Effect of the Stage of Life and Lifestyle on Pedestrian Behavior in East Asian Countries

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Abstract: Walking, a universally available transport mode, has been important throughout human history. Recently, the emphasis on development of sustainable societies with emphasis on low carbon footprint has regenerated interest in pedestrian facilities and creation of seamless transport systems. Novelty of research work presented here is in its attempt to investigate walking in a framework consistent with the societal influence. For this purpose, general attitudes and preferences toward walking in different urban areas have been investigated to understand similarity and dissimilarity of pedestrian travel culture. This research work is based on field surveys in Japan Taiwan and South Korea. The present study provides a three-way comparison of pedestrian travel culture among the three countries. The paper focuses on the relationship between pedestrian behavioral characteristics, and personal characteristics such as lifestyle and stage of life. The analysis reveals that each country has an own identity in terms of the pedestrian culture.

Key Words: pedestrian travel culture, attitudes of pedestrians, statistical comparison, lifestyle issues, EASTS IRG05.

1. INTRODUCTION

Walking as a means of mobility has been important since the beginning of the human evolution. Today, walking is an unavoidable element in most passenger transport systems. To cater for walking, planners have to provide safe and user oriented pedestrian facilities. Also, in the modern day, importance of walking has increased as we strive to establish low-carbon emission cities to reorient the society toward ecological sustainability. The work covered in this paper attempts a quantitative analysis of pedestrians over three countries in an attempt to better understand characteristics of citizens when they are engaged in walking. This study to understand pedestrian travel behavior is based on a framework (described in section 2) that
accounts for the outlook of residents toward walking in their communities and their particular sociological background. In particular, this paper explores the relevance of certain issues related to lifestyle and stage of life of citizens in different 16 cities in Japan, Taiwan and South Korea.

Pedestrian traffic is a complex phenomenon that should be and could be approached from various fields of academic research. A useful contribution to the multidisciplinary nature of understanding the pedestrian activity was provided by Nagayama (1989) who investigated the difference of pedestrian attitudes and behavior in several Japanese cities from the psychological point of view. His work and other researchers who have looked at impacts of gender and ethnicity (for example, Seedat et al., 2006; Lawson and Edwards, 1991) have indicated the need to understand the cultural significance in the context of pedestrian safety. Similarly, a study by Hughes (1988) has documented the influence of regional culture in the context of aesthetics of pedestrian facilities.

Pedestrian travel behavior is a composite outcome of infrastructure, individual characteristics and societal attributes. For example, awareness and attitudes toward walking depends on the lifestyle and outlook of people in a given region. Conversely, this particular mind-set has an effect on pedestrian behavior. Thus, understanding of pedestrian behavior is incomplete without an appreciation of the societal perspective. It is the lifestyle outlook that is referred to as the ‘pedestrian travel culture’ in this paper.

Groundwork for this approach was documented by Sugihara and Tsukaguchi (2005) as well as Hsia and Yeh (2006). In follow up work, Tsukaguchi et al. (2007) made initial observations about comparison of pedestrian travel culture among selected number of cities in Japan. Since then, number of relationships within the ‘pedestrian travel culture’ framework has been investigated by the team of international research collaborators. For example, relationship between awareness toward walking and attributes of citizens has been reported in Tsukaguchi et al. (2009). Tanaka et al. (2009) has documented the relationship between level of service of public transport and pedestrian attitudes. Hsia et al. (2009) studied the impact of age using field data from four urban centers in Taiwan.

This paper incorporates new data available from South Korean cities and extends the analysis to compare the pedestrian behavior among three countries.

