YOUNG ADULTS AND MOBILITY: PERCEPTIONS AND ASPIRATIONS

LES JEUNES ET LA MOBILITÉ: PERCEPTIONS ET ASPIRATIONS

FINAL RESEARCH REPORT – PART III

David Suzuki Fellowships

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FONDATION DAVID SUZUKI

Un monde. Une nature.

March 2021

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Final research report – Part III
Interdisciplinary table on car dependency (« Chantier auto solo »)
David Suzuki Fellowship Program

About the David Suzuki Foundation

Established in 1990, the **David Suzuki Foundation** is a leading Canadian environmental non-profit organization, collaborating with all people in Canada, including government and business, to conserve the environment and find solutions for a sustainable Canada through evidence-based research, public engagement and policy work. Its mission is to protect nature's diversity and the well-being of all life, now and for the future. Its vision is that we all act every day on the understanding that we are one with nature. The Foundation operates in English and French, with offices in Vancouver, Toronto and Montreal.

About the Chantier auto solo

The objective of the *Chantier auto solo* is to better understand the psychosocial factors involved in the relationship between Quebecers and the automobile in order to promote adoption of sustainable mobility behaviours and reduce collective dependence on this mode of transport. To provide concrete answers to this social issue, the preferred angle is that of action research, which offers the advantage of building a bridge between research carried out in universities and non-academic stakeholders (political authorities, public transport agencies, private mobility players, NPOs and citizen associations, etc.) affected by the challenges of sustainable mobility.

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RÉSUMÉ

Mise en contexte

Le système d'automobilité est responsable de conséquences négatives importantes sur les changements climatiques, l'environnement, la santé publique, les finances publiques et personnelles et, plus largement, entraine des enjeux d'iniquité sociale et affecte la qualité de vie. La transition vers un paradigme de mobilité durable demande une approche holistique qui inclut des changements aux politiques de transport et d'urbanisme, aux infrastructures, à l'aménagement du territoire et la mise en place de stratégies de gestion de la demande en transport. Réussir cette transition va aussi demander des changements aux normes sociales, aux attitudes et aux styles de vie. Dans cette perspective, les tendances de mobilité des millénariaux seraient prometteuses puisqu'il a été démontré que cette génération semble plus sensible aux enjeux sociaux et environnementaux et moins orientée vers l'automobile que les générations précédentes. Ce troisième et dernier rapport de recherche d'une série de trois sur la dépendance à l'automobile présente les résultats d'une enquête web et de groupes de discussion menés auprès d'étudiants de 18 à 25 ans afin de mieux comprendre leurs croyances, perceptions et aspirations face à la mobilité et au style de vie futur.

Méthodologie

Une enquête web a été menée dans trois cégeps de la région de Montréal en avril 2018 : le Collège Ahuntsic, le Cégep Édouard-Montpetit et le Collège Montmorency. En plus de collecter des informations sur les caractéristiques socio-économiques et les comportements de mobilité, cette enquête a permis de recruter des participants pour la tenue de cinq groupes de discussion. Réunissant de cinq à neuf personnes durant des séances d'environ une heure trente, les discussions visaient à explorer les expériences générales de transport de cette génération. Elles se terminaient par un atelier prospectif afin de récolter les aspirations des participants à une mobilité et à un style de vie futur. L'échantillon final comprend 1 023 répondants à l'enquête web et 32 participants aux groupes de discussion.

Enquête web : principaux constats

Le taux de possession d'un permis de conduire chez les répondants est légèrement supérieur à la moyenne provinciale pour les groupes d'âge équivalents. Les répondants habitant des quartiers centraux ou de proches banlieues possèdent un taux plus bas que ceux habitant plus en périphérie. Parmi les détenteurs d'un permis de conduire, le taux d'accès à l'automobile est élevé alors que seulement 10 % n'ont généralement pas accès à un véhicule. Cette proportion est plus élevée en milieu urbain et plus basse en milieu suburbain ou rural. Ces résultats confirment qu'avec une plus grande qualité et diversité de modes alternatifs à l'automobile, les jeunes ressentent moins le besoin d'avoir un accès à l'automobile. Si le vélo peut être perçu comme un mode de transport attractif pour ce groupe d'âge en raison de leur santé physique et de son faible coût, son utilisation ne semble pas très populaire. Seulement 10 % des répondants déclarent l'utiliser une fois ou plus par semaine et 46 % en possèdent un pour leurs déplacements. Le transport collectif jouit d'une plus forte popularité : 70 % des répondants ont acheté au moins une carte mensuelle dans les 12 mois précédant l'enquête, mais seulement 16 % détiennent une carte annuelle. Cela peut être une indication que posséder une carte mensuelle à l'extérieur des sessions scolaires n'en vaut pas le coût. En ce sens, offrir aux étudiants une carte annuelle au même prix qu'une carte pour deux sessions (8 mois) leur permettrait d'utiliser le transport collectif à un coût marginal nul durant la saison estivale. Cette initiative pourrait augmenter, à faible coût, l'utilisation du transport en

commun et développerait des habitudes d'utilisation à plus long terme pour d'autres motifs que de se rendre à l'école.

Cette génération est hautement connectée : 94 % des répondants possèdent un téléphone intelligent et 80 % d'entre eux ont un forfait avec données informatiques. Cet appareil leur permet d'utiliser une variété d'applications mobiles pour obtenir des directions, consulter les horaires de transport collectif ou planifier leur trajet. Ces actions semblent faites majoritairement à l'aide de Google Maps qui est installé par 85 % des détenteurs de téléphone intelligent. Les autres applications de transport collectif sont installées par 23 à 28 % des détenteurs et Uber par un cinquième.

