MOTIVATORS AND BARRIERS TO UTILITARIAN CYCLING IN DOWNTOWN TORONTO

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Introduction

Cycling is increasingly gaining importance as a mode of urban transportation. Commuting by bicycle to work or school is healthy, cost-effective, and environmentally friendly. Compared to walking, cycling enables people to traverse longer distances; compared to public transit or cars, cycling is less expensive. Promoting cycling for transportation in Toronto is an important urban planning issue that has been acknowledged by government authorities in charge of transportation (Metrolinx 2008, City of Toronto 2001).

The 2009 City of Toronto Cycling survey results demonstrate that the number of commuters who ride bicycles to work or school in downtown Toronto has increased in the past ten years (Ipsos Reid, 2010). Cycling infrastructure has been developed and significantly improved since the introduction of the Toronto Bike Plan in 2001. However, Torontonians reported safety and insufficient quality of cycling infrastructure were reported the main concerns that inhibit them from engaging in cycling for transportation (Ipsos Reid, 2010). The increasing cyclist population has high expectations for improved infrastructure and safety (Ipsos Reid, 2010).

To address concerns of Torontonians with existing bicycle infrastructure and safety, in February 2010, the City of Toronto presented the 2010 Downtown Bikeway Projects. The projects are

designed to improve and expand the existing bicycle network and to introduce new bicycle support infrastructure, including bike boxes, rush hour sharrows, and the first-in-Toronto separated bike lane on University street (City of Toronto, 2010). To understand motivators and barriers to cycling for transportation in downtown Toronto, this study investigates factors that increase or decrease the likelihood of riding bicycles for utilitarian purposes. Findings of this research provide support to the City of Toronto 2010 Downtown Bikeway Projects.

The University of Toronto St. George campus case study

The U of T St. George campus is the largest downtown campus in Toronto and a commute destination for thousands of students, faculty and staff members. According to the Transportation Tomorrow Survey data, 20% of students, staff and faculty walk or cycle to the campus (The U of T Sustainability Office, 2009). Toor & Havlick (2004) argue that populations affiliated with universities are likely to cycle due to the age and ability of students and due to the proximity from their homes to the campus; if routes leading to the campus and the campus are equipped with appropriate bicycle infrastructure, cycling becomes competitive with other modes of transportation.

Primary data was collected by administering an online survey among University of Toronto students, faculty and staff members (n=402). The survey data includes information on the objective factors that influence the decision to ride a bicycle, including land-use, presence or absence of bike lanes and parking, and connectivity of bike lanes. Non-parametric analytic techniques were used to investigate factors that are positively or negatively associated with cycling.

Barriers to utilitarian cycling

Pikora et al. (2003) define four types of active transportation: recreational walking, utilitarian walking, recreational cycling and utilitarian cycling and argue that each of the four types is influenced by different factors. Understanding these factors and how they influence transportation choices and behaviour is important in planning infrastructure and interventions to influence human behavior (Transportation Review Board and Institute of Medicine, 2005).

Reviews of qualitative and quantitative research and urban planning and transportation policies on walking and cycling suggest that environmental and individual factors influence walking and cycling at the neighbourhood level (Pikora et al. 2003, Frank et al., 2003, Krizek et al. 2009).

Compact cities with mixed land uses, shorter travel distances (Pucher & Buehler 2006, Pucher & Buehler 2008) and reduced car speeds (Kees Maat et al., 2005) make people more likely to choose walking or cycling for transportation. This mode shift is likely to occur when street design ensures safety (Frank et al., 2003) and encourages cyclist and pedestrian movement (Ewing, 1999). High-quality bicycle- and pedestrian-friendly infrastructures contribute to higher level of walking and cycling for transportation (Kees Maat et al., 2005). Conversely, the absence of bike lanes on roads, concerns with traffic and safety influence negatively perception of bikeability at the neighbourhood level (Pikora et al. 2003, Winters and Cooper 2008).

Attitudes to active transportation and cycling are influenced by individual perceptions and motivations (Ajzen, 1991, Kitamura et al. 1997, Krizek 2003). Individual barriers include safety, the inconvenience of cycling, social image, and childcare responsibilities (Tolley, 2003). A particular transportation choice is based on the higher utility of that choice compared to the utility of other choices (Krizek & Levinson, 2005). Utility is a function of other factors including costs - time and price of travel. Utilitarian cycling, compared to other modes of transportation, provides an alternative that is less expensive and often faster over the 30 minutes or 4 km range than walking, driving or public transit (LEED ND Core Committee 2006, Tolley 1996). Longer distances, however, can be a barrier to utilitarian cycling, as they increase travel time significantly and require additional infrastructure to support cyclists, such as bicycle racks on public transportation vehicles and secure bicycle parking (The U of T Sustainability Office, 2007).

