The much anticipated marriage of cycling and transit: But how will it work?

Julie Bachand-Marleau
Master's student
School of Urban Planning
McGill University
Suite 400, 815 Sherbrooke St. W.
Montréal, Québec, H3A 2K6
Canada
Tel.: 514-398-4075
Fax: 514-398-8376
E-mail: julie.bachand-marleau@mail.mcgill.ca

Jacob Larsen
Research Fellow
School of Urban Planning
McGill University
Suite 400, 815 Sherbrooke St. W.
Montréal, Québec, H3A 2K6
Canada
Tel.: 514-398-4075
Fax: 514-398-8376
E-mail: jacob.larsen@mail.mcgill.ca

Ahmed M. El-Geneidy
Assistant Professor
School of Urban Planning
McGill University
Suite 400, 815 Sherbrooke St. W.
Montréal, Québec, H3A 2K6
Canada
Tel.: 514-398-8741
Fax: 514-398-8376
E-mail: ahmed.elgeneidy@mcgill.ca

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Abstract

In response to the environmental, economic and social costs associated with over-reliance on the automobile, planners and transportation professionals are promoting sustainable alternatives such as walking, cycling, and public transit, either as single modes or in combination. It has been argued that the marriage between cycling and transit presents opportunities for synergy by enlarging catchment areas of transit stations, while drawing in new users to both of these "green" modes. However, due to the marginality of this practice in North America, there is a shortage of reliable empirical studies in this area. The present research addresses this gap through an analysis of travel behavior and preferences related to cycle-transit integration (CT). An on-line survey was conducted in the region of Montréal, Canada during the summer of 2010. The questionnaire included a section on Montréal's public bicycle sharing system, BIXI, and its potential for integration with transit. We identify three current or potential CT users groups using a factor-cluster analysis: current parking bike-and-riders, BIXI users and car drivers. Bringing a bicycle on transit is the preferred form of integration; however, scenarios involving bicycle parking (or using a public bicycle) are likely to be used more regularly. In order to accommodate the greatest number of bicycle-transit trips, measures facilitating parking at transit stops and those that enable bringing bicycles on board transit vehicles are recommended in tandem.

Keywords:

Sustainability – Cycling – Transit – Multimodal – Bicycle sharing – Bike-and-ride

Introduction

In response to concerns over congestion, air pollution and sedentary lifestyles related to automobile dependency, transportation professionals and researchers are seeking new solutions. Many cities have adopted strategies to increase the attractiveness of walking, cycling, and public transit usage. Among the measures implemented, some have been aimed at facilitating the combination of two or more of these transportation modes under the moniker "bike-and-ride", cycle-transit integration (CT) or simply the transportation cocktail. Combining modes allows for more flexibility, making multi-modal transport more appealing and increases travel options. Similarly, integration can be beneficial for transit agencies as it expands transit stations' service area at both ends of the transit trip*(1)*. Some researchers claim that CT will increase the mode share of cycling and public transit at the expense of the use of private vehicle and help in decreasing congestion, while others debate this claim *(2)*. Up until this point, there has not been any study in the North American context that uses empirical data to measure the actual needs for such integration among cyclists and transit users.

Past literature has identified general measures that can facilitate bicycle and transit integration *(3)*, however details on how this union can work have been in short supply. Recognizing the need for elementary information on the subject for researchers and practitioners alike, this paper seeks to answer two basic questions related to bicycle-transit integration: 1) who are the potential users of this type of intermodal transport; and 2) what are their current needs and priorities. This research draws on a detailed online survey conducted in Montréal, Canada specifically for this purpose. The survey included demographic, travel behavior and spatial questions to explore the factors affecting the use of and opportunities for cycle-transit integration. Additionally, given the presence in Montréal of BIXI, North America's first large-scale public bicycle sharing system, a set of questions were included to measure the potential of this new system to augment the existing public transit service.

Literature

The body of knowledge on CT is relatively small; however, as evidenced by the growing literature and transportation initiatives, interest in this form of multimodal transportation is growing. Researchers have identified four areas for CT implementation: 1) enabling bicycles to be brought on transit vehicles; 2) improving the availability of parking near transit stops 3) connecting transit stations to an existing network of bicycle paths/lanes; and 4) providing bicycle sharing systems near transit stations and major destinations *(3)*. However, beyond this general roadmap, little is known about demand for various integration measures. Developing a more detailed understanding of this market, the priorities of potential users and the specific benefits of integration is an essential next step.

Not surprisingly given the reliance on buses as the main mode of public transit in North America, bicycles on buses (BOB) is by far the most common type of CT. For example, of the CT measures of 83 North American transit authorities listed in an online database, 63 involve BOB *(4)*. While no systematic method exists for monitoring usage of bus racks, reports from transit agencies range from 575,600 to less than 20 bicycle boardings per year, with an overall year-to-year growth documented in the share of BOB trips to total boardings *(5)*. Moreover, it appears that opportunities for BOB is growing; the provision of bicycle racks on buses has almost tripled in the U.S. in only eight years, from 27 percent in 2000 to 71 percent in 2008 *(3)*. Nonetheless, various criticisms have been raised about BOB, including delays to transit service and underuse *(2)*. More substantial, however, are the critiques that BOB will remain a marginal service, due to limited rack capacity and smaller bus stop catchment areas, in part due to stop spacing *(6-7)*.

The question of catchment or service areas is central to the branch of CT research concerned with cycling to transit, or bike-and-ride. In one study, in which survey respondents were presented with bike-and-ride scenarios containing hypothetical access distances, researchers found that the majority of people willing to bike-and-ride were within 2.4 km of the transit station, while those between 3.2 and 4.8 km demonstrated equal preference for car and bicycle as an access mode to transit *(8)*. A study from Mumbai revealed that while only 1 percent of commuters traveling 1.2 km or less used a bicycle to access transit, that figure climbed to 11 percent beyond that distance *(9)*. Overall, the mean access distance by bicycle was found to be 2.7 km. A Dutch study found that cycling was the predominant train access mode between 1.2 and 3.7 km; compared with U.S and Indian cases, this similarity suggests that access distances may traverse across cultures *(10)*. Further analysis from the Netherlands revealed that access and egress time is not stable for all trip purposes, but increases proportionately with in-vehicle time, then declines as total trip extends beyond 60 minutes *(11)*.