Une analyse par classes latentes a permis d'identifier trois profils de mobilité basés sur la fréquence d'utilisation de six modes de transport : voiture comme conducteur, voiture comme passager, bus, métro, marche et vélo. Dans le premier profil, les utilisateurs de bus représentent 46 % des répondants. Il est caractérisé par une utilisation très fréquente de l'autobus et une utilisation fréquente du métro et de l'auto comme passager avec un usage occasionnel des autres modes. Les utilisateurs de bus sont moins nombreux à avoir un emploi à temps partiel et à vivre dans une banlieue éloignée. La moitié n'ont pas de permis de conduire et seulement 11 % possèdent leur propre véhicule alors que 83 % détiennent une carte mensuelle de transport collectif. Le deuxième profil de mobilité regroupe les multimodaux (29 %) qui utilisent une variété de modes de transport. Ils sont plus nombreux à posséder un vélo et à être inscrits dans un programme préuniversitaire. Un tiers possèdent leur propre voiture et plus de la moitié ont une carte mensuelle de transport collectif. Le dernier profil est celui des conducteurs (25 %) qui utilisent presque exclusivement l'auto solo pour se déplacer et 90 % d'entre eux possèdent leur propre véhicule. Ils sont statistiquement plus âgés, plus nombreux à être inscrits dans un programme technique, à avoir un emploi à temps partiel et à vivre en banlieue éloignée que les deux autres profils. Alors que les ceux de ce profil vivent en moyenne plus loin que les deux autres, il est à noter que 40 % vivent tout de même plus proche de leur cégep que la distance moyenne des deux autres groupes combinés. Ceci indique que ces 40 % ont probablement accès aux mêmes niveaux de services de transport collectif et aux mêmes infrastructures de transport actifs que leurs pairs classés comme multimodaux ou utilisateurs de bus, mais décident tout de même de se déplacer en automobile pour la majorité de leurs déplacements. Un constat qui demande davantage d'investigation sur les raisons de ce choix.

Groupes de discussion : principaux constats

L'analyse des discussions sur les expériences et croyances liées aux transports indique que les considérations environnementales sont élevées tout comme l'idée d'éviter la congestion et de ne pas y contribuer. Le transport collectif est perçu positivement, car il permet de diminuer ces deux enjeux, mais son utilisation semble affectée par la perception d'un manque de fiabilité et de flexibilité des services. Ce dernier élément pourrait expliquer pourquoi la moitié des utilisateurs de bus parmi les participants aux groupes de discussion aspirent à un style de mobilité futur reposant sur l'automobile. Malgré son coût élevé, la voiture est unanimement reconnue comme un outil d'accès à l'autonomie, à la flexibilité et à la liberté. La mobilité active est largement perçue comme étant bénéfique pour le bien-être physique et mental, mais son utilisation est entravée par un haut sentiment de vulnérabilité face au trafic motorisé, aux agressions et aux conditions météo. Ces croyances pourraient être changées par l'augmentation d'infrastructures cyclables de qualité et par des stratégies de promotion et d'éducation aux déplacements à vélo visant à augmenter le sentiment de sécurité.

Les résultats de l'exercice prospectif indiquent que les trois quarts des participants aux groupes de discussion aspirent à vivre dans un endroit calme, paisible et sécuritaire en milieu suburbain ou rural. De ce nombre, la quasi-totalité habite actuellement en milieu densément peuplé à Montréal ou dans ses proches banlieues. Par ailleurs, 75 % des participants aux groupes de discussion aspirent à un style de mobilité futur principalement multimodal. Des analyses plus poussées de cette apparente contradiction ont permis de révéler que 45 % des participants aspirant à vivre en banlieue éloignée et proche de la nature espèrent aussi pouvoir se déplacer essentiellement sans automobile. En termes d'aspirations à la possession automobile, 4 participants sur 32 ont mentionné le désir d'avoir un véhicule de luxe, seulement deux ne souhaitent pas posséder de véhicule et la moitié désirent que leur futur véhicule soit électrique ou hybride. Cette aspiration à une voiture écologique semble leur permettre d'imaginer un futur en périphérie de la ville tout en étant en accord avec leur conscience environnementale. Cette aspiration pourrait avoir été influencée par un effort politique important par le gouvernement du Québec pour promouvoir la voiture électrique.

Recommandations

Les constats dégagés dans ce rapport permettent d'énoncer quatre recommandations pour favoriser le virage vers des comportements de mobilité et des styles de vie durables auprès des jeunes adultes.

Recommandation 1	**Recherche**
Fédéral Provincial	Financer davantage de recherches quantitatives sur les croyances et perceptions des jeunes adultes par rapport à la mobilité et à leurs aspirations de style de vie. Cela permettra d'identifier les barrières aux comportements de mobilité durable et les meilleures façons de promouvoir des styles de vie durables tôt dans les phases de vie.
Recommandation 2	**Politiques publiques et règlementation**
Provincial Municipal Institutions d'enseignement	Étudier la possibilité de mettre en place un système d'inscription automatique (avec option de sortie) à une carte annuelle par les institutions collégiales desservies par du transport collectif. Un exemple de succès au Québec est le Laissez-passer universitaire (LPU) mis en place à l'Université Laval, même si celui-ci ne couvre pas la session d'été.
Recommandation 3	**Planification des transports – Infrastructures**
Fédéral Provincial Municipal Sociétés de transport	Étendre le réseau de voies prioritaires pour bus sur les artères et autoroutes, notamment en périphérie où le transport lourd sur rail est moins présent. Cela permettrait d'améliorer la fiabilité des services d'autobus, de réduire les temps de parcours et de rendre ce mode plus compétitif face à l'automobile. Étendre le réseau de stations de vélopartage aux proches banlieues et à proximité des campus collégiaux afin d'augmenter l'accessibilité au vélo.
Recommandation 4	**Planification des transports – Gestion de la demande**
Fédéral Provincial	Développer des stratégies de communication et des campagnes visant à promouvoir des habitudes de mobilité et des styles de vie durables et moins