Buis (2000) suggests that in each urban setting, the most significant barriers and constraints should be identified and researchers should study the reasons why bicycles are not being used for transportation.

Based on these findings policies should be designed to help overcome these barriers, thus facilitating increased bicycle use (Buis, 2000).

This research aims to identify barriers to utilitarian cycling in downtown Toronto and asks two research questions: (1) *What factors increase or decrease likelihood of utilitarian cycling among people regularly commuting to the University of Toronto St. George campus? (2) How can factors which promote cycling be enhanced and how can barriers to cycling be overcome?*

Research methods

The Toronto Downtown Commuter survey was administered via Survey Monkey, a popular online survey tool often used by academics and students (http://www.surveymonkey.com/). The survey was anonymous and took 10-15 minutes to complete. Individuals affiliated with U of T were invited to participate in the survey. The total number of respondents was 402, of them 306 reported that they commuted by bicycle to the U of T St. George campus in the past 6 months and 98 reported that they did not cycle to the campus.

The survey begins with seven general questions including demographic characteristics, affiliation with the U of T, postal code, and cycling experience. Question eight[1] splits the survey into two different surveys addressing two groups: (1) commuters who do not cycle to the university and (2) commuters who cycle to the U of T campus. Section six of this report presents the results of the survey among respondents who do not cycle to the university, and section seven presents the results among people who commute to U of T by bicycle.

Research participants

Survey participants were recruited by sending an invitation to mailing lists of the U of T Sustainability Office, Bikechain, and of three U of T departments (Geography and Planning, Political Science and Chemistry). Information about the survey was posted on the Toronto

[1] Question 8. Have you cycled to the U of T St. George campus in the past six months? Answer: yes/no

Coalition for Active Transportation website and the Toronto Cyclists' Union Facebook page.

Data analysis Survey responses were coded using Likert's scale (1=not important at all ... 5=very important); therefore, the mean value is between 1 and 5, where higher number indicates higher importance of factors for respondents. Data distribution within each of the five groups of questions was analyzed using bar graphs. The analysis shows that the distribution is not symmetrical: the graphs for different questions were either negatively or positively skewed in different ways; therefore, descriptive methods of analysis were applied. A non-parametric analysis was performed in SPSS to identify and rank mean values for answers in each of the five groups of questions. The mean values were used to measure the average response to each question for a group of respondents.

Findings

Factors that decrease the likelihood of cycling among respondents who do not cycle for transportation

Weather and safety were ranked as the most important of all factors; 82% (n=87) of respondents ranked *bad weather conditions such as rain, snow, and wind* as important in their decision not to cycle. A combination of weather and safety issues was ranked important by 77% (n=86) of respondents who associate *cycling in bad weather* with a lack of safety.

The second most important set of barriers includes insufficient infrastructure, interaction with other road users and safety. For 78% of respondents (n=86) an important barrier is the *need to share the road with cars, buses, and taxis*. That *not enough bike lanes lead from U of T to other destinations* is another important factor that keeps 74% (n=87) of respondents from cycling. *Discontinuity of bicycle lanes* and *a lack of bicycle paths separated from traffic* were important factors for 66% (n=87%). *Poor road surface conditions* (indicating that a road surface is uneven and there are a lot of potholes) were important for 53% (n=88) of respondents. A *lack of secure parking* was important for 47% (n=87) of respondents. A *lack*

of various types of parking and shower/change facilities was reported as important barriers by more than 30% (n=87) of respondents.

Careless drivers' behavior such as unsafe door opening and collisions was ranked as important by 60% (n=85) of respondents. Several respondents shared their personal experience of car/bicycle accidents. Factor *cycling is unsafe and traumatic* was ranked as important by 54% (n=84) of respondents, in comments, respondents shared personal experience of being in unsafe situations.

Time and distance
Forty four percent (n=85) of respondents ranked *lack of time* and *distance* as important factors. As mentioned in the respondent profile descriptions, 15% (n=98) of respondents commute from other cities or from a long distance elsewhere in Toronto. Based on the responses and the comments, some of the respondents who reside in Toronto live either on the St. George campus or within a 20 minute walk from the campus. These findings suggest that distances that are too long or too short can contribute to decreasing the likelihood of utilitarian cycling. The importance of distance in the decision not to cycle was supported in comments.

Traveling with loads such as books or groceries (*too many things to carry*) was ranked important by 61% (n=88) of respondents and *incompatible clothing* was also an important factor in the decision not to cycle for 49% (n=88%) of respondents.

Factors that could increase the likelihood of cycling among respondents who do not cycle for transportation
Reflecting their major concerns about infrastructure and safety-related factors, respondents reported that the most important improvements would include separating bicycle lanes from traffic (78% of respondents n=94 respondents), improving and connecting existing bike lanes (77% of respondents n=93), and introducing road designs that would give priority to cycling traffic (62% of respondents n=92).

