Pedestrian and bicyclist motivation: an assessment of influences on pedestrians’ and bicyclists’ mode choice in Mt. Pleasant, Vancouver

Jeffery M. Guinn* and Paul Stangl

Department of Environmental Studies, Huxley College of the Environment, Western Washington University, Bellingham, WA, USA

(Received 20 November 2013; accepted 18 March 2014)

The majority of short distance travel in North America is completed by single occupancy vehicles. Substituting walking and bicycling for these trips would reduce energy use and environmental pollution, while improving quality of life. Therefore, understanding influences on non-automotive travel behavior is crucial. Researchers and planners have touted specific factors for encouraging walking and biking, but the body of work remains fragmented. Previous studies have focused on a smaller number of factors and most of them relate to physical design. This study tests the relative importance of a range of factors, both physical and perceptual that could influence one’s choice to walk or bike. The Mt. Pleasant neighborhood in Vancouver, B.C., Canada was chosen as the location for this study as all of the pedestrian-motivating factors identified in a literature review were present. A questionnaire-based survey addressing distance, sidewalks/bike lanes, pedestrian/bicycle traffic signals, buffering from auto traffic, sense of security, cleanliness, opportunities to talk with others, enforcement of traffic laws, concern for the environment, weather, terrain, saving money, opportunities for exercise, and a visually appealing environment as influential factors was administered in person and online yielding 774 responses. All factors were shown to influence the decision to walk or bike, but some proved more significant than others, especially opportunities for exercise.

Keywords: pedestrian; bicycle; planning; urban; transportation

Introduction

Urban transportation in North America is at a crossroads. Continued heavy reliance on the automobile for the vast majority of all trips is unsustainable. In the United States, approximately 49% of all trips are less than three miles in length and 80% of these are made by single occupancy vehicles (Nationwide Household Transportation Survey, 2009). In Canada, motorized transport to work accounted for 91.2% of the modes in 2001, and over a quarter of the trips made in Canadian cities are less than two miles exemplifying a very similar story (Pucher & Buehler, 2005). This contributes to many adverse effects on the environment such as pollution, increased energy consumption, injuries and deaths, and health problems (Krieger, Rabkin, Sharify, & Song, 2009; Office of Transportation and Air Quality, 2010; Pedestrian and Bicycle Information Center, 2010; Rasciute & Downward, 2010; United States Energy Information Administration, 2009). All of these effects could be abated through the use of non-automotive based transportation for short distance travel.

*Corresponding author. Email: jmackguinn@gmail.com

© 2014 The Author(s). Published by Routledge.
This is an open-access article distributed under the terms of the Creative Commons Attribution License http://creativecommons.org/licenses/by/3.0/, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The moral rights of the named author(s) have been asserted.
Therefore, it is important to understand and implement measures to encourage a higher mode share for non-motorized transport. Many previous studies have drawn conclusions from the correlation of travel statistics with neighborhood form, or by surveying a portion of the population with regard to one specific influence such as mix of land uses or connectivity. This article presents the findings from a survey of pedestrians and cyclists about influences on their mode choice, both physical and perceptual, and asks pedestrians and cyclists to rate the influence these factors have on their decision for non-motorized transportation. A better understanding of these dynamic influences can guide efforts to encourage non-automotive-based modes of transport, and to guide future studies.

**Literature review**

The majority of previous research focuses on specific design features of the built environment and how they promote non-automotive transportation. Past studies have highlighted the importance of distance to destination. For example, Atash (1994) noted that 400 m is considered to be the maximum distance one will consider walking before utilizing automotive-based modes of transport. Building on this idea, many researchers and planners indicate that a compact, highly connected, higher density city with a fine-grained mix of land uses can encourage more use by creating shorter distances between destinations. Randall and Baetz (2001, p. 3) define connectivity as: “an indicator of how accessible a neighborhood is to its residents.” Southworth (2005, p. 249) demonstrates that, “connectivity of the path network is determined by the presence of sidewalks and other pedestrian paths and by the degree of path continuity and absence of significant barriers.” Other studies have shown that high levels of connectivity coincide with higher levels of pedestrian activity (Cervero & Duncan, 2003; Handy, 1996; Hess, 1997; Hess, Moudon, Snyder, & Stanilov, 1999). Cervero and Duncan (2003, p. 1482) concluded in their study that, “mixed land uses, and close proximity to retail activities were shown to induce non-motorized transport.”

Other research provides evidence of the importance of basic pedestrian infrastructure, such as marked crosswalks and crossing signals, especially, when pathways come into contact with streets, railways, and other various intersections. According to Powell, Martin, and Chowdhury (2003) pedestrians are more likely to walk if there are pedestrian accommodations at various intersections. Buffering from auto traffic also appears to be influencing walking and biking because of the feeling of safety or distance it provides (Pucher & Dijksstra, 2003). Hess (1997) found a higher level of pedestrian activity in urban environments with complete sidewalk systems. Dill and Carr (2003) discovered that for each additional mile of bike lanes that were added ridership increased by one percentage point.

Along with infrastructure, individual perceptions of the impacts and benefits of walking or biking also appear to be influencing mode choice. However, there is less previous research concerning an individual’s perception as opposed to physical design factors. First, it has been suggested that recent pro-environmental attitudes are encouraging non-automotive travel (Nilsson & Kuller, 2000). Second, many journal articles have demonstrated the positive health effects of walking or biking (Owen, Humpel, Leslie, Bauman, & Sallis, 2004; Pucher, Dill, & Handy, 2010; Suminski, Poston, Petosa, Stevens, & Katzenmoyer, 2005), and a few recent articles have pointed to the importance of health benefits as a motivating factor for bicyclists (Heinen & Handy, 2012; Noland, Deka & Walia, 2011). Third, perceptions of terrain or weather also appear to
influence mode choice, but have rarely been tested (Cervero & Duncan, 2003; Dill, 2004; Humpel, Owen, Iverson, Leslie, & Bauman, 2004; Pucher & Buehler, 2006). Fourth, personal finances appear to be influencing mode choice. However, previous literature has only illustrated how increased costs of owning and operating an automobile correlate with higher levels of walking and biking (Hess et al., 1999; Pucher & Buehler, 2006). Fifth, according to Powell et al. (2003) persons are more likely to walk if they perceive routes to be safe. Sixth, aesthetic interest along pathways can potentially encourage walking through landscaping, street furniture, architecture, and public art (Isaacs, 2000; Mehta, 2008). Seventh, a sense of belonging, “is the ability for a person to belong to a group, to be accepted in it and to feel a sense of attachment to it” (Mehta, 2008, p. 222). By creating communal places or walkable environments that foster interaction one may be encouraged to walk instead of drive. The majority of these perceptual factors have only been studied in relation to pedestrians; therefore it is important to begin addressing these influences with cyclists as well.

Methods

Many researchers have studied travel behavior by examining correlation between travel behavior and neighborhood design. Researchers essentially utilize previously collected and available databases, such as citywide travel statistics, census data, or other transportation surveys, and compare the results to different neighborhood forms to draw conclusions regarding travel behavior and the influences at work (Hess, 1997; McCormack, Rutherford, & Wilkinson, 2001). While this research provides insight regarding connections between urban form and actual travel behavior, it cannot evaluate the relative importance of different factors in an individual’s mode choice, and does not include non-physical factors.

