necessary*. This indicates a preference for high quality environment associated with walking facilities. Citizens who want to live (4) *in city center* and (5) *in convenient locations* have shown general agreement with (g) *preference for busy streets*. Addition to these, citizens who practice (3) *environmentally friendly life*, and (6) *maintaining good health* have disagreed with (h) *preference for shortest path*.

Figure 3 suggests that public transport usage is the most significant lifestyle index for relationships between lifestyle and pedestrian awareness. Therefore, relationships with lifestyle indicator (6) *Activities for maintaining good health*, (7) *Volunteer activities* and (8) *Out-door activities* are important as already shown in Table 4 for cities with high and low usage of public transport. In cities with high public transport usage, lifestyle (6) *Activities for maintaining good health*, has impacts on opinions as supported by statements (f) *I prefer a street with good surroundings*, (h) *I prefer the shortest route* and (i) *I walk faster than others*. On the other hand, lifestyle (6) *Activities for maintaining good health* has an impact on most of the ten opinion statements presented to respondents of low public transport usage urban centers. In addition, (7) *Volunteer activities* effects especially on general awareness and attitude toward walking in the both types of cities.

As shown in Table 4, effects of (6) *maintaining good health* and (7) *volunteer activities* on pedestrian attitudes are different in high public transport usage cities and low usage ones. But in both types of cities, these lifestyles have effects on pedestrian attitudes towards walking. Encouraging those lifestyles can assist the importance and growth of planning for pedestrians.

Furthermore, lifestyle indicators (6) *Activities for maintaining good health*, (7) *Volunteer activities* and (8) *Out-door activities* effects pedestrian attitudes toward walking in cities with low usage of public transport. Therefore, relationships among pedestrian opinions (a) *I like walking*, (b) *Walking is smart*, (c) *I am willing to walk for a short distance in daily life*, and (d) *I like to walk and stroll*, and lifestyle

indicator (6) *Activities for maintaining good health*, (7) *Volunteer activities* and (8) *Out-door activities* have to be taken into account in order to attract residents of those cities to walking.



Solid line: The two indicators have the same trend, e.g., when one increases the other also increases.
 Dotted line: The two indicators trend in opposing in directions, e.g., when one increases the other decreases.
 Arrow: Significant relationship (Black arrow: effective for only Japanese cities; White arrow: effective for Japanese cities and Sydney)

Figure 8 Relationships among pedestrian attitudes and lifestyle indicators

These findings could be presented as shown in Figure 8 to describe relationships among pedestrian opinions and lifestyle indicators associated with public transport usage and personal (non-transport) activities.

The solid lines between lifestyle indicators indicate the two indicators are compatible with each other and have similar character in terms of its influence on pedestrian opinions. For example, lifestyles related to (3) *environmentally friendly life* and (6) *maintaining good health* are likely to co-exist supporting both lifestyle objectives simultaneously. On the other hand lifestyles connected by the dashed line in the figure are opposing styles. For example, (1) *frequent user of public transport* and (2) *frequent user of car* are non-compatible lifestyles. It is not realistic for one to practice those two lifestyles simultaneously.

Arrows in Figure 8 indicate relationships among lifestyle indicators and pedestrian awareness and attitudes toward walking. The characteristics of the arrows are different according to the color of the

arrow. Where a black arrow line is applied, the field survey has not supported the existence of the relationship in Sydney although surveys in Japan have supported those connections.

White arrow in Figure 8 indicates the existence of the relationship in both countries. Therefore encouragement of environment friendly lifestyle is consistent with the broader planning objectives of maximizing participation in transport modes such as walking and public transport.

6. CONCLUSIONS

Pedestrian traffic behavior is a composite outcome of infrastructure, individual characteristics and societal attributes. Therefore, awareness of available pedestrian facilities and attitude toward walking is likely to affect the lifestyle. Conversely, lifestyle is likely to have an effect on pedestrian behavior. This study has been conducted in order to inspect these two-way relationships.

Since lifestyle has been expressed in different ways in literature, this study has adopted eight indicators to measure lifestyle. These lifestyle indicators belong to three broad categories: public transport usage, living preferences, and personal non-transport activities. Initial part of the study looked into co-relationships among these lifestyle measures. There are clear connections between some lifestyle measures, for example between public transport usage and living in city center, and environmentally friendly life and maintaining good health as shown when summarizing the project findings using Figure 8.

A statistical analysis has been performed to capture meaningful relationships between lifestyle choices people have made and how they view walking experience. Certain lifestyles enhance the individual's perception about pedestrian facilities and walking in general, possibly because those lifestyles place some reliance on walking as a transport mode. Figure 8 is a schematic diagram prepared to identify the lifestyles that influence the pedestrian culture in a city. Lifestyles that place an importance on good health, participation in out-door activities and volunteer activities appear among those that can make an attitudinal change about walking. As expected, a lifestyle that relies on use of public transport also has the ability to affect pedestrian attitudes.

The analysis has also shown that the level of existing public transport in the urban area has an overarching influence on these relationships. To handle this issue, this project had to divide the cities surveyed into two different groups as those with high public transport usage and low transport usage.

Comparison of results between the surveys in Japan and Australia has shown that both samples agree that a lifestyle stated as favoring environmentally friendly style has an impact on shaping pedestrian attitudes. It is encouraging to note that contrasting countries can have a similar pattern of outcomes from adoptees of this lifestyle. Policy implications of this finding remain to be investigated. Anyhow, the project has been successful in showing that regional characteristics need to be considered in attempts to better understand the pedestrian behavior.

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APPENDIX

Kruskal-Wallis method and Bonferroni method

If the H statistic is greater than the critical Chi-squared value as shown in the equation (1) given below, a significant difference exists between the responses.

$$H(\chi^2) = \frac{h}{1 - \sum_{j=1}^m \frac{T_j}{(N^3 - N)}} \geq \chi_{\alpha-1}^2(\alpha) \quad (1)$$

where

$$h = \frac{12}{N(N+1)} \sum_{i=1}^k \frac{R_i^2}{n_i} - 3(N+1) ,$$

and

$$T_j = t_j^3 - t_j,$$

Also:

m : number of attributes in the analysis,

N : total number of respondents,

n_i : number of respondents with a particular attribute i ,

R_i : sum of the ordered data for each attribute i,

t_j : number of samples in the same rank order j, and

α : level of significance.

When a difference is identified using the above method, the following estimator from the Bonferroni method provides the level of significance for comparison of the particular pair of subgroups.

$$Z = \frac{\left(U - \frac{n_1 n_2}{2} \right)}{\sqrt{\frac{n_1 n_2}{N(N-1)} \left(\frac{N^3 - N}{12} - \sum_i T_i \right)}} \quad (2)$$

$$T_i = \frac{U_i^3 - U_i}{12}$$

U: Mann-Whitney's U parameter,

n_1, n_2 : sample size of the pair of subgroups