2. STUDY FRAME-WORK OF PEDESTRIAN TRAVEL CULTURE

The final aim of this research team is to provide evidence of the existence of the concept of pedestrian travel culture and to propose the appropriate direction applicable to pedestrian planning. In order to achieve this goal, it is necessary to explain important elements of the concept of pedestrian travel culture. The conceptual framework of pedestrian travel culture in this study is shown in Figure 1. This figure is a simplified illustration of the connectivity among elements that contribute to the pedestrian travel culture as proposed in Tsukaguchi et al. (2007). Briefly, the pedestrian behavior is influenced by system characteristics referred to here as regional characteristics. There are three main elements considered as regional characteristics. They are (A) level of service of the urban infrastructure (B) regional environment and (C) citizen attributes. It is the inclusion of citizen attributes under regional characteristics that allows us to consider pedestrian behavior in a cultural framework. There are interrelationships between elements of regional characteristics shown at the upper part of
Figure 1 and pedestrian characteristics shown in the lower part of the diagram. Pedestrian characteristics include range of attributes such as pedestrian travel properties, awareness and general attitude toward walking, and awareness of pedestrian facilities and the surrounding.

Highlighted terms in Figure 1 and the thick arrow connecting them indicate the relationship that has been analyzed here for the purpose of three-way comparison among countries in this paper. The focus area indicated by the thick line is based on our hypothesis that the stage of life and life style of citizens have an impact on awareness and attitudes of pedestrians. Previously, the project group has studied several other relationships as documented elsewhere. Those studies were limited to comparison of regions within a single country but allowed the research team to develop and refine the conceptual framework and analysis methodology. Relationships previously analyzed following this framework are summarized in Table 1. It is shown that a range of regional factors influencing pedestrian behavior has been already explored.
### Table 1 Relationships previously documented

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Database</th>
<th>Publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between (B) regional environment (Urban form: characteristics of cities including the location and population), and (ii) awareness and attitude toward walking</td>
<td>10 Japanese cities</td>
<td>Tsukaguchi, et al. (2007)</td>
</tr>
<tr>
<td>Between (A) level of service of urban infrastructure (public transportation) and, (iii) awareness of pedestrian facilities and environment</td>
<td>15 Japanese cities</td>
<td>Tanaka et al. (2009)</td>
</tr>
<tr>
<td>Among (C) attributes of citizens and, (i) pedestrian travel properties and (ii) awareness and attitude toward walking</td>
<td>10 Japanese cities</td>
<td>Tsukaguchi, et al. (2009)</td>
</tr>
<tr>
<td>Between (C) attributes of citizens (age) and, (ii) awareness and attitude toward walking</td>
<td>4 Taiwanese cities</td>
<td>Hsia, et al. (2009)</td>
</tr>
</tbody>
</table>

### 3. DATA COLLECTION METHODOLOGY

Questionnaire surveys were conducted in the respective official languages in 10 Japanese cities, 4 Taiwanese cities, and 2 South Korean cities listed in Table 2. Selection of the target cities in Japan focused on selecting urban centers with greater than 100,000 of population. There were 227 such cities. These cities were sorted into seven types of cities using a principal component analysis and successive cluster analysis as reported in Tsukaguchi et al. (2007). Target urban centers were selected to be distributed approximately evenly in this list of cities. In Taiwan and South Korea, the target cities were selected for opportunistic reasons, based on proximity to the university where the collaborating research team members are located. An attempt is made to select cities that fit into the range of population size encountered in the Japanese surveys while selecting cities near the host universities in Taiwan and South Korea to minimize the survey administration cost.