To address these issues, some researchers attempt in-person interviews or surveys (Isaacs, 2000; Handy, 1996; Mehta, 2008; Shriver, 1997). This paper employed an intercept survey of walkers and cyclists, providing them with a short questionnaire. The respondents were asked to rate how 14 different variables influence their choice to walk or bike (see Appendices 1 and 2) by indicating no, little, some, or highly influenced. This survey captured individuals already walking or biking in a neighborhood that caters to cyclists and pedestrians to compare the different influences that encouraged them to walk or bike. The purpose was to have a general overview of these different influences on an equal playing field where they were all present.

The Mt. Pleasant neighborhood in Vancouver, B.C. (Figure 1) was chosen for this purpose. First and foremost, it exhibited all of the previously discussed physical factors that influence walking and biking: various types of housing and land uses, excellent pedestrian infrastructure including complete sidewalks, street furniture, marked crosswalks with sensors, on-street bike lanes, and many bike parking facilities. This allows the study to address all of these factors, and compare the differences and relationships that exist among them. Second, the neighborhood exhibited high levels of pedestrian and biking activity, enabling the possibility of obtaining a large sample of intercept surveys, something very difficult in auto-dominated areas.

Four survey collection points that consisted of intersections where large numbers of pedestrians and cyclists had been observed during preliminary field observations were chosen. These were located along designated bike routes, contained pedestrian signage and signals, and a mix of land uses. To capture pedestrians and cyclists traveling for utilitarian and non-utilitarian reasons, the hours between 3:30 pm and 8:00 pm were
designed as the data collection times; an approach derived from Shriver’s intercept survey method (1997). An online survey matching in-person walking and biking surveys was also set up in the event that willing participants did not have enough time to complete the survey in person. Data was collected on four days for each of the four locations. A total of 774 surveys were completed both in person (589) and online (185). To capture respondents surveyors interacted with as many pedestrians and cyclists as possible at their given location. Since these users had already decided to walk or bike it was important to test what influenced them. Granted this method only provides a singular point of view.

The survey did not include automobile drivers, who may respond differently to the motivating factors. For instance, Mia Birk suggests that some will bicycle in any environment simply because they love bicycling and some will not bicycle no matter what the conditions. Moreover, those falling between the extremes are not a homogenous group and some can be more easily motivated to bicycle than others (Birk, 2010). Therefore, this study should have the greatest value for neighborhoods with lower rates of bicycling and walking than Mt. Pleasant. Yet, it remains to be seen whether future studies in other neighborhoods will suggest more variability in the relative importance of motivational factors from locale to locale.

It is also important to mention that the survey was administered during the months of June and July when the average temperature was between 63 and 70 °F. Had the survey been conducted during the winter months the results could have been very different. Regardless it is still important to discuss weather as a motivating factor.

For analysis responses were assigned a numerical value between 1 and 4 with 1 being the lowest level of influence and 4 being the highest for comparison. The
Wilcoxon signed ranks test and the Friedman test were used to rank the variables in terms of their relative influence. These tests place the variables in groups with similar scores, by establishing breaks between variables showing statistically significant differences allowing one to clearly see which variables held a stronger influence.

Demographics were also collected and analyzed, but only a few significant differences were revealed. Thus further research and analysis is required. The response rates for each group are provided in both the walking and biking sections. For analysis, the Mann–Whitney U test (two variables) and the Kruskal–Wallis H test (multiple variables) were utilized to highlight significant differences among the different demographic groups. Both tests assume the sample distributions will be the same, so if any demographic is significantly different it will show which group was more influenced by a given variable. These tests were chosen to highlight the differences among each group, but they do not provide any correlation.

It is important to note that question number eight in the socio-demographic behavioral section, purpose of today’s trip, was not clearly written. The question was supposed to directly relate to the rated influences. However, the overall survey asked participants to rate what influences them to walk or bike, not what influenced them to walk or bike for that particular trip they made when intercepted. Therefore, no conclusions can be drawn from the analysis of these results. However, the response rates for utilitarian (work, bus stop, and shopping/eating) and non-utilitarian (exercise and recreation) are included for discussion purposes. Also the 18–19-year-old responses were combined with 20–34 year olds, 35–64 year olds were combined with 65+ year olds, and respondents who made more than $100,000 per year were combined with the respondents who made $50–100,000 per year because of the small representation of the original group.

Results and discussion
As some differences emerged in the results from the walking and biking surveys, these are discussed separately.

Walking survey
The final walking data-set totaled 293 complete surveys after incomplete responses were removed. The means varied from 2.16 to 3.17, Figure 2, illustrating a very small range, and all of the variables were shown to have influence over the respondents’ decision to walk. This is important to note because it shows that no single variable is the key-motivating factor for walking, but that a combination of many variables contribute to increased pedestrian activity. Table 1 shows the response rate from each demographic group.

The results of the Wilcoxon signed ranks test and the Friedman test highlight groups of similar influence. The Wilcoxon test was applied first to test each adjacent variable. Table 2 highlights these groupings. As is evident, only two comparisons of adjacent variables were significantly different indicating three basic groupings of influence. Interestingly, opportunities for exercise stood out among the rest of the variables as a strong motivating factor in one’s choice to walk.

The Friedman test was employed next to highlight other possible differences among variables and provide a more focused grouping. Unlike the Wilcoxon, the Friedman test allows for the comparison of groups of variables. By moving through the rankings, variables were added one at a time until their comparison proved to be significant. Table 3
highlights the results. The results of the Friedman test highlight three different groupings of variables, and two variables, group numbers 1 and 5 that are significant in their own regard when compared with the other adjacent variables. The assigned group numbers represent variables of similar levels of influence.

A summary of the Mann–Whitney $U$ test and Kruskal–Wall $H$ test results are shown in Table 4. The table highlights different demographic groups more influenced by the given variable than their counterparts. The remainder of the walking section discusses the variables within each group of influence as shown by the Wilcoxon and Friedman tests, and any important demographic relationships.
Opportunities for exercise stood above other factors as the most important variable, with an average mean of 3.17. Previous literature has focused on ways to increase levels of walking for the benefit of the individual’s health, but has given little attention to the importance of an individual’s desire to improve their health as a motive for walking. Owen et al. (2004) point to exercise as a motivating factor for pedestrians, but treat it as a type of walking trip that is separate from utilitarian trips, or walking to a destination for a specific purpose. This study found that a desire for exercise is the most important factor for even utilitarian trips. As many survey respondents own cars, which are faster for most trips in Mt. Pleasant, it may be that the desire for exercise trumped convenience for many respondents. In other words, exercise may prove a very important

Table 2. Wilcoxon test results, walking.

| Comparison                                      | Sig. |
|------------------------------------------------|------|
| Opportunities for exercise                      | .022 |
| Concern for the natural environment             | .486 |
| A visually appealing environment                | .195 |
| Distance to destination                         | .403 |
| Weather on a given day                          | .009 |
| Sense of personal security                      | .576 |
| Saving money                                    | .608 |
| Cleanliness of neighborhood                     | .461 |
| Buffering from automobile traffic               | .872 |
| Presence of sidewalks                           | .281 |
| Opportunities to talk or meet with friends or neighbors | .278 |
| Ease of terrain                                 | .402 |
| Marked crosswalks with signals                  | .234 |

Source: Author.