Although CT is related to the growing body of work on bicycle infrastructure usage generally, there has been only cursory study of the effect of bicycle lanes on increasing the attractiveness of CT. One such study indicated that the presence of bicycle facilities at the census tract level had a positive effect on demand for CT *(6)*. However, the effect of bicycle infrastructure has been shown to vary depending on cycling experience; among Texas cyclists, the presence of bicycle lanes had four times the effect on encouraging bike-and-ride among inexperienced riders relative to those with more experience *(8)*. It is logical to conclude that in other locations as well, the presence of infrastructure will have a greater effect attracting new and inexperienced cyclists to the CT option than among veteran cyclists.

Some research has been directed towards understanding the socio-demographic factors characteristic to current and potential CT users, although conclusions have been mixed. While preliminary research in the U.S. suggests that household income levels and vehicle ownership are negatively correlated to CT usage *(6-7)*, studies from the Netherlands reveals the opposite *(12)*. This may indicate that CT usage in the U.S. is higher among individuals with fewer travel options. Another explanation for these mixed results may be that CT usage is in part determined by attitudinal factors which cut across socio-demographic lines, as demonstrated in related research on opportunities for mode shifting *(13)*.

Data and Methodology

In order to better understand current and potential users of “bike and ride”, an online survey on CT was undertaken in the region of Montréal, Québec. The official mode share of cycling for Montréal is 1.3% of all trips *(14)*, which is around the national average, however central areas are between 6-7% *(15)*. Currently, bicycle and transit integration in Montréal is possible in some circumstances, while restricted at certain times and on certain transit vehicles. Bicycles are prohibited on the city’s metro during peak hours, on weekends and during special events, largely due to capacity limitations. While most stations are not equipped with aids for bringing bicycles to boarding platforms, newer and some downtown stations include elevators. Bicycles are allowed outside peak hours on two of the five commuter train lines. Buses operated by the Société de transport de Montréal (STM), the transit provider on the island of Montréal, are not equipped with bicycle racks; however, several other transit agencies in the region have installed such racks on their bus fleets. Regular outdoor bicycle parking can be found at most metro, bus and train stations; longer-term and covered parking is rare.

Given the limitations of online surveys, particularly for overrepresentation of certain groups, a variety of media were used to ensure a broad cross-section of the public was reached. The survey was publicized through a combination of email newsletters, mailing lists, several newspaper articles in English and French, a radio interview, and various social networking media. Flyers advertising the survey were distributed at major transit stations of the region. These measures allowed for broader exposure than would be possible with only email distribution, as recommended by Dillman, Smyth & Christian *(16)*. The total sample of the survey is 1,787 individuals. Incomplete and outlier observations were excluded from the analysis leading to a sample size of 1,432 individuals. This is approximately equivalent to the number of cycling trips recorded in the regional travel survey, which covers five percent of the region's population and is considered a representative sample *(17)*. This is also larger than most of the samples used in previous cycling travel behavior research *(18-22)*. However, since the region's AM peak transit mode share is over 20 percent, a larger sampling of transit users will be required to understand the preferences for CT integration among existing transit users..

The analysis section commences with an explanation of the state of CT in Montréal followed by descriptive statistics obtained from the survey. Descriptive statistics will concentrate on the demographics and travel habits of the surveyed population. Understanding the characteristics of CT potential users is the next step. This is done through a market segmentation analysis. Market segmentation is a common practice in the travel behavior research field, and has been used to develop a clearer portrait for new transit projects prior to major investments and to attract new patrons *(23-25)*. Central to this type of analysis is the concept that the market for any given product or service is comprised of several segments, rather than one homogenous whole. Studies have used market segmentation to identify perceived types of cyclists by users and non-users *(26)*, however this technique has not yet been used to identify opportunities for CT.

Factor-cluster market segmentation analysis, a two-step analytical procedure, is used to classify large datasets into meaningful groups (see *(23-25)* for an example of factor-cluster market segmentation analysis). We start with a principal component factor analysis to learn how each of our variables relates to one another. Factor analysis extracts a small number of fundamental dimensions (factors) from a larger set of inter-correlated variables measuring various aspects of those dimensions. The second step in our analysis is to perform a cluster analysis, using the newly generated factors as a "reduced-form" dataset, using the K-means statistical routine. Cluster analysis is used to sort different objects (in this case, a reduced form version of the responses to the survey questions) into groups wherein the degree of association between two objects is maximal if they belong to the same group and minimal otherwise. The purpose of the cluster analysis is to determine how each of the factors combines to represent different groups of bicycle and transit integrators and non-integrators.

After identifying the main factors affecting potential CT users, these factors are studied in detail in the following sections concentrating on priorities for integration, acceptable access and egress distances, and finally the role of bicycle sharing systems in promoting CT. This is done through a series of cross-tabulations of the relevant survey questions.

Analysis

Descriptive statistics

Respondents are aged from 18 to 87, however the majority fall between the ages of 25 and 35 (Figure 1a). Men are slightly overrepresented, constituting 58 percent of the sample, and represent a larger portion of regular and frequent cyclists (Figure 2b). Annual household income is quite evenly distributed among respondents and the majority live in small households of 1 or 2 people, indicating that young people with no families are overrepresented in the sample. In terms of transportation options, 94% of the respondents own a bicycle, 87% have a valid driver's license and 52% own at least one car per household. While respondents report driving and walking evenly throughout the year, cycling and transit usage have considerable variation; predictably, cycling decreases in winter months and transit usage increases, suggesting that individuals substitute one of these modes for another depending on weather conditions.

FIGURE 1 AROUND HERE

Overall, 63 percent of respondents indicated they would be willing to combine bicycle and public transit for a trip that they conduct. However, certain transit users report a greater interest in CT than others; over 80 percent of respondents using the metro and train equally or metro, train and bus equally are likely CT users (Figure 2a). Commuter train users, especially those connecting between multiple transit vehicles, represent the prime set of candidates for such measures. Based on respondents' reported cyling habits, we see that recreational and non-cyclists are least likely to integrate their cycling with transit (Figure 2b), while 68 percent of occasional cyclists reported that they would do so.