Municipal Institutions d'enseignement	dépendants à l'automobile. Ces campagnes ciblant les jeunes viseraient à augmenter le sentiment de responsabilité face aux conséquences de l'automobile, notamment les conséquences environnementales, tout en cherchant à diminuer la perception que l'automobile procure la plus grande liberté de mouvement dans tous les contextes. Développer des initiatives de promotions du vélo et des ateliers d'initiation et de réparation en partenariat avec Vélo-Québec afin d'augmenter la confiance et le sentiment de sécurité parmi les populations étudiantes. Un effort devrait être fait afin d'aider à identifier les routes les plus sécuritaires pour accéder aux campus. Promouvoir davantage les applications mobiles d'horaire et de planification de trajets de transport collectif. De plus, une fois celles-ci mises en place, promouvoir la disponibilité de l'information en temps réel sur les horaires de transport collectif afin de réduire le sentiment que les services d'autobus sont peu fiables.

EXECUTIVE SUMMARY

Context

The automobility system is responsible for a vast array of consequences regarding climate change, the environment, public health, personal and public finances and, more broadly, society, by fostering inequity and affecting quality of life. Shifting to a sustainable mobility paradigm requires a holistic approach with major changes in transport policies, urban planning, infrastructure and mobility management strategies. This will require important changes in social norms, attitudes and lifestyles. In this perspective, mobility trends of the millennial generation (also known as Generation Y) seem promising, as this generation has been shown to be more sustainability-focused and less car-oriented than previous generations. This third and final report in a series of three on car dependence details the findings of a web survey and focus group sessions conducted with millennial students, aged 18 to 25, to gain a deeper perspective on transportation-related beliefs and aspirations for future mobility and lifestyle.

Methodology

A web survey was conducted in three *cégeps* (colleges) of the Montreal Area in late April 2018: Collège Ahuntsic, Cégep Édouard-Montpetit and Collège Montmorency. The web survey, in addition to collecting information about socio-demographic characteristics and mobility behaviour, served as a recruitment method for five focus group sessions held in those cégeps shortly after. In 1.5-hour sessions with five to nine participants, overall experiences about mobility were discussed, followed by a prospective exercise about future lifestyle, mobility and residential preferences. The final sample is 1,023 for the survey and 32 for the focus groups.

Web survey: key findings

The respondents' driver's licensing rate is slightly above the provincial average, and those living in central urban neighbourhoods are less likely to hold a licence than those living in the suburbs. Among licence holders, car accessibility is high, with only 10 per cent having no or only occasional access to a car. The proportion is higher in urban settings and lower in exurban and rural settings, hinting that with higher quality and diverse alternatives to the automobile comes a lower need to have frequent access to a car. Although cycling could be thought of as an attractive option for young adults because of their good physical health and its low cost, it doesn't seem to be a popular option among the studied sample, with 10 per cent saying they use this mode on weekly and only 46 per cent owning a bike that they can use for trips. Transit is a more popular option, with 70 per cent having bought at least one transit pass over the previous year, but only 16 per cent having a year-round pass. This could mean that the cost of having a pass outside the school period might not be considered worth it. In this sense, offering students a yearly pass for the same price as eight monthly passes could allow them to use transit at no marginal cost during the summer vacations, a potential easy way to increase transit use over the summer and build long-term public transportation habits.

This generation is highly connected, with 94 per cent owning a smartphone and 80 per cent of those having a data plan. This allows them to use a variety of apps to get directions and transit schedules and plan trips. Google Maps is most commonly used, installed by 85 per cent of smartphone owners, while other transit planning apps are installed by 23 to 28 per cent and Uber by one-fifth.

The results of a latent class analysis allowed identification of three mobility types based on frequency of use of six transport modes: car driver, car as passenger, bus, metro, walking and cycling. The largest type is the ***bus riders*****,** making up 46 per cent of the sample. It is defined by very frequent use of bus services, frequent use of metro and car as passenger and occasional use of other modes. The bus riders are less likely to have a job and less likely to live in outer suburbs/rural neighbourhoods. Half do not have a driver's licence and only 11 per cent have their own car, while 83 per cent have a monthly transit pass.

The second largest type is the ***multimodals*** (29 per cent), comprising respondents with a diversity of modes used frequently. They are more likely to have a bike and to be enrolled in a pre-university program. About a third of them have their own car and more than half have a monthly transit pass. The last type, making up 25 per cent of respondents, is the ***car drivers*****,** who use almost exclusively the car as driver, with occasional use of all other modes. They are statistically older and are more likely to be enrolled in a technical program and to have a part-time job, with 90 per cent owning their own vehicle. They are more likely to live in the outer suburbs/rural areas and less likely to live in the city than the two other groups. While this mobility type lives further away their cégep on average than than the other two types, it is worth noting that 40 per cent live closer to their cégep than the mean distance for the two other types combined. This indicates that they are likely to have similar levels of transit accessibility as their peers classified as *multimodals* or *bus riders* but still decide to drive for most of their daily trips.