### Table 2 Number of respondents in different East Asian cities

<table>
<thead>
<tr>
<th>Country</th>
<th>City</th>
<th>Population</th>
<th>Year Surveyed</th>
<th>Response Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>Sapporo</td>
<td>1,906,129</td>
<td>2004</td>
<td>237</td>
</tr>
<tr>
<td></td>
<td>Sendai</td>
<td>1,037,093</td>
<td></td>
<td>241</td>
</tr>
<tr>
<td></td>
<td>Tokyo</td>
<td>8,502,527</td>
<td></td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>Nagano</td>
<td>387,815</td>
<td></td>
<td>259</td>
</tr>
<tr>
<td></td>
<td>Kanazawa</td>
<td>458,833</td>
<td></td>
<td>194</td>
</tr>
<tr>
<td></td>
<td>Kyoto</td>
<td>1,464,137</td>
<td></td>
<td>243</td>
</tr>
<tr>
<td></td>
<td>Osaka</td>
<td>2,667,817</td>
<td></td>
<td>222</td>
</tr>
<tr>
<td></td>
<td>Hiroshima</td>
<td>1,174,103</td>
<td></td>
<td>216</td>
</tr>
<tr>
<td></td>
<td>Matsuyama</td>
<td>515,857</td>
<td></td>
<td>242</td>
</tr>
<tr>
<td></td>
<td>Fukuoka</td>
<td>1,461,631</td>
<td></td>
<td>275</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Taichung</td>
<td>1,078,348</td>
<td>2006</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Tainan</td>
<td>772,279</td>
<td></td>
<td>318</td>
</tr>
<tr>
<td></td>
<td>Kaohsiung</td>
<td>1,525,999</td>
<td>2008</td>
<td>296</td>
</tr>
<tr>
<td></td>
<td>Chiayi</td>
<td>274,657</td>
<td></td>
<td>329</td>
</tr>
<tr>
<td>Korea</td>
<td>Pusan</td>
<td>3,523,582</td>
<td>2008</td>
<td>511</td>
</tr>
<tr>
<td></td>
<td>Daegu</td>
<td>2,464,547</td>
<td></td>
<td>401</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>4524</td>
</tr>
</tbody>
</table>

Note: Population values in Japanese cities are estimates available for 2010. Population values in Taiwan and Korea were as reported for 2007 and 2009 respectively.
There were some notable differences in survey administration method among countries. In Japan, questionnaires were mailed to 1000 randomly selected citizens in each city. Response rate achieved was approximately 24%. Interview survey technique was applied for data collection in Taiwan using trained university students. In South Korea the questionnaire forms were distributed and collected during classes held for renewal of driver license. It is acknowledged that these differences in the survey administration cause different biases to the survey sample selection. Respondent sample sizes are shown in the last column of Table 2.

The questionnaire forms were written in the three native languages Japanese, Chinese and Korean for the respective countries. Much effort had been devoted to select the equivalent wording and terminology as well as the structure of the questionnaire. In this research project, the awareness and attitudes toward walking is measured by asking members of the community about their agreement or disagreement to a series of questions in a scale of 0 to 4 as explained later. The subjects were asked to respond to following 10 statements. The first four statements were related to the general attitude toward walking. The next four statements were related to characteristics of preferred routes for walking, and the last two statements were related to personal reflections of the individual’s walking behavior. The 10 statements were:

(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.

Complete agreement with a statement was indicated by a value of 4.0, while strong disagreement with the statement was indicated by a value of 0.0. In this scheme, statements that receive responses greater than 2.0 were considered positive responses and those with a response less than 2.0 were considered negative responses.

The aim here is to analyze the relationship between these pedestrian characteristics and demographic attributes of citizens. Therefore, citizen’s attributes and accessibility properties were also recorded, including gender, age, car ownership, public transport usage, distance to the nearest bus stop and railway station, and perceived walking time to the nearest bus stop.

Recall that this study intends to analyze the relationship between pedestrian characteristics in terms of awareness and attitudes toward walking, and attributes of citizens in terms of lifestyle and life stage as shown in Figure 1. Pedestrian behavior characteristics relevant here are measured using responses for the statements (a) to (j) given in the questionnaire. For the purpose of stage of life and life style one relevant variable is the ‘age’ of respondents. The age was recorded at intervals of 20 years, in other words, respondents were grouped into age groups designated as ‘below 20 years’, “20 – 40 years”, 40 – 60 years” and “above 60 years” old. This classification is sufficient to reflect the stage of life. It is acknowledged that the stage of life implies attributes such as marital status, number and age of children and employment or retirement stages which were not covered in the surveys performed. Such attributes can be expected to have a co-relationship with the biological age. On the other
hand, age may represent lifestyle as well, but to a limited extent.

The other variable of interest for the purpose of the current analysis is the ‘public transport usage’. Indeed, the term lifestyle has a broad meaning, and “public transport usage” covers one aspect of lifestyle. This variable has been recorded as a frequency of usage where the respondent stated how often per week he or she has used public transport during a week. For the purpose of this study, a respondent who claims to use public transport more than once a month is considered a public transport user. A person who claims public transport usage is less than 1 per month is termed ‘non-user’ in the analysis presented later.