Table 3. Friedman test results and groupings, walking.

| Variable groups                                      | Rank | M    | Group | Sig. |
|------------------------------------------------------|------|------|-------|------|
| Opportunities for exercise                           | 1    | 3.17 | 1     | .022 |
| Concern for the natural environment                  | 2    | 3.04 | 2     | .688 |
| A visually appealing environment                     | 3    | 3.01 | 2     | .358 |
| Distance to destination                              | 4    | 2.90 | 2     | .054 |
| Weather on a given day                               | 5    | 2.84 | 2     | .618 |
| Sense of personal security                           | 6    | 2.63 | 3     | .293 |
| Saving money                                         | 7    | 2.58 | 3     | .276 |
| Cleanliness of neighborhood                          | 8    | 2.54 | 3     | .000 |
| Buffering from automobile traffic                    | 9    | 2.50 | 3     | .237 |
| Presence of sidewalks                                | 10   | 2.48 | 3     | .016 |
| Opportunities to talk or meet with friends or neighbors | 11   | 2.40 | 4     | .884 |
| Ease of terrain                                      | 12   | 2.32 | 4     | .084 |
| Marked crosswalks with signals                       | 13   | 2.25 | 4     | .004 |
| Enforcement of speeding and other traffic laws       | 14   | 2.16 | 5     | .004 |

Source: Author.

Group 1

Opportunities for exercise stood above other factors as the most important variable, with an average mean of 3.17. Previous literature has focused on ways to increase levels of walking for the benefit of the individual’s health, but has given little attention to the importance of an individual’s desire to improve their health as a motive for walking. Owen et al. (2004) point to exercise as a motivating factor for pedestrians, but treat it as a type of walking trip that is separate from utilitarian trips, or walking to a destination for a specific purpose. This study found that a desire for exercise is the most important factor for even utilitarian trips. As many survey respondents own cars, which are faster for most trips in Mt. Pleasant, it may be that the desire for exercise trumped convenience for many respondents. In other words, exercise may prove a very important
tipping factor in decision-making to walk rather than drive. It also proved to be a more influential factor among women.

The extreme importance of exercise in this study suggests that it should be given far more attention. Planning research and practice need to move beyond examining physical characteristics of neighborhoods and infrastructure, and engage personal motivations such as exercise. Though planners tend to see perceptions as outside their purview, the profession is increasingly engaged in outreach efforts as an effective means of shaping perceptions and converting existing perceptions into actions. These efforts can be implemented for much less money than infrastructure improvements and have been shown to be effective (Stangl, 2011, p. 299).

**Group 2**

The second most significant group of motives included concern for the natural environment, a visually appealing environment, distance to destination, and weather on a given day. The averages consisted of a mean that ranged from 3.04 to 2.84.

Two of these variables, distance to destination and a visually appealing environment, relate to physical features of the built environment that city planners have traditionally engaged. Distance to destinations can be shortened through improvements in the connectivity of a neighborhood, mixed-use zoning, and higher densities, while street improvements and urban design guidelines can enhance aesthetics. Further demographic analysis demonstrates that non-residents, car owners, and those who make fewer trips walking per week are more influenced by distance. The importance of these factors is no surprise, as shown in numerous studies (Cervero & Duncan 2003; Hess et al., 1999; McCormack et al., 2001). However, the relative importance of these factors in this survey suggests that they merit more attention. While aesthetics has primarily been shown to have importance for recreational trips rather than utilitarian trips (Isaacs, 2000; Mehta, 2008; Southworth, 2005), this study suggests it can be an important motivational factor for all

| Variable groups                              | Rank | Group | Sig. relationships                                                                 |
|----------------------------------------------|------|-------|------------------------------------------------------------------------------------|
| Opportunities for exercise                    | 1    | 1     | Female and bachelors                                                                |
| Concern for the natural environment          | 2    | 2     | Female                                                                            |
| A visually appealing environment              | 3    | 2     | 35–65+ and postgraduate                                                             |
| Distance to destination                       | 4    | 2     | Non-resident, bachelors, car owner/yes, and 0–5 trips                              |
| Weather on a given day                        | 5    | 2     | 18–34 and 0–5 trips                                                                |
| Sense of personal security                    | 6    | 3     | Female and bachelors                                                                |
| Saving money                                  | 7    | 3     | Car owner/no                                                                      |
| Cleanliness of neighborhood                   | 8    | 3     | 35–65+ and car owner/yes                                                            |
| Buffering from automobile traffic             | 9    | 3     | 35–65+                                                                            |
| Presence of sidewalks                          | 10   | 3     | 35–65+, $50–100,000+, and car owner/yes                                             |
| Opportunities to talk or meet with friends or neighbors | 11   | 4     |                                                                                   |
| Ease of terrain                               | 12   | 4     | Female                                                                            |
| Marked crosswalks with signals                | 13   | 4     | 35–65+                                                                            |
| Enforcement of speeding and other traffic laws| 14   | 5     | 35–65+ and female                                                                  |

Source: Author.
trips and that it has been undervalued. It also demonstrated a stronger influence with older respondents.

Concern for the natural environment ranked second among all factors. It may be even more important than the results indicate, as automobiles are readily accessible to many people who are choosing to walk. This factor, along with aesthetics and a desire for exercise may all work in concert as features that outweigh the convenience of the automobile. Despite this, concern for the natural environment has received scant attention in research on pedestrian behavior, as planners tend to see personal perceptions as outside their purview. Nilsson and Kuller (2000) discovered that, “environmental attitudes were more potent than factual knowledge in promoting pro-environmental travel behavior” (p. 229). This may be taken as evidence that knowledge of the impact one’s car has on the environment is less important than just being sensitive to the fact that it has an impact. Planners should engage in education and marketing efforts that package factual evidence to reinforce this sensitivity as a means of encouraging more walking.

Finally, while weather can have major impacts on walking levels, a study in Vermont revealed a 13% drop in pedestrian activity from precipitation and 16% drop during winter months, but no drop during the Christmas season (Aultman-Hall, Lane, & Lambert, 2009). This suggests that weather is less important than how people view weather. Planners and officials can engage in educational efforts to assist people to overcome mental barriers that hinder them from walking in adverse weather. In the Mt. Pleasant survey weather also proved to have more influence over younger respondents and those taking fewer trips by walking per week. This suggests that outreach should target certain demographic groups, especially the young, who are still forming habits that will last a lifetime. However, it is unclear whether survey respondents in Mt. Pleasant viewed bad weather as a disincentive to walk or very good weather as an incentive to walk. Given the significance of this variable, in-depth interviews may provide more insight into possible means of addressing perceptions and behaviors of walkers and potential walkers.