Focus groups: key findings

The analysis of discussions about transportation experiences and beliefs indicates that environmental concern is quite high among participants, as is the idea of avoiding traffic and not contributing to it. Public transportation is perceived positively as reducing both of those consequences, but its use might be hindered by a strong perception of unreliability of services and could explain why about half of current bus riders aspire to a car-based mobility future. As for the car, its high cost is its main perceived drawback, but it is unanimously acknowledged to provide autonomy, freedom or flexibility in travels. Active travel is widely perceived to be beneficial for physical and mental well-being but is hindered by high feelings of vulnerability (from motorized traffic, but also from strangers) and exposure to weather. These perceptions could be changed through better cycling infrastructure and awareness and education strategies to improve feelings of safety.

Results from the prospective exercise indicate that more than 75 per cent of focus group participants would prefer to live in a peaceful, quiet and safe suburban or exurban neighbourhoods in the future. Interestingly, among those, almost all currently live in a dense urban environment, either on the Island of Montreal or in the most inner suburbs. On the other hand, 75 per cent of focus group participants described their aspiration for future mobility lifestyle as being highly multimodal. Further analysis of this apparent contradiction revealed that 45 per cent of participants seem to idealistically picture themselves living either in suburbs or rural areas while still having the opportunity to rely on modes other than the car to get by. In terms of car ownership decisions, owning a luxury car in the future was mentioned by only four of 32 participants. Two expressed the desire not to own a car and half of them explicitly mentioned wanting their future car to be all electric or hybrid. This aspiration of an "environmentally friendly car" seems to imply a possible way for them to imagine a future on the fringe of the city while staying in line with their environmental values. This common aspiration might have been influenced by a strong push from the provincial government over the past few years to promote and subsidize electric vehicles.

Recommendations

Based on this report's findings, we offer four recommendations to encourage a shift toward sustainable mobility behaviour and lifestyle decisions among young adults.

Recommendation 1	**Research**
Federal Provincial	Fund more quantitative research on young adults' beliefs about transportation modes and aspirations for future mobility. This will help identify key barriers to sustainable mobility behaviour and identify the best ways to promote sustainable lifestyles at an early life stage.
Recommendation 2	**Policies and regulations**
Provincial Municipal	Study the possibility of providing automatic and year-round transit passes (with opt-out options) for students of collegial institutions where a public transit service is offered. A current example in Québec is the Laissez-passer universitaire (LPU) at Université Laval, although this initiative does not include the summer months.
Recommendation 3	**Transportation planning — Infrastructure**
Federal Provincial Municipal Public transit authorities and agencies	Extend the network of priority bus lanes on many artery roads and highways, notably in peripheral areas where rail transit is scarce. This would improve bus service reliability while offering faster and more competitive travel times. Extend the network of bike-sharing services in the suburbs and around suburban campuses to improve bicycle accessibility.
Recommendation 4	**Transportation planning — Transportation demand management**
Federal Provincial Municipal Educational Institutions	Develop communication strategies and awareness campaigns targeted at young adults to promote sustainable mobility lifestyles that are less car-dependent. Those campaign should also try to enhance the sense of responsibility for consequences linked to car use, notably environmental consequences, while trying to decrease the belief that the car provides the greatest freedom and autonomy of all modes in all contexts. Develop bicycle initiatives, workshops and introduction classes, possibly in partnership with Vélo-Québec, to improve confidence and feelings of safety among students and help them identify the safest cycling routes to and from campus. Promote transit-schedule and trip-planning app usage through various strategies. Once put in place, promote more extensively the availability of real-time bus information to reduce the perception of unreliability of bus services.

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1 INTRODUCTION

It has been widely demonstrated that car-based mobility systems — *automobility* — are responsible for a vast array of consequences regarding climate change, the environment, public health, personal and public finances and, more broadly, society by fostering inequity and affecting quality of life (e.g. Gärling and Steg, 2007; Gössling et al., 2019). Shifting the paradigm in transportation and moving away, as a society, from automobility toward a sustainable mobility paradigm requires a holistic approach (Banister, 2008). These major changes in transport policies, urban planning, infrastructures and mobility management strategies as well as social norms and perceptions about the role of the car in society will demand important changes in people's lifestyles (Van Acker, Goodwin, and Witlox, 2016). In this perspective, mobility trends of the millennial generation (also known as Generation Y) have captured a lot of attention, optimism and debate in recent years as this generation appears to be more sustainability-focused and less car-oriented (Chatterjee et al., 2018; Delbosc and Currie, 2013) than previous generations. Although the first studies of this phenomenon have focused on the trends themselves as well as possible causes, the most relevant question today is whether this generation will maintain somewhat more sustainable travel habits or reach the level of car dependency of previous generations at a later age. While the link between the built environment and travel behaviour is widely acknowledged (Ewing and Cervero, 2010), to understand how mobility behaviour of young adults will evolve as they age, it appears relevant to explore not only their actual mobility preferences but also their aspirations for future residential preferences and associated lifestyles.

This third and final report in a series of three on car dependence details the findings of a data-collection process with millennial students, aged 18 to 25. A web survey about mobility behaviour was conducted in three colleges (*cégeps*) of the Montreal area in April 2018 and was followed by focus group sessions in each college to gain a deeper perspective on transportation-related beliefs and aspirations for future mobility and lifestyle.

The main objective was to explore the reasons behind what appears to be a lower inclination towards car-based mobility among this generation (Morency, Verreault, and Bourdeau, 2016) and how this could translate on their future lifestyle, residential location and mobility choices.

The report is divided into four sections. The first is a review of existing scientific literature on mobility trends of the millennial generation, their changing attitudes toward the automobile and research on prospective life courses. The second details the data-collection methodology. The third section reports on the main findings of the web survey and the section reports on focus group session results. The report concludes with key elements of discussion regarding mobility patterns of this generation and suggests policy recommendations to steer this generation toward more sustainable travel habits than previous generations.