Preliminary investigation has shown that there are differences in the age profile of respondent properties in the samples from the three countries. This is an outcome of the differences of the sampling techniques mentioned earlier, in the three countries. Age distribution of respondents from Japan has almost half the sample in age group of above 60 years (See Figure 2). The below 20 years group was consistently very low in the survey samples from Japan. These observations could be considered consistent with the mail back survey technique that relied on the time availability and the goodwill of respondents. Samples from Taiwan and South Korea have a large proportion of respondents in the age band from 20 to 60 years old, as shown in Figure 2. The statistical analysis method followed during the comparison study is able to account for these variations of age distribution.

As mentioned earlier, the other variable considered here to reflect the stage of life and lifestyle is the public transport usage. The public transport usage values of respondent samples are shown in Figure 3. In one city (from South Korea) the public transport usage group has exceeded 90%. Cities in Japan have provided the largest spread of the usage counts and values vary from approximately 33% to 90%. Public transport usage counts in Taiwanese cities remain in low levels.
4. OVERVIEW OF COMPARISON OF AWARENESS AND ATTITUDES TOWARD WALKING AMONG THE THREE COUNTRIES

As the first step of comparison of general attitudes, preferences and stated behavior of pedestrians among the 3 countries, average values were computed from the corresponding cities for responses to the 10 statements mentioned earlier and labeled as from (a) to (j) in Section 3. These average values are presented in Figure 4.

Recall that attitudes toward walking were interpreted from statements (a) to (d) and all cities in Japan and Taiwan show an average value of greater than 2.0 in the agreement scale. This shows positive attitudes toward walking in general in these two countries. In comparison, South Korean results show that the average values are below 2.0 for statements (a) to (d) indicating a negative attitude regarding walking.

Statements (e) to (h) related to preferred characteristics of pedestrian paths and the results shown in Figure 4 indicate a much larger spread. The 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” have similar level of high agreement from pedestrians in cities in Japan and Taiwan. Strangely, the average score obtained from Korean respondents were less than 2.0 and means a disagreement with the need for a pleasant environment for walking. On the other hand, for the statements (g) “I prefer a street with some people, even if a littl detour is necessary” and (j) I usually cross a road during a red signal if there is no traffic, the Korean respondents have provided a relatively positive response.

The spider-web representation adopted here is able to display these observations in an effective manner. Figure 4 suggests that there is a clear difference among views from pedestrians of the three countries. However, difference between results from Japan and Taiwan are relatively small in comparison to the differences with South Korea.

The next step of the analysis is an attempt to view these results in terms of citizen attributes.
already presented in Figures 2 and 3. The statistical method adopted for this purpose is explained in the next section.

5. DIFFERENCES OF AWARENESS AND ATTITUDE TOWARD WALKING

5.1 Statistical method
This study has applied the nonparametric variance analysis using Kruskal-Wallis test to inspect the statistical significance of differences between attributes of citizens and cities from the viewpoint of the above statements. This method is suitable to perform statistical comparisons where multiple significance tests are necessary to account for different sizes of groupings within the overall sample. If equation (1) given below holds, a significant difference exists between the responses (Siegel and Castellan, 1988).

\[ H(\chi^2) = \frac{h}{1 - \sum_{j=1}^{m} \frac{T_j}{N^3 - N}} \geq \chi^2_{m-1}(\alpha) \]  

(1)

where

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

\[ T_j = t_j^3 - t_j, \]

\[ n_i : \text{number of respondents with a particular attribute } i, \]
\[ m : \text{number of attributes in the analysis}, \]
\[ N : \text{total number of respondents}, \]
\[ R_i : \text{sum of the ordered data for each attribute } i, \]
\[ t_j : \text{number of samples in the same rank order } j, \text{ and} \]
\[ \alpha : \text{level of significance}. \]
When a difference is identified, the following estimator in the Bonferroni method (Siegel and Castellan, 1988) leads to the level of significance for the particular pair of citizen attributes or the pair of cities.