FIGURE 2 AROUND HERE

Also the highest values among potential transit users come from users who are using more than one mode of transit to reach their destination. This finding is consistent with Mees's *(27)* observation that CT users will come mainly form existing transit users who would like to replace an inconvenient portion of their trip.

Factor-cluster analysis

Using 28 variables derived from responses to survey questions, we obtain thirteen factors with Eigen values above 1 which are used to define categories of current and potential users (Table 1). More questions were tested for this analysis yet they were dropped due to absence of statistical significance. The high values (above 0.5, indicated in bold) are all in a single column, each column representing one of the thirteen factors below. Cumulatively, these factors explain more than 75 percent of overall variation in the data. Using these newly generated factors, a cluster analysis is performed. In this type of analysis, it is important to determine the most appropriate number of clusters. We hypothesized that there are at least two, and possibly three, clusters representing general profiles: current CTUs, potential CTUs and non-CTUs. We tested for a variety of cluster numbers and obtained the best result with five groups.

The cluster average for each of the previously defined thirteen factors is represented by the height and direction of each bar, as shown in Figure 3. Current bicycle and transit integrators account for 23 percent of our sample, non-integrators represent 47 percent of our sample and the remaining 30 percent are potential integrators. In addition to presenting the cycling and transit integration potential for each group, the analysis shows that respondents are clustered according to their current transportation habits.

FIGURE 3 AROUND HERE

The first cluster is characterized by a high value for the *transit potential* factor, a higher than average value for the *occupation and income* factor and a positive value for the *currently parking* factor; respondents in this cluster have a positive perception of CT and already park-and-ride. The second cluster is characterized by a high value in the *BIXI using* factor, a positive value in the *transit potential* factor and a positive value for the two factors indicating interest in bringing bicycles on transit (*priority bringing racks* and *priority bringing time*). These BIXI users are willing CT users and prioritize measures to bring bicycles on transit vehicles. The third cluster shows a high value for the *car potential* factor, a higher than average value for *household size, occupation* and *income*, and a positive value for the factors related to bringing bicycles on transit. This group represents respondents with children, currently driving and willing CT users, particularly if it involves bringing their bicycle on board. The fourth cluster is mostly characterized by a high value in the *experience* factor, and negative or low values for the other factors, indicating that these respondents are older and have been cycling for longer. They are poorly served by public transit and are not likely CT users. The last and largest of the clusters is composed of committed cyclists that have a lower value in the *occupation and income* factors and are relatively young; this group is considered non-potential CT users.

The factor and cluster analysis identified three willing groups of current and potential CT users: the current *parking bike-and-riders*, and two groups of potential CT users, the *BIXI users* and the *drivers*. Both *BIXI users* and *drivers* selected priorities related to bringing bicycle on transit vehicles; other priorities were selected by current parking bike-and-riders, indicating that different population groups have distinct needs and preferences for bicycle-transit integration. Awareness of these different groups, and a better understanding of their priorities, will enable transit authorities to provide appropriate services and facilities to satisfy existing demand and attract new users.

TABLE 1 AROUND HERE

Identifying Priorities

Despite growing interest in bicycle CT schemes, little study has been directed at the travel circumstances in which individuals are most likely to desire and choose this option. We identified four possible scenarios in which bicycles could be incorporated into a transit trip, and asked survey respondents to select the one which they were most like to use (Figure 4). 56 percent of all respondents indicated a preference for one of the scenarios. Overall, 60 percent of respondents selected option C—bringing their bicycle with them on transit—followed by the option A—accessing transit by bicycle and walking to one's final destination (21 percent). Since each different CT option entails different costs for transportation agencies and may appeal to different segments of the population, we explore these scenarios in greater detail.

FIGURE 4 AROUND HERE

Of those respondents expressing interest in combined CT trips, 40 percent reported they would do so for regular trips (eg. to work or school), while 60 percent would use this option primarily for irregular trips (eg. shopping, social visit). This contrasts with past research which has observed CT users to be primarily commuters *(7, 28-29)*. Our research shows that the ratio of regular to irregular CT potential users varies according to the scenario selected (Figure 5); while only 34 percent of respondents who prefer to bring their bicycle on transit (option C) would be regular CT users, 48 percent of respondents who would cycle to transit (option A) would be regular CT users. These findings suggest that good quality bicycle parking facilities will be most useful to regular commuters, while racks on vehicles will appeal more to those irregularly using CT.

FIGURE 5 AROUND HERE

Respondents were asked what type of a trip they were most likely to replace with a CT trip. Overall, trips made by one public transit vehicle accounted for 34 percent of potential CT trips, followed by car (25 percent), existing multimodal trips (24 percent), bicycle (9 percent), walking (5 percent) and taxi (3 percent). To better understand how opportunities for CT vary by location, respondents' distance from a central point in downtown is cross-tabulated with the mode most likely replaced by a CT trip (Figure 6). Not surprisingly, respondents living at central locations where private automobile ownership is lowest are more likely to replace trips involving transit as one of two or more modes. These are the *Parking bike-and-riders* and *BIXI users* identified in the factor-cluster analysis. Beyond 15 kilometers from downtown, *Drivers* are the group most likely to constitute the greatest share of replaced trips.

FIGURE 6 AROUND HERE

Every respondent was asked to provide his priority for a better integration of cycling and transit in Montréal. Of all priorities indicated, the preference for bringing bicycles on transit vehicles is dominant, particularly for extending the time in which the bicycles are allowed on board. More generally, measures facilitating bringing bicycles on transit account for 45 percent of the identified priorities, whereas various measures facilitating bicycle parking at transit stations represent 34 percent of the priorities. Another 13 percent identified bicycle network connectivity with transit stop as their top priority. That no single integration measure was clearly identified as the number one priority by a majority of respondents also reveals that a host of different interventions are needed to promote CT.