Group 3

The third group included five variables with means ranging from 2.63 to 2.48. Once again there is a mixture of physical characteristics of the neighborhood and personal values/perceptions. These factors include sense of personal security, saving money, cleanliness of the neighborhood, buffering from automobile traffic, and presence of sidewalks.

Presence of sidewalks and buffering from automobile traffic falls within the confines of traditional planning, and their ranking in this study confirms what previous research has determined. A complete sidewalk system makes walking easier because of shorter trip distances, greater safety and comfort, and this is essential on busy streets (Hess et al., 1999, p. 18). In fact, when Hess (1997) compared urban and suburban pedestrian networks he found incomplete sidewalk systems to be a major deterrent for walking. In this study complete sidewalks held more influence over older respondents, higher income levels, and car owners. The influence over car owners perhaps relates to safety or the fact that those who do not own a car do not have a choice. Either way a complete sidewalk system could encourage more drivers to walk.

Buffering is another infrastructural factor considered by pedestrian planners. Some have measured “buffers” in terms of physical distance from the pedestrian walkway to the street, and the presence of a parking lane or street trees. However, the effect is
psychological and involves many subtleties. For instance, seasonal changes in deciduous street trees (presence and absence of leaves) have been shown to impact pedestrian’s sense of safety (Ozhanci, Yilmaz, & Yilmaz, 2013). This, along with the importance of aesthetic factors suggests an important role for urban designers in planning for pedestrians, especially in communities with older populations.

Cleanliness of the neighborhood, like aesthetics, helps shape the experiential dimension of walking. Mann and Abraham (2006) provide evidence of the importance of experiential and emotional factors vs. utility factors (time, cost, and reliability) for mode choice involving automobiles and transit, and this study suggests their importance to walking. Pikora, Giles-Corti, Bull, Jamrozik, and Donovan (2003) also demonstrated the significance of cleanliness to walking for transport or recreation, suggesting that this factor is undervalued by planners. Cleanliness has come to the attention of local government for commercial centers, though often the work has fallen to business improvement districts rather than planning agencies. This variable also held more influence over older respondents and car owners highlighting another overlooked facet that could encourage walking over driving.

The remaining two variables have received limited attention by planners, as they are often seen as personal characteristics. Sense of personal security was intended to capture a sense of freedom from danger arising from crime or discomfort arising from undesired attention. Stangl (2011) observed that security is far more important to pedestrians than to planners working on pedestrian issues, and the high ranking of security in this survey supports this conclusion. It was especially influential with the women in this study. This often neglected issue could be addressed through “safescaping” or policing in targeted areas (Zelinka & Brennan, 2001). Evidence also indicates that the aesthetics and maintenance factors are related to sense of security, including the condition of yards and houses lining streets (Foster, Giles-Corti, & Knuiman, 2011). The interrelatedness of these factors is noteworthy and will be discussed in the Conclusion.

Research has associated increased income and auto ownership with a decline in pedestrian travel (Hess et al., 1999), however, the relative influence of saving money as a motive has not been examined. The Mt. Pleasant survey shows that even those with higher incomes are motivated by a desire to save money as no difference existed among the different income levels.

Group 4

The fourth highest grouping included opportunities to talk or meet with friends or neighbors, ease of terrain, and marked crosswalks with signals. Their averages included a mean ranging from 2.40 to 2.25. Though less significant than many of the factors, it is important to remember that these too had an influence on pedestrian behavior.

A very limited amount of research has investigated the impact of opportunities for social interaction on pedestrian behavior, but this should not belie its importance. Mehta (2008) has been shown that creating neighborhoods with a sense of community or belonging can encourage walking, and these results support this idea. Mehta’s survey participants often chose, “destinations to meet neighbors, friends, and sometimes strangers” (p. 239).

Like weather, ease of terrain is seemingly beyond planners’ control. In some locations it may prove very important. Cervero and Duncan (2003) found evidence that topography in the San Francisco Bay Area had far greater influence than built environment factors. The topography of Mt. Pleasant is relatively moderate and the impact of
topography ranks far lower than many factors in this study. Yet, in some locations with extreme topography, such as Montmartre in Paris, there are high levels of walking. This suggests that attitudes towards topography may be as important as the topography itself. Also the women in this study found ease of terrain more influential than men.

Marked crosswalks with signals relate to a sense of safety and comfort for pedestrians, and previous literature has suggested it will provide a safer environment, encouraging more walking (Hess, 1997; Powell et al., 2003). In Mt. Pleasant, older respondents were more influenced by the functioning signals and marked crosswalks at every intersection. In this study perhaps marked crosswalks with signals proved to have less influence overall because pedestrians were simply taking the safety provided for granted.

**Group 5**
The last group contained only one variable, the enforcement of speeding and other traffic laws, which held the least influence with a mean of 2.16. The reason for this low ranking is difficult to determine. Pedestrians may be taking the significance of law enforcement for granted, and would only become cognizant of its impact if it were withheld. Also, as Mt. Pleasant is a very pedestrian-friendly environment with excellent pedestrian infrastructure, enforcement may simply be less necessary. Regardless and more interesting than its ranking is the fact that it held more influence over older respondents and women.

**Biking survey**
The biking data were analyzed with the same statistical tests used in the previous section, and interestingly contained very similar results. All of the variables proved to be influential and there were many parallels in the ordinal ranking, however, there was considerably more variation in the scores, which ranged from 1.97 to 3.44, see Figure 3. The final data-set for bicyclists contained 417 complete surveys once incomplete responses were removed. Table 5 lists the response rate from each demographic.

![Figure 3. Biking survey results.](image)
The Wilcoxon signed ranks test was employed to each adjacent variable to focus the study by grouping variables of similar influence. Table 6 details the results. As is evident, there are several points of significant difference within the ranked means. This highlights how some of the adjacent variables are relatively stronger than others.

The Friedman test results, as shown in Table 7, further highlight variables of similar influence by allowing the comparison of groups of variables. Variables were added to the analysis one at a time until they proved to be significant. As is evident, there were a total of eight groups, each representing a similar level of influence among the included

Table 5. Demographic group response rate, biking.

| Demographic group               | Response |
|---------------------------------|----------|
| Resident                        | 167      |
| Non-resident                    | 250      |
| 18–34 year olds                 | 220      |
| 35–65+ year olds                | 197      |
| Male                            | 209      |
| Female                          | 208      |
| <50,000 per year                | 225      |
| 50–100,000+ per year            | 192      |
| Some HS/Diploma                 | 23       |
| Some college                    | 93       |
| Bachelors                       | 164      |
| Postgraduate                    | 137      |
| Car owner                       | 210      |
| No car                          | 207      |
| Utilitarian                     | 312      |
| Non utilitarian                 | 105      |
| 0–5 trips per week              | 104      |
| 6–10 trips per week             | 146      |
| 11+ trips per week              | 167      |

Source: Author.