Other infrastructure improvements would increase the convenience of cycling. More bicycle parking and different types of bicycle parking (e.g. indoor, covered parking) at the destinations (school, work, shops, etc.) and shower and change facilities, would help to increase the appeal of cycling (42% of respondents n= 92). Parking at Toronto public transit stations and GO Train stations was ranked as important by (40% of respondents n=92). Thirty four percent of respondent (n=91) would cycle if they could rent a bicycle. Figure 1 summarizes factors that could increase the likelihood of cycling. These factors important to the respondents (with the mean values higher than 3) were ranked and listed in descending order, starting with the factor rated as the most important.

Figure 1. Factors that could increase the likelihood of cycling to U of T among individuals who do not commute by bicycle

Motivators	Agree	n
1. Avoid sharing the road with cars and buses (e.g. bike lanes separated from traffic)	78%	94
2. More bike lanes are introduced on the streets and bike lanes are connected	77%	93
3. Shared roadways are designed to give priority to cycling traffic	62%	92
4. Different types of bicycle parking and storage are available (e.g. indoor, covered parking)	42%	93
5. More bicycle parking is available at destinations and in residences	42%	92
6. Showers and change facilities are available at destinations	42%	92
7. Bicycle parking is available at the TTC and Go Train stations	40%	92
8. Bicycle rental program	34%	91

Factors that decrease the likelihood of cycling among respondents who cycle for transportation

Interactions with other road users: Most cyclists (86%-96% of respondents, n=296) rated high a group of questions about safety and interactions with other road users. Although this was one of the last questions, it had a very high response rate: 294 respondents answered all questions in this group. All these factors were ranked as important with the mean value higher than 4.3. Figure 2 presents all these factors in descending order, starting with the factor rated as the most important.

Figure 2. Types of interactions with other road users	Somewhat important-very important	n
1. Unsafe door opening	95.9%	296
2. Careless drivers behavior	95.7%	298
3. Vehicles driving in bike lanes	93.3%	298
4. Vehicles parked in bike lanes	89.0%	298
5. Careless other cyclists' behavior	85.5%	296

Bike route designation and bike route maintenance:
Characteristics of bike routes that make people more likely to cycle:

- Bike lanes are important for 89% (n=300);
- Off-street paved bike paths are important for 67% (n=298);
- Bike sharrows (bike symbols marked on the pavement) are important for 61% (n= 296);
- A dedicated high occupancy vehicle lane (HOV) lanes: 37% important and 37% not important (n=298);
- Signs indicating bike routes without bike lanes: important for 30% (n=299).

Sixty-seven percent of survey participants rated off-street paved bike paths as the second important bikeway type. Interviewees agreed that having bike routes that separate cyclists from traffic and parked cars would make cycling safer. Bike sharrows are a new type of bikeway

designation introduced by the City of Toronto to facilitate cyclist positioning on the road and to increase awareness of drivers about presence of cyclists. Survey respondents (61%) rated sharrows as somewhat important or important. Attitude of utilitarian cyclists is different toward parts of the Toronto bike network where a route is designated on a map or guided by a sign without bike lane designation on the pavement (e.g. high occupancy vehicle lane or a bike route sign). This type of bike route designation is reported as less important compared to bike lanes or sharrows.

Similarly important factor influencing cyclists' decisions is maintenance of bike routes. Most important reported deterrent to cycling is snow on the way in winter and uneven pavement and potholes. Less important are puddles and splashing water, and the quality of bike lane marking is insignificant.

Parking:
All types of bicycle parking were rated high (mean value higher than 3), indicating that bicycle parking is an important issue for commuters.

1. Parking at trip destinations:
    - Post-and-Ring bike stands within 1-2 minute walk to your destination: 93% of respondents (n=299)
    - Covered parking facilities: 64% of respondents (n=292).
    - Indoor parking facilities at the university or workplace: 61% of respondents (n=293).
    - Bicycles parking near subway station: 57% of respondents (n=291).
2. Parking in one's residence:
    - Indoor parking in your residence: 79% of respondents (n=291).
    - You are allowed to keep your bicycle in your apartment: 71% of respondents (n=286).
    - Outdoor parking in your residence: 61% of respondents (n=288).

Survey participants were asked about the importance of parking at their destinations and residences. All types of bicycle parking are rated as important. Post-and-Ring bike stands within 1-2 minute walk to one's destination are rated the most important (94%), followed by indoor parking in residence (79%) and ability to store bicycles in one's apartment (71%). Covered parking and indoor parking facilities at the university or at work are important for 64% and 61% respectively. Outdoor parking in residence is important for 61%. Parking near subway stations was rated important by 57% respondents who commented on availability of secure parking at the GO Train stations.