2 LITERATURE REVIEW

Studies have observed that millennials are showing distinctive travel behaviour trends, including lower licensing rates compared to previous generations across several western societies (Delbosc and Currie, 2013; Sivak and Schoettle, 2012) and a lower propensity to own (Klein and Smart, 2017) and drive a car (Davis, Dutzik, and Baxandall, 2012; Millard-Ball and Schipper, 2011).

More recently, analyses of these trends have concluded that changes in demographics and living arrangements (Delbosc and Currie, 2014a; Hjorthol, 2016; Polzin, Chu, and Godfrey, 2014), economic circumstances affecting this generation in particular (Klein and Smart, 2017; K. M. Ralph, 2015) and change in residential location preferences (Melia, Chatterjee, and Stokes, 2018; K. Ralph et al., 2016) contributed to these trends, to varying extents. Another important line of investigation has focused on changes in attitudes and lifestyle preferences that could explain and account for some of the observed decline in licensing rates and car use (e.g. Delbosc and Currie, 2014b; Ortar, Vincent-Geslin, and Boudreau, 2018; Puhe and Schippl, 2014). A recent review of evidence of change in millennials' travel behaviour by Chatterjee et al. (2018) concluded that disposable income and employment are leading factors, as is a higher proportion of this population living in urban environments, but that all other above-mentioned factors also played a role in the observed trends.

Recent analysis of mobility trends of young adults has been conducted for the Greater Montreal Area (Morency et al., 2016). The study shows, using large-scale Origin-Destination survey data, that between 1987 and 2013, driver's licence decline is strongest among men aged 20 to 29 and is more pronounced in urban than suburban contexts. Results indicate no statistically significant decline for women (their licensing rates began at lower levels than men and still haven't reach the level of young men). Decline in the proportion of car-driving trips for men can be observed for 25 to 44 years old across the metropolitan region, while it is only observed in the most central neighbourhoods for women between 15 and 34.

2.1 Changing attitudes and prospective life course

Attitudes toward cars are changing in Canada among youth. Mobility trends of young adults in France and the Province of Québec, as well as their evolving relationship with the car, were recently examined (Ortar et al., 2016; Ortar et al., 2018). Using quantitative and qualitative methods, the study concluded that while economic conditions of millennials are an important factor in observed licensing and car-use decline, a change in attitudes toward the car and licensing is also apparent. For the studied sample, the car is not perceived as strongly as before as a symbol of identity and autonomy, and obtaining a driver's licence is not the rite of passage into adulthood it used to be. Results have revealed that this phenomenon is particularly strong in core urban areas where the car is perceived to be a mobility tool among many others and does not represent the dream it once was. While providing valuable insights, this study, however, did not investigate aspirations related to residential location or from a life-course perspective.

Trying to fill this gap, Delbosc and Nakanishi (2017) used in-depth interviews with young Australians to explore interactions between prospective life-course and future mobility. Using a typology approach, three life-course segments emerged from their analysis: "traditional," "delayed traditional" and "non-traditional/uncertain," and four mobility types: "choice multimodals," "captive multimodals," "choice drivers" and "captive drivers." The traditional life-course defined those more family-oriented who wanted to have kids before the age of 30; the "delayed-traditional" preferred to spend their 20s being unconstrained, attaining higher education and career goals first. The "non-traditional/uncertain" preferred keeping their option opens, having no goal of forming a family, preferring to live an unconstrained life. While 82 per cent of interviewees belong to the "traditional/delayed traditional" life-course, the results for transportation expectations were somewhat less "traditional," with the majority (55 per cent) across life-course typologies showing a preference for a multimodal lifestyle and only one-third indicating a clear preference for the car. In terms of future residential location, the authors underscore that "choice multimodals" and "captive drivers" showed a strong interest in inner-city

locations with good accessibility, with some saying they would like to pursue this kind of lifestyle even with a family. Others, who aspired to a more suburban context did not perceive transportation as a strong consideration of their future lifestyle. Extending their research on prospective life-course, the authors conducted a quantitative investigation of life-course typologies of young Australians using latent class analysis (Delbosc and Naznin, 2019b). They extended their life-course typology from three to five segments and explored how these segments related to actual mobility behaviour, destination accessibility and future home location. The desire for suburban living was equivalent across segments and was overall slightly more favoured than inner-city settings. The desire to live close to good public transport across all segments seemed strong, with "delayed" and "independent" life-courses segments showing a stronger preference than the variations of "traditional" segments. Their study, however, did not investigate the possible dissonance between preferred home locations settings and preferred transportation and accessibility to commercial, leisure and job opportunities. Investigating this dissonance is at the core of the current analysis as it appears important to understand how millennials' travel behaviour will evolve as they age. While questions of dissonance or concordance between travel behaviour and actual residential preference has already been studied (e.g. De Vos et al., 2012; Schwanen and Mokhtarian, 2005), to the best of our knowledge, this is the first time it is explored specifically for aspirations of millennials. Strong dissonance in aspirations could indicate that difficult trade-offs between neighbourhood preferences, characteristics and transport accessibility will have to be made.