Respondents who said that they would not integrate cycling and transit indicated why they would not do so. The reason most commonly given was unwillingness to forego a bicycle trip, which speaks to the dedication of Montréal cyclists and the many short distance trips made. Over half of the reasons given are related to convenience (no time savings; impractical), while 20 percent indicated lack of appropriate parking facilities or fears about theft. This question underscores the difficulty of quantifying preference for a currently little-used practice; in particular, it is unclear whether the overwhelming preference for bringing bicycles on transit is the expression of a fundamental need, or whether it reflects a lack of other viable options, such as secure and convenient parking.

Acceptable distances

Those respondents that selecting a CT integration scenario were then asked to indicate acceptable travel times for each portion of the trip: access, egress and on board transit. Using distance decay functions, these acceptable access and egress times by both walking and cycling are graphed. Respondents show markedly higher acceptable travel times by bicycle than by walking. Comparing access and egress distances (Figure 7), we note a steeper egress curve by both walking and cycling, indicating that a greater proportion of CT users are willing to accept longer access than egress times. This finding seems to confirm respondents' preference for using a bicycle at the home end rather than the destination end of a journey.

FIGURE 7 AROUND HERE

Bicycle sharing

Given the recent implementation of BIXI (short for bicycle taxi), the public bicycle system in Montréal, a section was included in the survey to examine the role bicycle sharing systems can play in CT. Users can take a BIXI from one of 400 docking stations located in the city center, cycle to their destination and leave the bicycle at another station. There are three possible membership types: pay-per-use, monthly or yearly enrolment. 37 percent of respondents are BIXI users, traveling by BIXI on average 12 times per month when the service is available between May and November. Among the sample, memberships are split almost evenly between pay-per-use and yearly, with only 1 percent of the BIXI users indicating they use a monthly membership; these users are not considered in the remainder of the analysis. More than half of the BIXI users live less than 0.8 kilometers from a metro station and pay-per-use users tend to live farther from metro stations. As indicated by the factor-cluster analysis, yearly BIXI members are more likely than pay-per-use users to integrate cycling and transit (Figure 8a).

In most cases, bicycle sharing usage replaces trips previously made by other "green" modes, namely public transit, bicycle or walking. Approximately 8 percent of BIXI users replaced taxi trips, while only 2 percent of the respondents use a BIXI instead of driving, revealing that official estimates of CO_2 reduction due to the implementation of the program are exaggerated *(30)*. The availability of bicycle sharing incited 3 percent of the respondents to add an extra trip they would not otherwise have made. Among the different reasons for using BIXI, the most popular is their usefulness for one-way trips, which is followed by their practicality to use in conjunction with public transit; nonetheless, the majority of BIXI trips involve no other transportation mode. This may be due to the fact that BIXI stations are spatially concentrated, resulting in short-distance trips that can be made easily. Finally, many respondents expressed the need for BIXI stations outside the central neighbourhoods where transit stops cannot always be accessed by foot.

FIGURE 8 AROUND HERE

Discussion and Conclusions

As municipalities and transit providers aim to provide better options for "green" transport, cycle-transit integration offers significant opportunities for synergy between these modes. Existing knowledge has identified several factors affecting the cycle-transit usage including transit mode, urban form, access and egress catchment areas and trip purpose. Given the variety of options for increasing cycle-transit integration, and the significant costs associated with certain measures, the results in this paper may help to guide municipalities in selecting the most cost-effective solutions based on their goals and type of users they are trying to attract. However, the needs and preferences in terms of bicycle and transit integration may differ from one city to another; it is thus important to use locally obtained data when determining the most appropriate measures.

Through market segmentation using factor-cluster analysis, three of five distinct groups were found to be current or potential CT users: a) *Parking bike-and-riders*, b) *BIXI users*, and c) *Drivers*. Descriptive statistics confirmed this finding: self-described occasional cyclists are more likely to choose CT than those who cycle recreationally, regularly or almost always. Understanding the dynamics and preferences of these groups can significantly aid in the provision of cycle-transit integration services. A better knowledge of these groups' characteristics can also help transit agencies to effectively match resources to their potential users' preferences as part of a competitive positioning strategy to increase their market share *(23)*.

The present research reveals that transit users who primarily use Montréal's commuter rail train, or make train-based multimodal trips, are the most likely CT users, mirroring findings from locations where the practice is more common *(10-11, 31)*. In order to replace car trips with CT trips, a major preoccupation within this field, this research suggests that opportunities are greatest for people living farther than 15 km from the city center. Thus, improving the integration of cycling and rail transit, particularly if combined with suburban cycling infrastructure improvements, is expected to result in the greatest increase in CT rates. On the other hand, given the greater ridership of the city's metro system and its higher overall share of current CT trips, improvements focused on this transport mode will likely yield a greater gain in absolute terms, though more likely at the expense of other "green" modes. Specific policy objectives and the availability of resources will thus determine whether efforts are best directed towards replacing car trips, improving overall accessibility and mobility or working towards both of these goals.

The preference expressed by over 60 percent of respondents for the option to bring their bicycle on board transit presents serious challenges to promoting more widespread usage. Capacity limitations and capital costs associated with this option will necessitate more aggressive promotion of short- and longer-term parking options and public bicycle programs to significantly increase cycle-transit integration. This research makes several promising contributions to this dilemma: trips involving access or egress by bicycle at only one end of the trip accounted for the greatest proportion of respondents who stated they would be regular CT users. In other words, while the option to bring a bicycle on transit remain the most popular, scenarios involving parking a bicycle (or using a public bicycle) at one end are likely to be used more regularly. To the extent possible, measures facilitating both bicycle parking at transit and those enabling bringing bicycles on board transit are recommended.

Given the absence of research on public bicycle sharing systems, and their planned adoption in other North American cities, a section on Montreal's BIXI system was included. Over one third of survey respondents reported having used BIXI. As shown through factor-cluster analysis, BIXI users, especially those with a yearly membership, are most likely to integrate cycling and transit. However, despite the claims of reducing transportation emissions, this service appears to mostly replace trips made by "green modes". While the popularity of bicycle sharing suggests that there are significant benefits to users in terms of convenience and overall mobility, its environmental benefits have been grossly exaggerated. Further research into bicycle sharing systems will be needed.