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

where

\[
T_i = \frac{t^3 - t}{12}
\]

U: Mann-Whitney’s U parameter,
n1, n2: sample size of the pair of groups

5.2 Impact of the stage of life on general attitudes toward walking

Table 3 shows the pattern of the relationship of awareness and attitude toward walking, and age group. Here, age is adopted as the proxy variable for the stage of life as mentioned in Section 3. The statistical method used here is the non-parametric variance analysis mentioned in the previous section. When there is a difference, we indicate the age group that provided the more positive score using the mathematical symbol for larger than sign. For example, ‘Below 20 > 20-40’ means that the age group less than 20 years old provided a higher score than group 20-40 years old. When the difference of the average scores between the age groups were not statistically significant, the tabulation has a blank cell using the - symbol. When there is a statistical difference between scores in which younger group’s score is lower than that of elder group, bold letters are used in the tabulation in addition to the use of the appropriate mathematical symbol. This is done to assist the visual inspection of the table. On the other hand, when there is a statistical difference between scores in which younger group’s score is higher than that of an elder group, regular fonts are used.

Results presented in Table 3 indicate that the age group the respondents belong to makes a difference in the level of awareness and attitudes toward walking. As for the statements (a) through (d) that indicate general attitudes toward walking, the younger generation’s scores are lower than the scores of older generation in Japan and Taiwan. This means younger groups are less positive in attitudes toward walking than elder generations in these countries. Results for Korea show the opposite trend. There, general attitudes toward walking appear to deteriorate as one advances through different stages of life.

Statements (e) through (j) represent characteristics of preferred routes for walking and personal reflections of walking behavior. Table 3 shows that the stage of life as indicated by the age of respondent makes a difference in the three countries to preferences and the stated behavior of respondents, according to majority of statements put forward to them.
Table 3  General attitude toward walking by age group

<table>
<thead>
<tr>
<th></th>
<th>Japan</th>
<th>Taiwan</th>
<th>Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) I like walking</td>
<td>-</td>
<td>Below 20 &lt; 20–40</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Below 20 &lt; 40–60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Below 20 &lt; above 60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20–40 &lt; 40–60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20–40 &lt; above 60</td>
<td></td>
</tr>
<tr>
<td>(b) Walking is smart</td>
<td>Below 20 &lt; 20–40</td>
<td>Below 20 &lt; 20–40</td>
<td>20–40 &gt; 40–60</td>
</tr>
<tr>
<td></td>
<td>Below 20 &lt; 40–60</td>
<td>Below 20 &lt; 40–60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Below 20 &lt; above 60</td>
<td>Below 20 &lt; above 60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20–40 &lt; 40–60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20–40 &lt; above 60</td>
<td></td>
</tr>
<tr>
<td>(c) Willing to walk a short</td>
<td>Below 20 &lt; 40–60</td>
<td>Below 20 &lt; 20–40</td>
<td>-</td>
</tr>
<tr>
<td>distance daily</td>
<td>Below 20 &lt; above 60</td>
<td>Below 20 &lt; above 60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20–40 &lt; above 60</td>
<td>Below 20 &lt; above 60</td>
<td></td>
</tr>
<tr>
<td>(d) I like a leisurely walk</td>
<td>20–40 &lt; above 60*</td>
<td>-</td>
<td>Below 20 &gt; above 60*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20–40 &gt; above 60*</td>
</tr>
<tr>
<td>(e) Prefer good scenery en-route</td>
<td>-</td>
<td>Below 20 &lt; 20–40</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20–40 &gt; above 60</td>
<td></td>
</tr>
<tr>
<td>(f) Prefer good neighborhood</td>
<td>Below 20 &lt; above 60</td>
<td>Below 20 &lt; 20–40</td>
<td>-</td>
</tr>
<tr>
<td>en-route</td>
<td>20–40 &lt; above 60</td>
<td>Below 20 &lt; 40–60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20–40 &lt; 40–60</td>
<td>Below 20 &lt; 40–60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Below 20 &lt; 40–60*</td>
<td>40–60 &gt; above 60</td>
<td></td>
</tr>
<tr>
<td>(g) Prefer busy routes</td>
<td>-</td>
<td>-</td>
<td>Below 20 &lt; 40–60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20–40 &lt; above 60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20–40 &lt; 40–60*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20–40 &lt; above 60</td>
</tr>
<tr>
<td>(h) Prefer shortest route</td>
<td>Below 20 &gt; above 60</td>
<td>Below 20 &lt; 20–40*</td>
<td>20–40 &lt; 40–60</td>
</tr>
<tr>
<td></td>
<td>20–40 &gt; above 60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Below 20 &gt; 40–60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20–40 &gt; 40–60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Below 20 &gt; 20–40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Fast walker</td>
<td>20–40 &gt; above 60</td>
<td>Below 20 &lt; 40–60</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>40–60 &gt; above 60</td>
<td>20–40 &lt; 40–60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>40–60 &gt; above 60</td>
<td></td>
</tr>
<tr>
<td>(j) Regular signal violator</td>
<td>Below 20 &lt; 20–40</td>
<td>Below 20 &gt; 20–40</td>
<td>Below 20 &lt; 40–60</td>
</tr>
<tr>
<td></td>
<td>Below 20 &lt; 40–60</td>
<td>Below 20 &gt; 40–60</td>
<td>Below 20 &lt; above 60</td>
</tr>
<tr>
<td></td>
<td>Below 20 &lt; above 60*</td>
<td></td>
<td>20–40 &lt; 40–60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20–40 &lt; above 60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20–40 &lt; 60–60</td>
</tr>
</tbody>
</table>