Urbanization of young adults has changed in recent years. Studies have shown an urbanization process of this population segment in the last two decades in several countries (Lee, 2018; Melia et al., 2018), including in Canada where Montreal inner high-density neighbourhoods are attracting a greater share of young adults aged 25 to 34 than before. In the U.K., a similar urbanization process contributed to reduced driving and increased public transport use among the 16 to 34 population group (Melia et al., 2018). Furthermore, still in the U.K., those aged 25 to 34 reported the high importance of being close to their workplace and to restaurant, leisure and cultural facilities as a reason for choosing their home location, more so than any other age group (Thomas, Serwicks, and Swinney, 2015). Exploring if the younger of the millennials (those born between 1993 and 2000) also picture themselves living in central neighbourhoods with high non-automobile accessibility and proximity to employment/amenities once they complete their studies and transition into adult/family life cycle appears highly relevant in shaping policies to ensure the pursuit of sustainable travel behaviour by this generation in the future.

3 METHODOLOGY

3.1 Data-collection process

3.1.1 Collegial institutions ("cégeps") in the province of Québec

In the present study, data was collected using a two-step method: a web survey and a series of focus group sessions among college students. The web survey was distributed by the administration of three public colleges (called "cégeps" in the province of Québec, an acronym for Collège d'enseignement général et professionnel, known in English as a general and vocational college) in the Montreal area in April and May 2018. The cégeps are publicly funded collegial institutions unique to the province of Québec, in Canada. After graduating from secondary school (usually at 17 years old), around 70 per cent of young Quebecers will enroll at one of the 48 cégeps in the province, either in a pre-university two-year program (mandatory to enter a Quebec university after secondary school for those under 21 years old) or

a technical three-year program leading straight to employment (Gouvernement du Québec, 2017). For the current study, cégep students were targeted instead of university students for two reasons. First, cégep students are more socioeconomically diverse, with a larger share of the population attending cégeps than university because of the characteristics and the role of those institutions in the Quebec education system. The second is the age at which students attend cégep, with most students aged between 17 and 21, a crucial point in life regarding mobility independence and acquisition of a driver's licence. Indeed, as of 2018, young Quebecers can start their licensing process at 16 and obtain their licence for unsupervised driving at 17.

3.1.2 Web survey

The web survey was distributed by the administration of each institution using different means (official email, internal web portal, social media) at the end of April 2018. Questions about socio-demographics and mobility behaviour were asked. The details of the topics investigated are presented in Figure 1. The web survey also served as a recruitment method for the focus group sessions. Students willing to participate in one of the two focus groups that would be held at their cégep were subsequently contacted by the research team.

3.1.3 Focus groups

Focus groups have been shown to be an effective way to explore in greater depth the underlying factors behind mobility choices of a specific population segment like young adults (Clifton and Handy, 2003). In addition, this method has been chosen over individual interviews because it allows for dynamic interactions between participants where ideas, attitudes and experiences formulated by one participant can lead others to recall specific experiences highly relevant to the topic (Geoffrion, 2009).

The focus groups were held in the two weeks following completion of the web survey. Two themes were explored during those discussions. In the first part, mode choice and overall mobility experience were discussed, while the second part focused on aspirations for future lifestyle and mobility. Furthermore, unlike traditional focus groups, two types of data-collection methods were used in addition to video recording of all sessions. First, throughout the first part of the discussions, participants were invited to answer directly, using their smartphone or tablet, to specific multiple choice questions shown on the projector screen via the interactive presentation software *Mentimeter*. The individual answers collected through the software were linked to each participant using a unique ID. Those questions either served as a topic start point or to quickly collect answers following a discussed topic. Second, to allow for richer and more detailed answers than permitted by the *Mentimeter* software, written answers to some questions were collected on a printout "participant's guide." For example, transport mode choice to school that day was asked via *Mentimeter* with onscreen aggregated answers used as a starting point for a discussion on perceived benefits and drawbacks of each mode (car, public transit, walking and cycling). Following the discussions on each mode, participants were asked to write down their personal top three perceived benefits and drawbacks for each mode.