Table 6. Wilcoxon test results, biking.

| Comparison                                      | Sig.    |
|-------------------------------------------------|---------|
| Opportunities for exercise                      | .048    |
| Concern for the natural environment             | .000    |
| A visually appealing environment                | .662    |
| Buffering from automobile traffic               | .990    |
| Presence of bike lanes                          | .196    |
| Sense of personal security                      | .270    |
| Saving money                                    | .070    |
| Distance to destination                         | .630    |
| Presence of bike signals at intersections        | .727    |
| Weather on a given day                          | .000    |
| Ease of terrain                                 | .033    |
| Enforcement of speeding and other traffic laws  | .040    |
| Cleanliness of neighborhood                      | .001    |

Source: Author.
variables. Group 7 was added to the groupings since Wilcoxon test demonstrated significance through the comparison of the enforcement of speeding and other traffic laws and the cleanliness of the neighborhood.

Table 8 summarizes the results of the Mann–Whitney $U$ test and Kruskal–Wallis $H$ test, which provide an overview of the different demographic groups and the variables that held more influence over them. Like the walking discussion the remainder of the biking section discusses the variables within each group of influence as shown by the Wilcoxon and Friedman tests, and any important demographic relationships.

Table 7. Friedman test results and grouping, biking.

| Variable groups                                      | Rank | $M$  | Group | Sig. |
|------------------------------------------------------|------|------|-------|------|
| Opportunities for exercise                           | 1    | 3.44 | 1     |      |
| Concern for the natural environment                  | 2    | 3.35 | 2     | .043 |
| A visually appealing environment                     | 3    | 2.91 | 3     | .000 |
| Buffering from automobile traffic                    | 4    | 2.89 | 3     | .950 |
| Presence of bike lanes                               | 5    | 2.88 | 3     | .985 |
| Sense of personal security                           | 6    | 2.82 | 3     | .369 |
| Saving money                                         | 7    | 2.75 | 3     | .188 |
| Distance to destination                              | 8    | 2.62 | 4     | .000 |
| Presence of bike signals at intersections            | 9    | 2.6  | 4     | .809 |
| Weather on a given day                               | 10   | 2.59 | 4     | .858 |
| Ease of terrain                                      | 11   | 2.41 | 5     |      |
| Enforcement of speeding and other traffic laws       | 12   | 2.27 | 6     | .033 |
| Cleanliness of neighborhood                          | 13   | 2.15 | 7*    | .142 |
| Opportunities to talk or meet with friends or other cyclists | 14   | 1.97 | 8     | .000 |

*Significance originally shown by Wilcoxon test results.
Source: Author.

Table 8. Significant demographic relationships, biking.

| Variable groups                                      | Rank | Group                        | Sig. relationships |
|------------------------------------------------------|------|-----------------------------|--------------------|
| Opportunities for exercise                           | 1    | 1 Female, postgraduate, and car owner/yes |
| Concern for the natural environment                  | 2    | 2 Female, <$50,000, and 6–10 trips |
| A visually appealing environment                     | 3    | 3 Female and 0–5 trips       |
| Buffering from automobile traffic                    | 4    | 3 Female and 0–5 trips       |
| Presence of bike lanes                               | 5    | 3 Female and 0–5 trips       |
| Sense of personal security                           | 6    | 3 Female and postgraduate    |
| Saving money                                         | 7    | 3 18–34, female, <$50,000, and car owner/no |
| Distance to destination                              | 8    | 4 Postgraduate, car owner/yes, and 0–5 trips |
| Presence of bike signals at intersections            | 9    | 4 Female, 0–5 trips         |
| Weather on a given day                               | 10   | 4 18–34, female, car owner/yes, and 0–5 trips |
| Ease of terrain                                      | 11   | 5 18–34, female, and 0–5 trips |
| Enforcement of speeding and other traffic laws       | 12   | 6 35–65+                    |
| Cleanliness of neighborhood and streets              | 13   | 7                            |
| Opportunities to talk or meet with friends or other cyclists | 14   | 8 <50,000 and car owner/no  |

Source: Author.
Group 1

As in the walking data-set, opportunities for exercise proved to have the greatest influence, and it was the only variable in group 1. It had a mean of 3.44. Despite its apparent importance, only a few recent studies indicate the influence of desire for exercise on cycling activity. The studies that do include this factor provide additional evidence of its extreme importance as a motivator (Heinen & Handy, 2012; Noland, Deka, & Walia, 2011). This suggests the possibility of encouraging bicycling through outreach designed to make the public aware of its benefits. This was also the most important factor in the walking section, raising questions about the distinction between those choosing non-motorized transport and those who do not, which will be discussed in the conclusions section. Furthermore, it held more influence over women, like the walking survey, and car owners.

Group 2

The next group also contained a single variable, concern for the natural environment, which had a mean of 3.35. This variable was also ranked second in the walking survey. This is especially interesting because the influence of environmental concern has been rarely tested in past travel behavior studies. Nilsson and Kuller (2000) discovered that, “the intention to behave in an environmentally responsible way to a considerable degree may depend on attitudes related to the environment, the car and to the hazards of traffic” (p. 228). In fact respondents making 6–10 trips/week by bike were more influenced by their concern for the environment perhaps highlighting a negative attitude related to the automobile. Women and respondents making less than $50,000 per year were also highly influenced by their concern. A great deal more attention needs to be directed at understanding this influence and determining how to incorporate it into outreach efforts to encourage more biking.

Group 3

The third group contained five different variables, their means ranging from 2.91 to 2.75. This group included a visually appealing environment, buffering from automobile traffic, presence of bike lanes, sense of personal security, and saving money. As in the walking data-set, a visually appealing environment ranked third overall. Beyond the third variable, differences between the rankings ensue when comparing both the walking and biking results.

It is surprising that bicyclists ranked a visually appealing environment as highly as pedestrians, as the latter experience their environment at a slower pace. This factor has received even less attention for bicyclists than for pedestrians. Given that bicyclists are more prone to take trails than pedestrians, one might consider that Lindsey, Wilson, Yang, and Alexa (2008) discovered that recreational trail use, “correlated positively and significantly with trail segments that have larger, more open viewsheds, are greener than the neighbourhoods that surround them, and have greater land-use diversity within viewsheds” (p. 76). It may be that fine-grained perceptual cues are more important to pedestrians and larger scale factors for bicyclists; an interesting point of inquiry for future studies.

Buffering from automobile traffic and the presence of bike lanes were the fourth and fifth ranked factors, and at this point the biking data-set analysis begins to differ from
the walking data-set. Bike lanes were not included in the walking survey, but like buffering they protect bicyclists from autos, and both of these were ranked far higher by bicyclists than buffering was by pedestrians. This should be no surprise, as bicyclists’ risk of injury or death from a collision with an automobile is continuous along many routes. Fittingly, there is a great deal of literature on the topic and the impact of these variables on biking activity. Dill and Carr (2003, p.7) showed that, “Higher levels of bicycle infrastructure are positively and significantly correlated with higher rates of bicycle commuting. Achieving consistent results with a larger, more uniform (e.g. no small or college towns) set of cities lends strength to this finding.” More specifically, they found that every additional mile of bike lanes accounted for a one percent increase in the number of cyclists commuting to work. Pucher, Komanoff, and Schimek (1999) suggested that in order to increase levels of cycling the North American bicycle facilities would need to be expanded, and all roads should be made bikeable. In addition, buffering and bike lanes were more influential to women and those making fewer trips, which seem to relate to the safety or accessibility of biking in general. In other words, making it more accessible could encourage those with any trepidation.