Neighbourhood Land Use and the environment en-route
Survey respondents were asked to rank characteristics of three types of neighbourhoods on a scale from 1 to three (1-you feel comfortable cycling in this environment, 2 – you feel neutral, 3 – you will enjoy riding in this environment):

1. Residential areas with little traffic, mainly 2-3 story residential buildings: 86.1% of respondents (n=297) will enjoy cycling in such areas.
2. Streets with significant traffic, mainly 3-6 story buildings: 53% of respondents (n=296) feel neutral about cycling this type of streets, 29% will avoid such streets.
3. Major roads with heavy traffic, high-rise buildings: 53% of respondents (n=297) will avoid cycling and 36% feel neutral.

Traffic conditions: As an integral part of the environment that cyclists encounter on their way, traffic conditions were rated as important as an important factor in a decision to cycle or to select a route.

Characteristics of traffic that make people less likely to cycle

- Wide roads with fast moving traffic: 85% of respondents (n=295);
- Many Buses and Taxis: 76% of respondents (n=295);
- Congested road with many cars moving slowly: 73% of respondents (n=295);
- Many parked cars: 69% of respondents (n=289).

Characteristics of traffic that make people more likely to cycle

- Small roads in residential areas with calm traffic: 79% of respondents (n=295).

Weather and topography: Survey respondents (n=298) ranked bad weather conditions as important factors that decrease their likelihood of cycling. Snow and ice (89%), snow (81%) and rain (62%) are the most important factors, followed by rain, cold and wind. Although topography was ranked lower than weather, it is an important factor for 45% of respondents (n=295). Smog and darkness are the least important factors.

Factors related to convenience of cycling: Survey respondents (89% of respondents, n=297) and six of the seven interviewees reported that they are more likely to cycle if they plan to visit several places. These findings correspond with the answers to the question about utilitarian cycling trip destinations. At least once a week, 55% of respondents (n=292) ride their bicycles to go shopping and 54% of respondents ride a bicycle to visit friends. Three percent cycle to pick up their children from day care or school. Respondents would be less likely to cycle if they had a formal event that required formal wear; 70% of respondents (n=299) likely will not cycle on such day.

Peer support factors: While all peer-support factors were reported as not very important (mean values less than 3); the *number of other cyclists taking the same route* was important for 43% of respondents (n=296) and 34% of respondents (n=293) ranked as important *support from their friends, family and colleagues*.

The importance of these peer-support factors corresponds with the research which shows that the more pedestrians and cyclists are on the road, the higher is the awareness of motorists and the lower is the likelihood of collisions between motorists and cyclists (Jacobsen 2003). Jacobsen (2003) concludes that policies increasing the number of people cycling are an effective route to improve the safety of all road users. The title of the article "Safety in numbers" became a slogan used among cyclist activists.

Discussion

An analysis of responses of both survey participants who commute to the U of T St. George Campus by bicycle and those who do not cycle for transportation indicates that safety, interactions with other road users, insufficiently safe infrastructure, and weather, are the main barriers to cycling. In downtown Toronto existing cycling infrastructure does not provide sufficient safety, bicycle lanes are disconnected, cars drive or park on bike lanes, there are instances of unsafe door opening and other types of careless driver behavior.

These main factors that increase perception of Toronto roads as unsafe are safety and infrastructure related; therefore, improved bikeways, more and better connected bike lanes, and bike lanes separated from traffic have the potential to increase the likelihood of cycling. The survey results indicate that addressing infrastructure related factors would reduce safety concerns. Weather related concerns could be partially addressed by improving cycling infrastructure.

Conclusions

Findings of this research correspond with the results of the City of Toronto Cycling Survey (2009) and provide evidence in support of the City of Toronto 2010 Bikeway Projects initiative. The study results indicate the need for further infrastructure improvements and for introducing new measures and policies that would increase the safety of all road users.

Suggestions for improvements:

- Designing bikeways to give greater priority to cyclists, installing and connecting bike lanes, and separating cyclists from traffic to make commute by bicycle comfortable for cyclists of all ages and abilities.
- Introducing bikeway designation and signage that facilitates position of cyclists on the road, such as sharrows and bicycle boxes (City of Toronto, 2010).
- Introducing more parking options, including different types of parking to accommodate increasing demand and to increase convenience of utilitarian cycling in downtown Toronto.

High quality infrastructure and measures to improve safety are "a prerequisite to the bicycle achieving and retaining a full status position in a traffic system" (Rocky Mountain Land Use Institute, 2009). Improving cycling infrastructure and safety can increase the likelihood of cycling for transportation among commuters in Toronto.

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