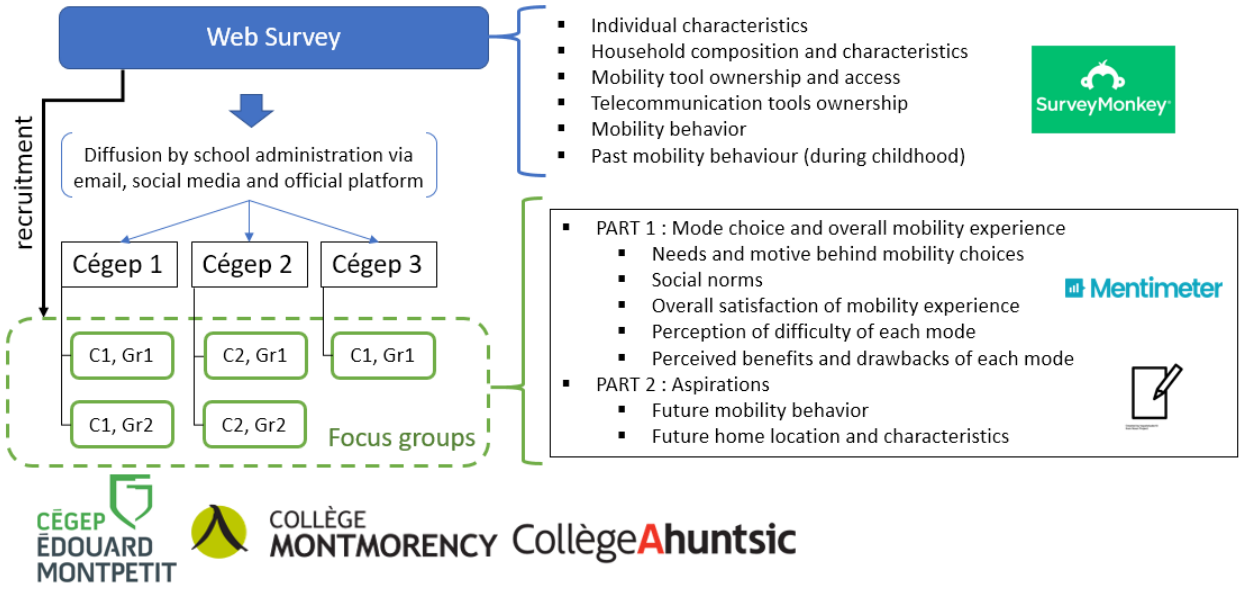


Figure 1 : Data collection process

The second part of the focus groups was a prospective exercise for which participants were asked to write down their aspirations for future lifestyle and mobility preferences. The time frame was set 10 years in the future (at a point when most participants would reach the age of 30) and the written questionnaire contained eight open-ended questions guiding them through the process of describing their "ideal" (but realistic) future. They were asked to describe: (Q1) the type of home they would like to live in; (Q2) their preferred residential location (e.g., central, suburbs, countryside) and neighbourhood characteristics they would favour (transport supply, amenities, vibe, etc.), (Q3) their desired work schedule and (Q4) their work location relative to their home location. For mobility preferences, they had to describe (in their own words) (Q5) which mode they would like to use for getting to different activity (work, leisure, shopping, etc.), (Q6) if they would own a car, they had to specify if they wanted more than one and of what type. To conclude, they were asked to (Q7) look back at their answers for the first six questions and indicate which elements are most important in their ideal future home location. The last question (Q8) asked them about how having a family would change their described prospective future. This prospective exercise was completed only by writing and participants were told that their aspirations would not be discussed openly at any point during the focus group sessions. The reason for this more private approach was to make sure participants could freely express their true aspirations while not being judged by other participants. Indeed, it can be assumed that aspirations for future lifestyle are something people would prefer not to share with strangers. Observation by the moderator of participants "hiding" their written answers during this part of the sessions confirmed that this was a good way to approach this topic in a focus group setting.

3.2 Participants characteristics

A total of 1750 respondents began the web survey, among which 1,656 were above 18 years old and agreed to the ethic consent form. Among those, 1,050 completed the questionnaire (64 per cent completion rate). The sample does not propose to be representative of the entire youth population in the Montreal area and while the survey was distributed by each institution's administration, it is hard to assess if it is representative of the student population of the three targeted cégeps since detailed

demographics of each institution could not be obtained. In total, the sample of students who completed the web survey represent 4.8 per cent of the three cégeps entire student population. While this could be considered high by many survey standards, because of the non-probabilistic nature of the sample, it is not possible to estimate margin of errors.

For focus groups sessions, the original plan was to hold six groups (two per institutions), but a total of five focus groups of five to eight participants were finally held for a total of 32 participants, which is in line with Morgan (1998) recommendations for optimal group size and number of groups. Each session was conducted in French and lasted between 75 and 90 minutes.

Descriptive statistics of web survey respondents and focus group participants are presented in Table 1. Those aged 35 and above are excluded from all further analysis as they are not the targeted demographic, which leaves 1,023 valid respondents. While the share of women in the sample appears considerably high, it needs to be noted that they also represent 57.6 per cent of the entire Québec province public cégeps population (Fédération des cégeps, 2019).

For each respondent, the neighbourhood type was assessed using Forward Sortation Area's density (FSA refers to the region defined by the Canadian postal code's first three characters). The threshold between types was defined based on knowledge of the Greater Montreal area and on analysis of FSA's density in order to divide roughly into "low density" (~ outer suburbs/rural areas), "medium density" (~inner suburbs) and "high density" (central/downtown areas). A map of the FSA by neighbourhood type is illustrated on Figure 2 with the number of respondents in each FSA. Finally, based on the observed statistics, it cannot be assumed that focus groups participants are representative of web survey respondents.

Table 1 : Web survey and focus group individual and household characteristics

		Web survey		Focus groups	
Variable	**Value**	**n**	**%**	**n**	**%**
		1023		32	
Individual characteristics					
Gender	Female	732	71.6 %	22	68.8 %
	Male	270	26.4 %	10	31.3 %
	Other/Prefer not to answer	21	2.1 %	0	0.0 %
Age	18-19	600	58.7 %	19	59.4 %
	20-21	188	18.4 %	4	12.5 %
	22-24	122	11.9 %	5	15.6 %
	25-29	82	8.0 %	2	6.3 %
	30-35	31	3.0 %	2	6.3 %
Cégep	Ahuntsic (City of Montreal)	238	23.3 %	4	12.5 %
	Édouard-Montpetit (South suburb)	485	47.4 %	13	40.6 %
	Montmorency (North suburb)	300	29.3 %	15	46.9 %
Program type	Pre-university	462	45.2 %	15	46.9 %

	Technical	535	52.3 %	16	50.0 %
	Other / did not mention	26	2.5 %	**1**	3.1 %
Employment status	Full time	94	9.2 %	0	0.0 %
	Part time	673	65.8 %	23	71.9 %
	None	237	23.2 %	9	28.1 %
	Did not mention	10	1.0 %	0	0.0 %
Household and location characteristics					
Living arrangements	Alone	26	2.5 %	1	3 %
	With partner/sharing	132	12.9 %	7	22 %
	With one parent	204	19.9 %	11	34 %
	With both parents	615	60.1 %	12	38 %
	Other	46	4.5 %	1	3 %
Number of cars	0	60	5.9 %	5	15.6 %
	1	243	23.8 %	9	28.1 %
	2	380	37.1 %	14	43.8 %
	3	211	20.6 %	2	6.3 %
	4+	118	11.5 %	2	6.3 %
Neighbourhood type	Low density (< 1400 people/km^2)	390	38.1 %	8	25.0 %
	Medium density (1400 to 3500 people/km^2)	273	26.7 %	8	25.0 %
	High density (> 3500 people/km^2)	330	32.3 %	16	50.0 %