The sixth highest ranked variable is sense of personal security. This is an area that is largely ignored in literature on bicycling. It would seem logical that bicyclists would be less concerned with security than pedestrians, but the factor was ranked sixth in importance by both groups. It appears, this factor is vastly undervalued by planners and researchers examining biking and walking. However, it is possible that some respondents conflated personal security (against crime) with safety (against automobiles) and future surveys may take measures to distinguish these more clearly. Either way, this survey highlights the influence security has over women, and further warrants more research.

The final variable in the third group was saving money, yet another influence that has not been researched extensively. It has been suggested that finances may be a motivating factor for non-motorized transport, especially in times of financial stress or when the cost of owning or operating an automobile is too high (Hess et al., 1999; Pucher & Buehler, 2006). The results of this study indicate that it has considerable influence for many bicyclists, especially younger respondents, women, those who make less money, and those who do not own a car. This influence could be even greater if, as in some European countries, the cost of owning and maintaining an automobile were higher (Pucher & Buehler, 2006). Further, educational efforts demonstrating potential savings from bicycling, may increase ridership, especially in poor areas.

**Group 4**

The fourth group contained, distance to destination, the presence of bike signals at intersections and weather on a given day. Their averages ranged from a mean of 2.62 to 2.59.

Distance to destination proved to be less influential for cyclists than pedestrians, most likely because cyclists have considerably longer ranges than pedestrians. Regardless, it was ranked eighth, suggesting that shorter distances, created by highly connected environments, mixed land uses, and higher densities, can be influential (Pucher & Buehler, 2006). Like the walking data-set it held more influence over car owners and respondents taking fewer trips per week so regardless of mode choice shorter distances are key to encouraging non-automotive travel. Pucher et al. (2010) found in their review of international transportation studies that, “By promoting compact, mixed use
development, European land use policies generate shorter trip distances, which are readily more covered by bicycle” (p. 121).

The presence of bike signals at intersections represents another design factor that can be easily implemented, much like bike lanes, which again held more influence over women and those taking fewer trips by bike per week. These physical design factors that create safer environments for cyclists are key. Within Mt. Pleasant, there were several busy intersections that contained bicycle-specific sensors and buttons that could be engaged to trigger a traffic signal allowing for safe passage. Vancouver had about 170 bicycle-specific signals as of 2004 (Pucher & Buehler, 2005), which definitely appear to be influencing cycling.

The last variable contained within group 4 is weather on a given day; another area that has received limited attention in literature. Pucher and Buehler (2006) discovered in their review of United States and Canadian census data that, “excessively high or low temperatures can deter cycling, while precipitation of any amount, whether rain or snow, generally discourages cycling” (pp. 270–71). It is understandable that weather would deter cycling since the rider is subject to the elements, but equally noteworthy is the fact that seven different variables proved to be more influential than weather at encouraging cycling. Also noteworthy, bicyclists in countries like Denmark and Germany are far more willing to tolerate inclement weather and may provide lessons for reducing its impact here in North America. Interestingly, the data show that weather held more influence over younger respondents, women, car owners, and those taking fewer trips per week. Again, education and outreach targeted to demographic groups, in particular the young, could pay significant dividends.

Group 5

Ease of terrain was the sole variable in group 5, with a mean of 2.41. Similar to weather it held more influence over younger respondents, women, and those taking fewer trips. In relation to cycling, this variable represents another research-deficient area. Most studies do not account for topographical factors, but instead have focused on things such as inhospitable roads that contain narrow lanes or large drain gates (Schimek, 1996). However, Dill (2004) suggests that, “A cyclist, for example, might choose a slightly longer route if he or she can use a bicycle lane, a street with less traffic, or a less steep hill” (p. 1). The latter of these issues relate to ease of terrain. The Mt. Pleasant neighborhood is relatively flat with gradual elevation change which makes traveling by bicycle easier. Topography may be more important in areas with extreme topography, though its impact should not be overestimated as hilly cities such as San Francisco and Seattle have high levels of bicycle ridership.

Group 6

Group 6 also contained a single variable, the enforcement of speeding and other traffic laws, which had a mean of 2.27. This variable has often been touted as a means for encouraging cycling, but its influence has rarely been tested. Schimek (1996) suggested that enforcing traffic laws evenly between cyclists and motorists would encourage cycling. These results do provide some support to this notion. In fact, while data was being collected for this study the Vancouver police department was observed stopping and ticketing numerous cyclists for failure to wear a helmet. Pucher and Buehler (2006) attribute Canada’s higher rates of cycling partially to, “stricter police enforcement of
traffic regulations, or to more considerate driving behavior of motorists in Canada” (p. 277). The results lend some support to this idea, and once again like the walking data-set it only held more influence over older respondents.

Group 7
The only variable contained in group 7 was cleanliness of the neighborhood, with a mean of 2.15. This variable showed more influence on pedestrians than cyclists, likely because cyclists experience the environment at a quicker pace, and often on a completely different pathway or surface. However, one would assume that obstacles created by trash, for example broken glass, would deter cycling. Perhaps in a less well-maintained area, cyclists would be more conscious of the impact of this factor — as a deterrent. Previous literature has only shown the influence it holds over walking, but these results do warrant further study with respect to cycling (Mehta, 2008).

Group 8
The last group only included one variable, that is opportunities to talk or meet with friends or other cyclists, which represents the weakest influence over one’s decision to bike in comparison with all the other variables (mean 1.97). Unsurprisingly, this variable held more influence over pedestrians than cyclists, as even with leisurely bike riding, it is hard to converse with other cyclists. In the Mt. Pleasant neighborhood most cyclists were observed traveling in single file and rarely side-by-side unless space permitted, thus making it difficult to hold a conversation. However, this variable still proved to hold more influence over those making less money and those without a car. This might relate to the camaraderie of the cycling community, which can be particularly strong among those who solely depend upon a bicycle for transportation. The results may have been different with relation to influence and demographics if the study was conducted on a recreational trail.

Conclusions
This study provided evidence of the relative importance of a range of motivating factors for pedestrians and bicyclists, though limited to a specific neighborhood with distinct demographic, cultural, and physical characteristics.

First, all of the variables tested were shown to have some influence over one’s choice to walk or bike. While this supports the conclusions of much previous research, most of this work attempted to isolate one or a few variables. This study indicates a need to examine the constellation of forces influencing pedestrian and bicycling behavior in specific environments. In The Death and Life of Great American Cities, Jacobs (1961) argued that the four generators of diversity that create urban vitality and life on the streets all need to be present as they work together; they cannot function in isolation. Perhaps it is time for researchers to move beyond attempts to isolate variables and examine how combinations of different sets of variables work together in different neighborhoods.

Second, the top three variables in both walking and biking relate more to one’s personal attitude than specific physical design features. In order of importance, these were opportunities for exercise, concern for the natural environment, and a visually appealing environment. These have been treated as peripheral in planning research and to some
extent planning practice, as they deal more with personal perceptions than objective physical attributes. In the case of exercise and concern for the natural world, attention needs to be given to outreach effort-shaping perceptions and converting these to actions. In the case of aesthetics, planners need to obtain a better understanding of the factors influencing residents’ perceptions in order to better address these through improvements to the physical environment.