Note  - indicates failed to show a statistically significant difference. * indicates difference is significant at 5%. All others have a difference significant at 1%.

However, the distribution pattern of results for individual statements is different among the three countries. For example, in relation to the statement (f), younger group’s score is lower than that of relatively older groups in Japan, younger group’s score is higher than that of an older group in Korea, and mix of the pattern is observed in Taiwan. Anyhow, an interesting pattern is present in Table 3 when we ignore the numbers and focus on the direction of the comparison signs (also highlighted by the use of bold and regular symbols). Recall that the lower age group is always stated first in the comparison. In majority of situation in the tabulation, the comparisons move in one direction of the chronological age. For example, in
the row (a), for Taiwan results, the response scores become more positive as respondents grow older. In contrast, in row (d), for results from Korea, the scores become less positive as respondents move through different stages of life. Although there are some exceptions, the response scores generally display a unidirectional movement with age.

Further research is required to find specific reasons for the movement of attitudes in different directions in different countries at different stages of life. However, the difference observed in Table 3 has provided statistical evidence for the presence of the concept of ‘pedestrian travel culture’ specific to different societies, and the need to treat pedestrian behavior studies within that framework.

5.3 Impact of lifestyle on general attitudes toward walking

As mentioned in section 3, the proxy variable to denote the lifestyle in this research work is the level of usage of public transport. Table 4 shows results from the comparison study performed for each of the statements presented to the respondents to measure the awareness and general attitudes toward walking. To reduce complexity, the comparison is made here between those who were classified as users and those considered non-users of public transport. The statistical method described earlier in Section 5.1 is applied again for this comparison.

Table 4 has ‘User’ as the lead label in all comparisons. When this group’s score is lower than the non-user group, the bold font is selected to highlight the change in direction of the inequality symbol. In Japan, public transport users have generally more positive attitudes (as indicated by (a) through (d) in the statement list) toward walking compared to those who do not use regular public transport services such as trains and buses. Implication of this observation is different for different cities as some cities have a high percentage of public transport users (example – Tokyo in Figure 4) and others may have a large proportion of non-users (examples: Nagano and Matsuyama).

Comparison of data from Taiwan for the attitude indicators shows a reversal of the direction of the inequality symbol, indicating that non-users have provided a relatively higher score than users for two of the indicators (see rows (a) and (b) in Table 4). Results for South Korea also has two indicators where non-users of public transport have scored the larger magnitude (see rows (a) and (c) in Table 4). Although it is not possible to provide a definitive reason for these changes of behavior from different countries according to the lifestyle variable, these results indicate the importance of considering pedestrian system development in the context of the local pedestrian travel culture.