After thoroughly reviewing the state of the knowledge from small but growing subset of transportation research, this paper includes a wide-ranging analysis into how and for whom to promote cycle-transit integration. The present study has several limitations, including risks for sample bias and the difficulty of analyzing a marginal transportation practice. The former is addressed by using multiple dissemination tools; the latter is shortcoming that can only be overcome as this practice becomes more widespread.

Nonetheless, using the preferences and practices of current and potential CT users in Montréal, we make concrete conclusions that can guide transportation professionals in implementing cost-effective solutions for better bicycle-transit integration. While caution should be taken to avoid generalizations, it is believed that the results will be of use to transportation researchers and professionals as they seek to understand and promote this promising form of multimodal transportation.

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Table 1: Factors with values of constituent variables

		1	2	3	4	5	6	7	8	9	10	11	12	13
Commitment to cycling	Metro per year	**-0.61**	0.01	0.05	-0.4	0.07	0.11	-0.07	-0.14	0.19	0.17	-0.06	0.05	0.09
	Bus per year	**-0.57**	0.10	0.03	-0.34	0.03	0.11	-0.03	-0.05	0.24	0.21	0.07	0.01	0.14
	Seasons cycling	**0.81**	0.08	0.07	-0.15	0.01	0.06	-0.08	-0.04	0.11	0.13	0.00	0.05	0.05
	Cyclist type	**0.84**	0.05	0.00	-0.25	0.05	0.05	-0.10	-0.01	0.12	0.08	0.03	0.02	0.05
Household size	People per household	0.04	**0.92**	-0.02	0.06	-0.03	0.01	0.01	-0.03	0.01	-0.01	0.03	0.01	0.03
	Children per household	0.08	**0.86**	0.09	0.01	-0.05	0.01	0.06	0.09	-0.03	0.01	0.00	0.03	-0.03
Occupation and income	Full-time worker	0.03	0.04	**0.90**	0.04	0.03	0.01	0.04	0.00	-0.01	-0.03	-0.01	-0.01	0.03
	Income	-0.04	0.48	**0.56**	0.21	0.11	-0.08	0.01	0.12	-0.08	-0.11	0.02	-0.06	-0.01
	Full-time student	-0.01	0.00	**-0.86**	-0.05	0.01	-0.02	-0.05	-0.2	0.01	-0.04	0.02	-0.02	0.02
Car potential	Replace car by bike-and-ride	0.13	0.01	0.15	**0.73**	-0.05	0.04	-0.07	-0.03	0.18	0.07	0.10	0.05	0.10
	Seasons driving	-0.21	0.10	0.02	**0.67**	-0.01	-0.01	0.19	0.13	-0.13	0.01	-0.07	0.00	-0.01
	Cars per household	-0.17	0.50	0.09	**0.56**	0.00	0.03	0.17	0.08	-0.09	-0.05	-0.09	-0.09	0.02
BIXI using	BIXI yearly membership	-0.01	0.00	0.06	-0.04	**0.91**	-0.02	-0.05	-0.03	0.06	0.01	0.01	0.02	0.02
	BIXI uses per month (2010)	0.01	-0.05	0.00	-0.02	**0.91**	0.00	-0.02	-0.03	0.07	0.01	0.00	-0.01	0.03
Currently bringing	Bringing on bus / year	-0.01	0.04	0.01	0.01	0.00	**0.91**	0.01	0.02	-0.04	-0.03	0.03	-0.01	-0.02
	Bringing on metro / year	0.00	-0.03	-0.02	0.01	-0.02	**0.91**	-0.01	0.02	0.08	0.04	-0.03	0.02	0.03
Poor transit service	Home to bus station	0.00	-0.01	0.03	0.01	0.00	-0.01	**0.88**	-0.02	0.00	0.01	-0.03	0.05	0.01
	Home to metro station	-0.11	0.11	0.06	0.14	-0.07	0.01	**0.85**	0.05	0.02	-0.01	0.02	-0.04	0.04
Experience	Years cycling	0.03	0.05	0.00	0.01	-0.01	0.02	-0.01	**0.90**	-0.02	0.03	-0.03	0.00	0.00
	Age	0.02	0.08	0.33	0.15	-0.08	0.02	0.05	**0.77**	-0.07	-0.03	0.00	0.00	-0.07
Transit potential	Willing to combine	0.10	-0.06	-0.01	0.25	0.09	0.09	-0.01	-0.03	**0.84**	0.15	0.09	0.06	0.06
	Replace transit by bike-and-ride	-0.07	-0.02	-0.05	-0.24	0.07	-0.05	0.04	-0.06	**0.76**	-0.10	-0.07	-0.02	-0.08
Currently parking	Parking at a bus stop	0.03	-0.04	0.01	0.11	0.01	-0.01	0.02	-0.07	-0.13	**0.77**	0.00	0.07	-0.02
	Parking at a metro station	-0.01	0.01	-0.04	-0.08	0.02	0.01	-0.02	0.07	0.16	**0.73**	-0.03	-0.08	0.00
Priority bringing racks	Priority : racks inside transit vehicles	0.06	0.01	-0.02	0.00	-0.03	0.01	0.02	-0.02	0.03	-0.05	**0.90**	0.17	0.15
Priority bringing time	Priority: Extend hours	0.17	0.00	0.00	0.02	-0.12	0.01	0.10	0.05	0.06	-0.05	-0.57	**0.55**	0.39
	Priority NOT indoor parking	0.00	0.00	0.02	-0.01	-0.04	-0.02	0.01	0.00	-0.02	-0.01	-0.16	**-0.91**	0.15
Priority not access to platform	Priority NOT Access	0.03	0.00	0.00	-0.07	-0.06	-0.01	-0.04	0.05	0.02	0.02	-0.08	0.10	**-0.92**