Third, though the Mt. Pleasant residents prioritize benefits to their own health and the natural environment and de-emphasize the importance of the built environment, this is likely not the case everywhere. In a neighborhood, where infrastructure is inadequate, those driving cars might cite the lack of infrastructure as significant motive for not walking or biking, despite their desire to obtain exercise. Mt. Pleasant may represent cities at a certain stage of bicycle and pedestrian friendliness. Cities less walkable and bikeable may have lessons to learn from Mt. Pleasant and Mt. Pleasant may have lessons to learn from cities that even more walkable and bikeable. Studies conducted in a broader range of environments could facilitate the construction of a typology of neighborhoods and key motivating factors.

Fourth, though the motives of bicyclists and pedestrians are rather similar there are some notable differences, and planners should be aware of these. Distance had a much stronger influence over pedestrians, likely because cyclists have a considerably longer travel range. Nevertheless, distance was still a factor for bicyclists, though relatively little is known about their travel distances. Also, cyclists responded differently to key pieces of infrastructure, rating buffering from auto traffic, presence of bike lanes, and bike-related signals higher than comparable factors were rated by their pedestrian counterparts. This may suggest that certain infrastructure is more crucial to encouraging bicycling than it is for encouraging walking. In contrast, pedestrians gave higher ratings to cleanliness of neighborhood and opportunity to talk or meet with fellow pedestrians than bicyclists gave to comparable factors.

Fifth, the demographic analysis, although minor, revealed a few relationships that warrant further exploration. For example car owners and those taking fewer trips per week, in both the walking and biking data-sets were more influenced by distance. This highlights a key area of focus for planners, which many have already implemented through greater connectivity and further supports previous research highlighting its importance (Hess, 1997; Southworth, 2005). Gender also needs to be considered and elaborated on because throughout this study women were influenced by a multitude of variables for walking and biking. What stands out is that many of the variables relate to or could influence one’s sense of security. The same could be said for the different age groups. Interestingly, older cyclists were more influenced by the enforcement of traffic laws, and older pedestrians were influenced by a multitude of variables including: a visually appealing environment, cleanliness, buffering, presence of sidewalks, marked crosswalks, and enforcement of traffic laws. Lastly, education, although included was not discussed thoroughly and needs to be revisited in relation to the different influences. Regardless, the response was primarily from individuals with some college background or degree, and it is important to note considering the overall study. Had the survey been performed in an area of low education the levels of influence may have changed.

Moving forward, researchers can delve more deeply into individual motivating factors to obtain a more in-depth understanding of how they are perceived by pedestrians and bicyclists. For instance, are concerns about security related to dangers to property (theft of bicycle and robbery) or dangers to person (harassment and physical assault, etc.)? Also, future studies can further examine variation in motivations relative to
socio-demographic make-up, including age, gender, income, and education. Motivating factors for pedestrians and bicyclists are crucial to understand, as increasing the mode share of alternative transportation for short trips would lead to less pollution, more physical activity, less sprawl, a stronger sense of community, and increased safety for pedestrians and cyclists. It is extremely important to continue on with similar studies so that we can better design our physical environments to support alternative forms of transportation.

References
Atash, F. (1994). Redesigning suburbia for walking and transit: Emerging concepts. *Journal of Urban Planning and Development, 120*, 48–57.
Aultman-Hall, L., Lane, D., & Lambert, R. R. (2009). Assessing impact of weather and season on pedestrian traffic volumes. *Transportation Research Record: Journal of the Transportation Research Board, 2140*, 35–43.
Birk, M. (2010). *Joyride: Pedaling towards a healthier planet*. Cadence Press.
Cervero, R., & Duncan, M. (2003). Walking, bicycling, and urban landscapes: Evidence from the San Francisco Bay area. *American Journal of Public Health, 93*, 1478–1483.
Dill, J. (2004). Measuring network connectivity for bicycling and walking. *Transportation Research Board Annual Meeting, 1–20.*
Dill, J., & Carr, T. (2003). Bicycle commuting and facilities in, major U.S. cities: If you build them, commuters will use them, another look. *Transportation Research Board Annual Meeting, 1–9.*
Foster, S., Giles-Corti, B., & Knuiman, M. (2011). Creating safe walkable streetscapes: Does house design and upkeep discourage incivilities in suburban neighbourhoods? *Journal of Environmental Psychology, 31*, 79–88.
Handy, S. (1996). Understanding the link between urban form and nonwork travel behavior. *Journal of Planning Education and Research, 15*, 183–198.
Heinen, E., & Handy, S. (2012). Similarities in attitudes and norms and the effect on bicycle commuting: Evidence from the bicycle cities Davis and Delft. *International Journal of Sustainable Transportation, 6*, 257–281.
Hess, P. (1997). Measures of connectivity. *Places, 11*, 59–65.
Hess, P., Moudon, A., Snyder, M., & Stanilov, K. (1999). Site design and pedestrian travel. *Transportation Research Record, 1674*, 9–19.
Humpel, N., Owen, N., Iverson, D., Leslie, E., & Bauman, A. (2004). Perceived environment attributes, residential location, and walking for particular purposes. *American Journal of Preventive Medicine, 26*, 119–125.
Isaacs, R. (2000). The urban picturesque: An aesthetic experience of urban pedestrian places. *Journal of Urban Design, 5*, 145–180.
Jacobs, J. (1961). *The death and life of great American cities*. New York, NY: Random House.
Krieger, J., Rabkin, J., Sharify, D., & Song, L. (2009). High point walking for health: Creating built and social environments that support walking in a public housing community. *American Journal of Public Health, 99*, S593–S599.
Lindsey, G., Wilson, J., Yang, J., & Alexa, C. (2008). Urban greenways, trail characteristics and trail use: Implications for design. *Journal of Urban Design, 13*, 53–79.
Mann, E., & Abraham, C. (2006). The role of affect in UK commuters’ travel mode choices: An interpretative phenomenological analysis. *British Journal of Psychology, 97*, 155–176.
McCormack, E., Rutherford, S., & Wilkinson, M. (2001). Travel impacts of mixed land use neighborhoods in Seattle, Washington. *Transportation Research Record, 1780*, 25–32.
Mehta, V. (2008). Walkable streets: Pedestrian behavior, perceptions, and attitudes. *Journal of Urbanism, 1*, 217–245.
Nilsson, M., & Kuller, R. (2000). Travel behaviour and environmental concern. *Transportation Research Part D: Transport and Environment, 5*, 211–234.
Noland, R., Deka, D., & Walia, R. (2011). A statewide analysis of bicycling in New Jersey. *International Journal of Sustainable Transportation, 5*, 251–269.
Office of Transportation and Air Quality. (2010). *United States environmental protection agency*. Retrieved from http://www.epa.gov/otaq/
Owen, N., Humpel, N., Leslie, E., Bauman, A., & Sallis, J. (2004). Understanding environmental influences on walking. *American Journal of Preventive Medicine, 27*, 67–76.