Pedestrian preferences and stated behavior (see (e) through (j) in the statement list) are also relatively more intense for public transport users according majority of indicators considered in Table 4 for respondents from Japanese cities. Taiwan samples have shown a significant difference for only one indicator in this comparison. That is for agreement with propensity to violate pedestrian traffic signals when crossing a street (row (j) of Table 4). Similarly, only one indicator in this group provided a significant difference in the South Korean study. It is interesting to note that the South Korean study showed the public transport non-users providing a relatively higher score, which is different from what was observed in Japan and Taiwan.

Anyhow, as public transport users in Japan prefer improved amenities for walking, it can be argued that efforts to establish quality public transport systems with integrated pedestrian
facilities are logical planning directions that would receive public support. However, dealing with the opposite direction of the preference comparison of South Korean results is more challenging. There, improved pedestrian facilities may not be a priority for public transport users. It is also important to review the survey methodology followed in providing an explanation for the results. The Korean survey was administered during classes held for driving license renewal and therefore the survey respondents could have a history of above average motor car dependence. This may have introduced a sample bias in representation of views toward public transport and walking. On the other hand, the low level of pedestrian network connectivity observed by some commentators in South Korea may be a reflection of the lack of public support indicated in results shown in Table 4.

| (a) I like walking | Japan User > non user | Taiwan User < non user | South Korea User < None user* |
| (b) Walking is smart | - | User < non user | User > non user* |
| (c) Willing to walk a short distance daily | User > non user | - | User < None user |
| (d) I like a leisurely walk | User > non user | User > none user* | - |
| (e) Prefer good scenery en-route | User > non user | - | - |
| (f) Prefer good neighborhood en-route | User > non user | - | - |
| (g) Prefer busy routes | User > non user | - | User < None user* |
| (h) Prefer shortest route | - | - | - |
| (i) Fast walker | - | - | - |
| (j) Regular signal violator | User > non user | User > none user* | - |

Note - indicates failed to show a statistically significant difference. * indicates difference is significant at 5%. All others have a difference significant at 1%.

6. CONCLUSIONS

This research work has studied the awareness and attitudes toward walking of three different countries in East Asia. The study is based on the concept of pedestrian travel culture that ties in level of service of urban infrastructure, regional environmental factors and attributes of citizens to explain the pedestrian travel behavior.

There are two attributes of survey respondents used as causal variables termed as stage of life and lifestyle considered in the work presented in this paper. The relevance of selection of these variables in the overall scheme of the travel culture is shown by the highlight and thick arrow line shown in Figure 1. The stage of life was measured through the proxy variable of age of respondents. For the purpose of this study, the age is classified into four groups. The variable adopted to measure the lifestyle is the public transport usage. Here, this is a binary variable, and classifies respondents to users and non-users of public transport. The methodology followed is based on searching for situations where there is a significant difference of average scores provided by respondents about their general attitudes toward walking. A computational method has been applied to conduct this search in a statistically meaningful manner.

The body of data collected for this research work has been growing since 2004 when data were first collected for 10 cities in Japan. Later a corresponding survey was conducted in Taiwan in the local language. Four cities in Taiwan were surveyed, in two installments, the
first two cities in 2006 and the other two in 2008. Also in 2008, two South Korean cities completed the field survey that contributed to the database. The paper has documented the relevant differences among the survey administration process. Relevance of background studies previously conducted to investigate differences among cities within a particular country has been mentioned in section 2 and Table 1.

The statistical analysis has shown that significant relationships exist for different indices in the urban communities studied, although the pattern of relationships is different among the three countries. Nevertheless, there is a regularity observed for relationships within each individual country, strengthening the argument for treating the pedestrian behavior analysis with a cultural perspective as adopted in Figure 1. It could be concluded that each country has an own identity in terms of pedestrian culture.

Although this project has identified where relationships exist and the direction of relationship patterns, it is acknowledged that reasons for such observations are somewhat hypothetical at this stage. There are further variables covered in the study framework that could now be explored to assist further. For example, analysis from the viewpoint of nationality, historical and cultural traits mentioned in the conceptual framework, may provide more appropriate and quantifiable explanation to observations made during the current analysis.

REFERENCES