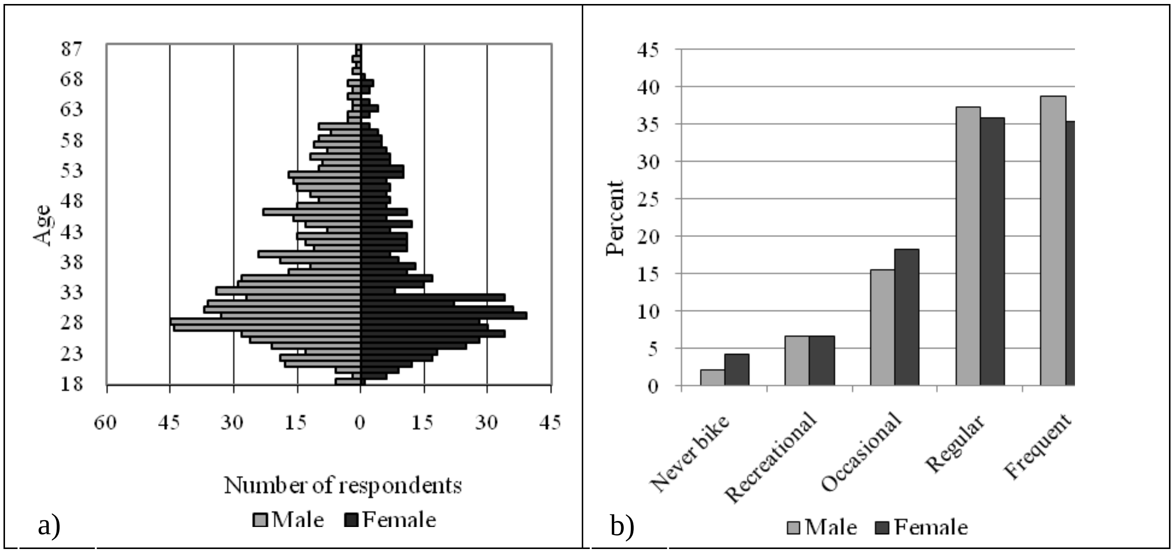


Figure 1: Socio-demographic characteristics and and travel habits

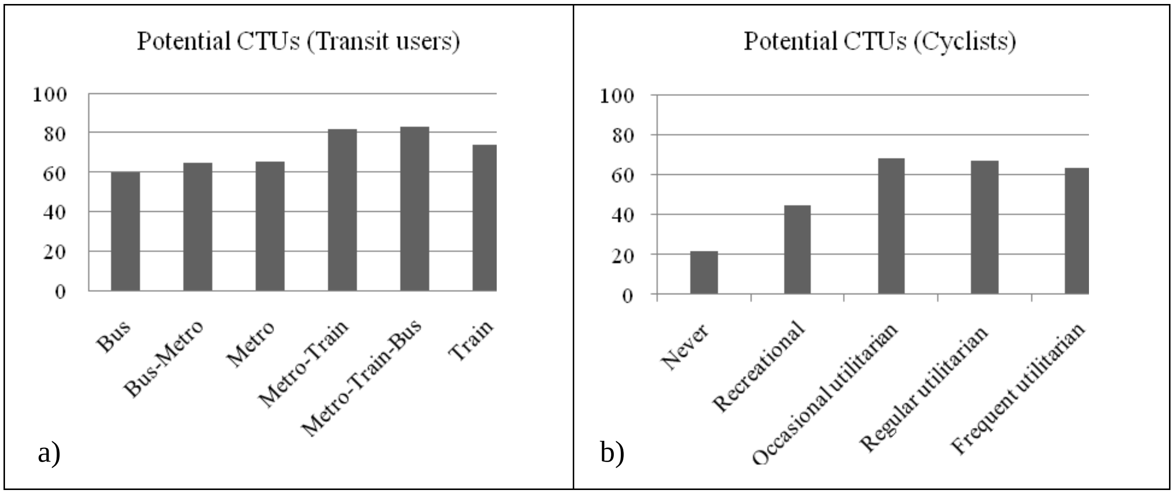


Figure 2: Travel habits of potential cycle-transit users

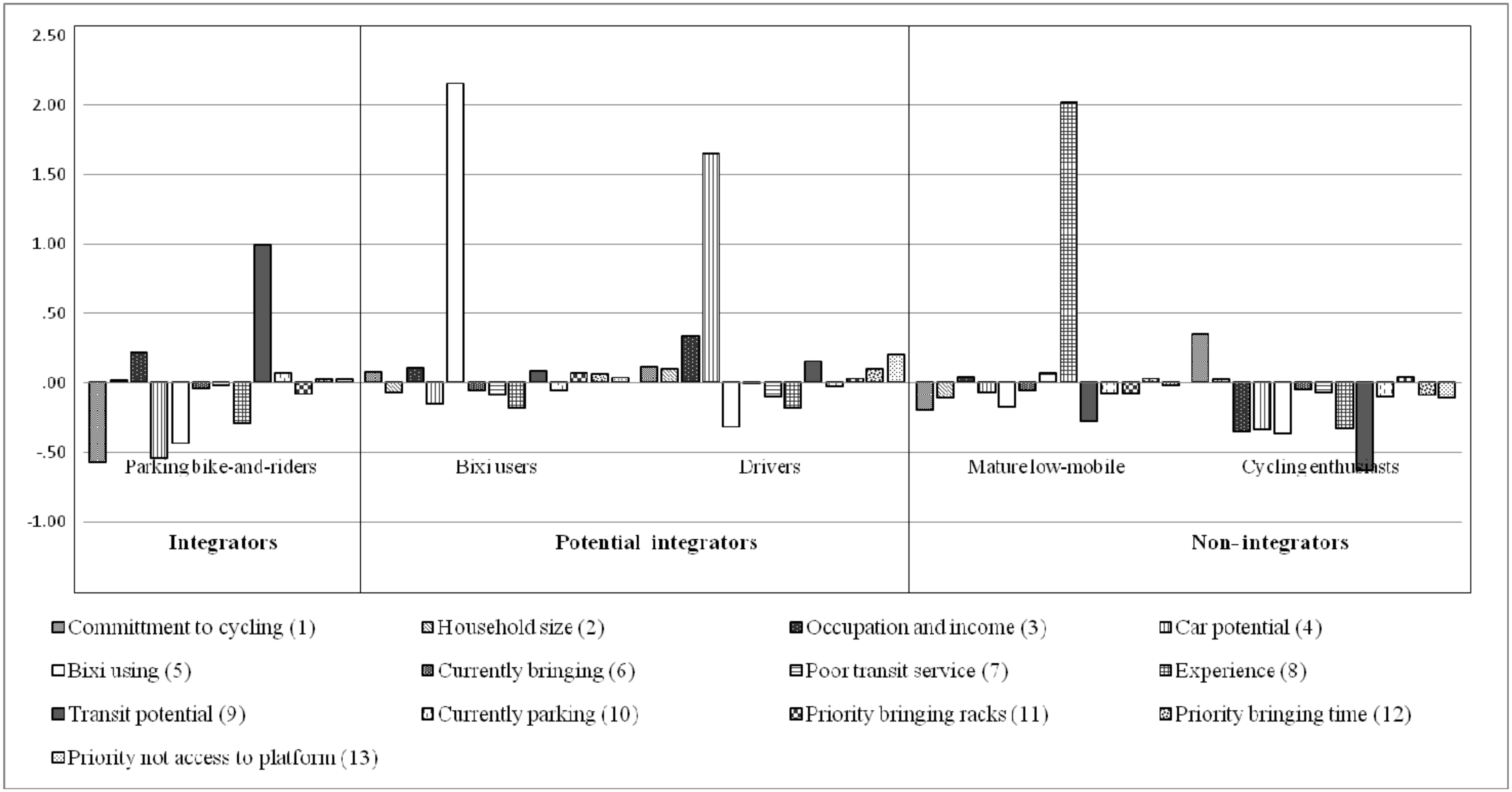


Figure 3: Current and potential CTUs based on factor-cluster analysis

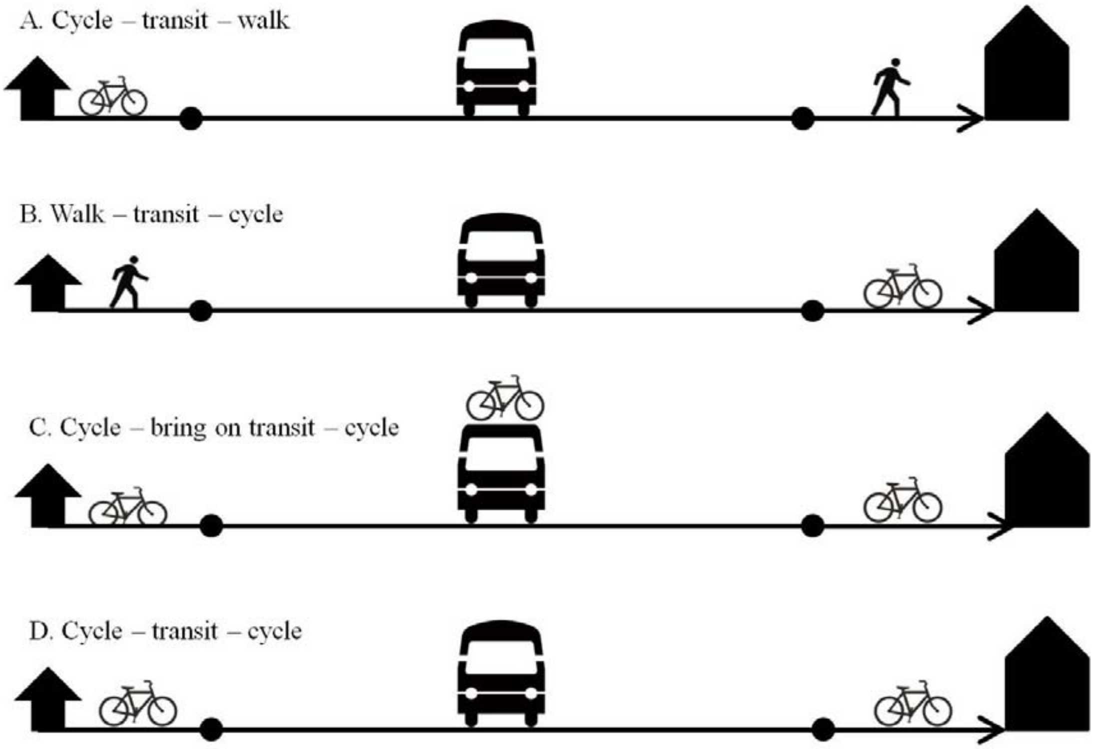