Ozhanci, E., Yilmaz, H., & Yilmaz, S. (2013). Safety perceptions of different plant designs in pedestrian and car streets. *Urban Design International, 1*, 1–8.

Pedestrian and Bicycle Information Center. (2010). PEDSAFE: Pedestrian safety guide and countermeasure selection system, crash statistics. Retrieved from http://www.walkinginfo.org/pedsafe/crashstats.cfm

Pikora, T., Giles-Corti, B., Bull, F., Jamrozik, K., & Donovan, R. (2003). Developing a framework for assessment of the environmental determinants of walking and cycling. *Social Science and Medicine, 56*, 1693–1703.

Powell, K., Martin, L., & Chowdhury, P. (2003). Places to walk: Convenience and regular physical activity. *American Journal of Public Health, 93*, 1519–1521.

Pucher, J., & Buehler, R. (2006). Why Canadians cycle more than Americans: A comparative analysis of bicycling trends and policies. *Transport Policy, 13*, 265–279.

Pucher, J., & Buehler, R. (2005). Cycling trends and policies in Canadian cities. *World Transport Policy and Practice, 11*, 43–61.

Pucher, J., & Dijkstra, L. (2003). Promoting safe walking and cycling to improve public health: Lessons from the Netherlands and Germany. *American Journal of Public Health, 93*, 1509–1516.

Pucher, J., Dill, J., & Handy, S. (2010). Infrastructure, programs, and policies to increase bicycling: An international review. *Preventative Medicine, 50*, 5106–5125.

Pucher, J., Komanoff, C., & Schimek, P. (1999). Bicycling renaissance in North America? *Transportation Research Part A: Policy and Practice, 33*, 625–654.

Randall, T., & Baetz, B. (2001). Evaluating pedestrian connectivity for suburban sustainability. *Journal of Urban Planning and Development, 127*, 1–15.

Rasciute, S., & Downward, P. (2010). Health or happiness? What is the impact of physical activity on the individual? *Kyklos, 63*, 256–270.

Schimek, P. (1996). The dilemmas of bicycle planning. Joint International Congress of the Association of Collegiate Schools of Planning (ACSP) and the Association of European Schools of Planning (AESOP). Retrieved from http://bicycledriving.org/about/the-dilemmas-of-bicycle-planning

Shriver, K. (1997). Influence of environmental design on pedestrian travel behavior in four austin neighborhoods. *Transportation Research Record, 1578*, 64–75.

Southworth, M. (2005). Designing the walkable city. *Journal of Urban Planning and Development, 131*, 246–257.

Stangl, P. (2011). The US pedestrian plan: Linking practice and research. *Planning Practice and Research, 26*, 289–305.

Suminski, R., Poston, W., Petosa, R., Stevens, E., & Katzenmoyer, L. (2005). Features of the neighborhood environment and walking by U.S. adults. *American Journal of Preventive Medicine, 28*, 149–155.

United States Department of Transportation Federal Highway Administration. (2009). *Nationwide household transportation survey*. Washington: GPO.

United States Energy Information Administration. (2009). *United States petroleum consumption*. Washington: GPO.

Zelinka, A., & Brennan, D. (2001). SafeScape: Creating safer, more livable communities through planning and design. Chicago, IL: American Planning Association.
### Appendix 1

**Please circle the correct answer below:**

1. Are you a resident of the Mount Pleasant neighborhood?  
   - Yes  
   - No

2. If no, how far do you live from this neighborhood?  
   - 0-5 km  
   - 5+ km

3. Age?  
   - 18-19  
   - 20-34  
   - 35-64  
   - 65+

4. Gender?  
   - Male  
   - Female

5. Gross yearly income?  
   - < 50,000  
   - 50,001 - 100,000  
   - 100,000 +

6. Education?  
   - Some High School/Diploma  
   - Some College  
   - Bachelors  
   - Post Graduate

7. Do you own a car?  
   - Yes  
   - No

8. Purpose of today’s trip?  
   - Work  
   - Shopping/Eating  
   - Bus Stop  
   - Recreation  
   - Exercise

9. On average, how many trips do you make by walking per week?  
   - 0-5  
   - 6-10  
   - 11+

**Please circle the correct answer below:**

1. Distance to destination  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

2. Presence of sidewalks  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

3. Marked crosswalks with signals  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

4. Buffering from automobile traffic  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

5. Sense of personal security  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

6. Cleanliness of neighborhood and streets  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

7. Opportunities to talk or meet with friends or neighbors  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

8. Enforcement of speeding and other traffic laws  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

9. Concern for the natural environment or “being green”  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

10. Weather on a given day  
    - No influence  
    - Little influence  
    - Some influence  
    - Highly influenced

11. Ease of terrain  
    - No influence  
    - Little influence  
    - Some influence  
    - Highly influenced

12. Saving money  
    - No influence  
    - Little influence  
    - Some influence  
    - Highly influenced

13. Opportunities for exercise  
    - No influence  
    - Little influence  
    - Some influence  
    - Highly influenced

14. A visually appealing environment  
    - No influence  
    - Little influence  
    - Some influence  
    - Highly influenced

### Appendix 2

**Please circle the correct answer below:**

1. Are you a resident of the Mount Pleasant neighborhood?  
   - Yes  
   - No

2. If no, how far do you live from this neighborhood?  
   - 0-5 km  
   - 5+ km

3. Age?  
   - 18-19  
   - 20-34  
   - 35-64  
   - 65+

4. Gender?  
   - Male  
   - Female

5. Gross yearly income?  
   - < 50,000  
   - 50,001 - 100,000  
   - 100,000 +

6. Education?  
   - Some High School/Diploma  
   - Some College  
   - Bachelors  
   - Post Graduate

7. Do you own a car?  
   - Yes  
   - No

8. Purpose of today’s trip?  
   - Work  
   - Shopping/Eating  
   - Bus Stop  
   - Recreation  
   - Exercise

9. On average, how many trips do you make by biking per week?  
   - 0-5  
   - 6-10  
   - 11+

**Please circle the correct answer below:**

1. Distance to destination  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

2. Presence of bike lanes  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

3. Presence of bike signals at intersections  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

4. Buffering from automobile traffic  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

5. Sense of personal security  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

6. Cleanliness of neighborhood and streets  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

7. Opportunities to talk or meet with friends or other cyclists  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

8. Enforcement of speeding and other traffic laws  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

9. Concern for the natural environment or “being green”  
   - No influence  
   - Little influence  
   - Some influence  
   - Highly influenced

10. Weather on a given day  
    - No influence  
    - Little influence  
    - Some influence  
    - Highly influenced

11. Ease of terrain  
    - No influence  
    - Little influence  
    - Some influence  
    - Highly influenced

12. Saving money  
    - No influence  
    - Little influence  
    - Some influence  
    - Highly influenced

13. Opportunities for exercise  
    - No influence  
    - Little influence  
    - Some influence  
    - Highly influenced

14. A visually appealing environment  
    - No influence  
    - Little influence  
    - Some influence  
    - Highly influenced