Figure 4: Four possible cycle-transit scenarios

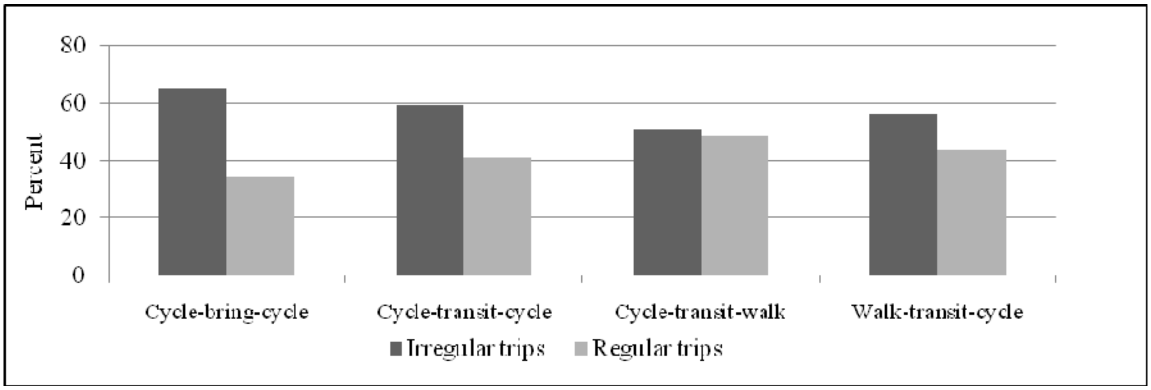


Figure 5: Preferred scenario by likely frequency of CT usage

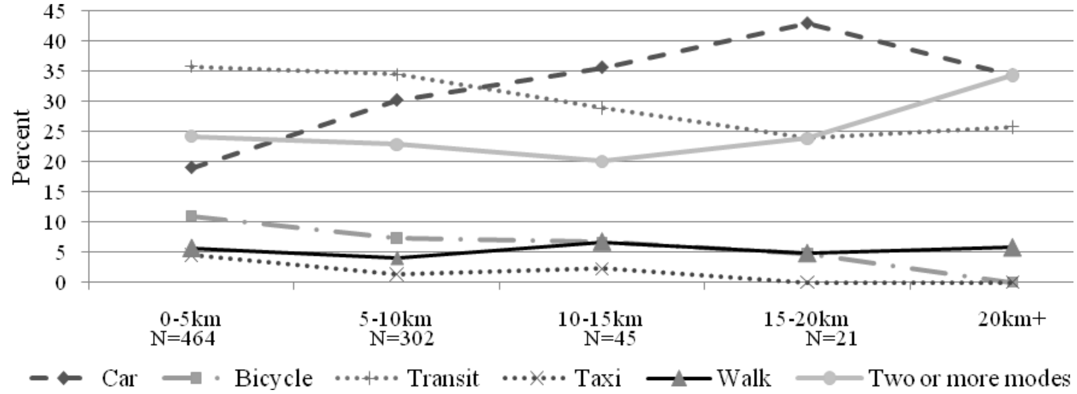
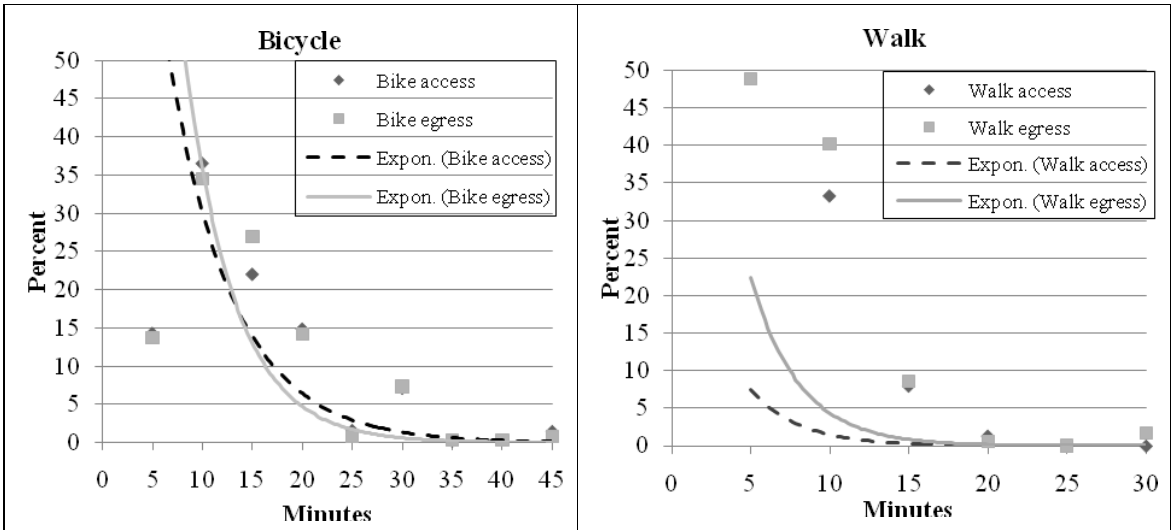


Figure 6: Stated mode replaced with CT by home- downtown distance



	Min	Max	Mean	Std	R^2		Min	Max	Mean	Std	R^2
Access	1	60	14.51	9.27	0.4701	Access	1	20	7.16	3.59	0.6986
Egress	2	90	14.97	10.16	0.4880	Egress	1	30	8	4.58	0.7071

Figure 7: Distance decay of reported acceptable bicycle and walk times

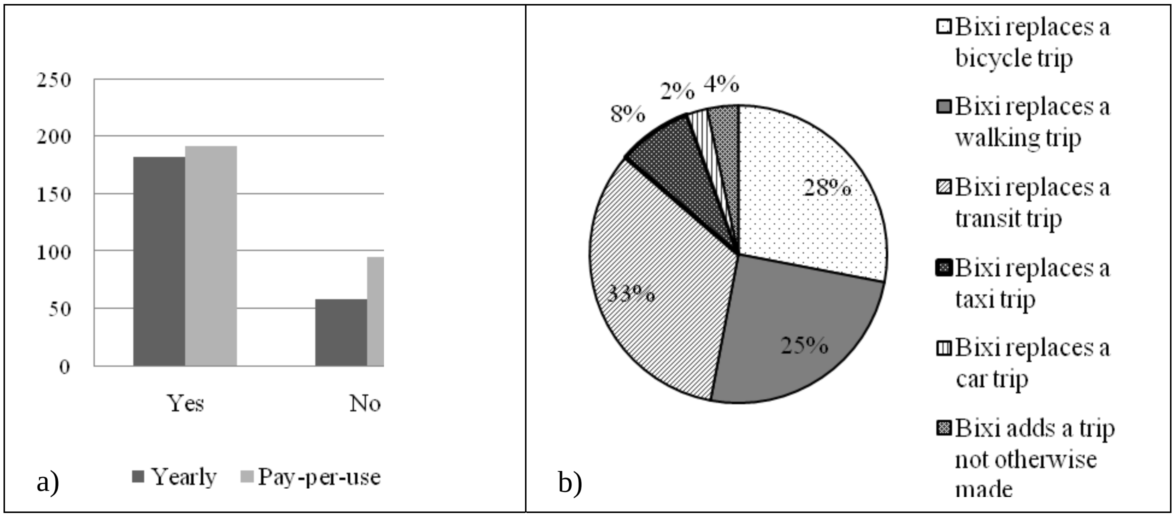


Figure 8: (a) Willingness to integrate by BIXI membership type; (b) trip types replaced by BIXI