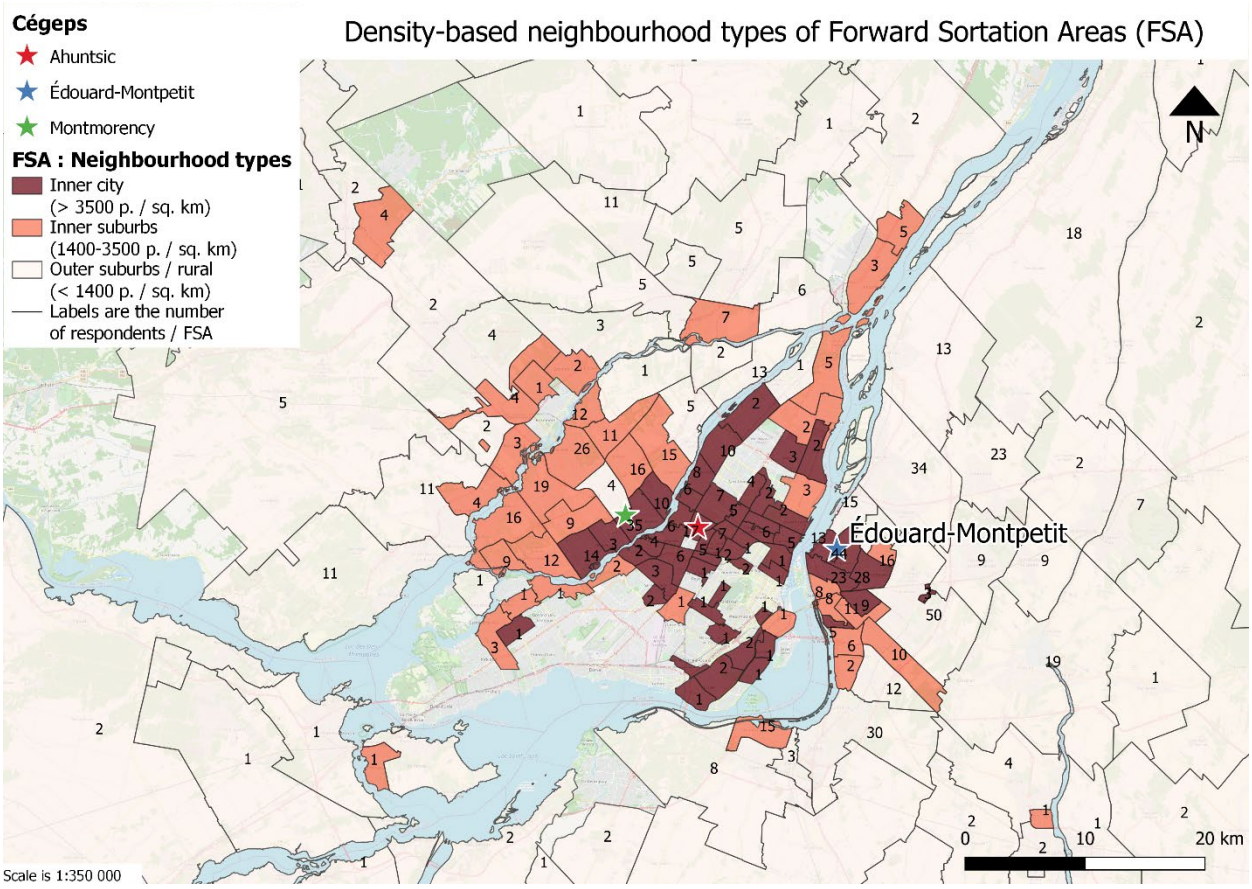


Figure 2 : Map of Forward Sortation Area (FSA) used for neighbourhood classification. The labels represent the number of respondents in each FSA.

3.3 Geographical context of the three cégeps

To understand the mobility behaviour of the survey respondents and focus group participants, it is necessary to give a bit of geographical and transportation context for each for the three collegial institutions where the data was collected. In the following subsections, characteristics of the built environment, transport system and regional role of each cégep are described.

3.3.1.1 Collège Ahuntsic

Collège Ahuntsic had a student population of 6,900 at the time of the data collection (Winter semester 2018) with 62 per cent enrolled in a technical program and 32 per cent in a pre-university program (College Ahuntsic, 2019). It is located eight kilometres northeast of Montreal's downtown in the Ahuntsic-Cartierville borough of the City of Montreal. Montreal city has a population of 1.78 million within the city proper (ISQ, 2019). The surrounding neighbourhood of the cégep is mostly residential with a mix of duplexes and triplexes apartment dwellings, condos and single-family homes. Parks and other institutions are also located in the vicinity. The neighbourhood has a population density of over 5,500 people/km^2, slightly above the City of Montreal average of 4660 people/km^2. It is well served by public transit, being located along the east branch of the orange Metro line, at a walking distance of one kilometre (12 minutes) from the nearest metro station and 1.4 kilometres (17 minutes) from the second nearest. It is also served by several bus lines of the Société de Transport de Montréal (STM), including

some high-frequency lines with headways of less than 10 minutes all day long. Accessibility by car is also good, being close to two major highways (A-40 and A-19). For students, parking is available but limited with only 870 permits awarded to students at an annual cost of $368 (Collège Ahuntsic, 2021). Daily parking cost is $4/hour, up to $12. Parking can also be found on nearby streets but is crowded during school days and subject to neighbourhood residents' permit restrictions.

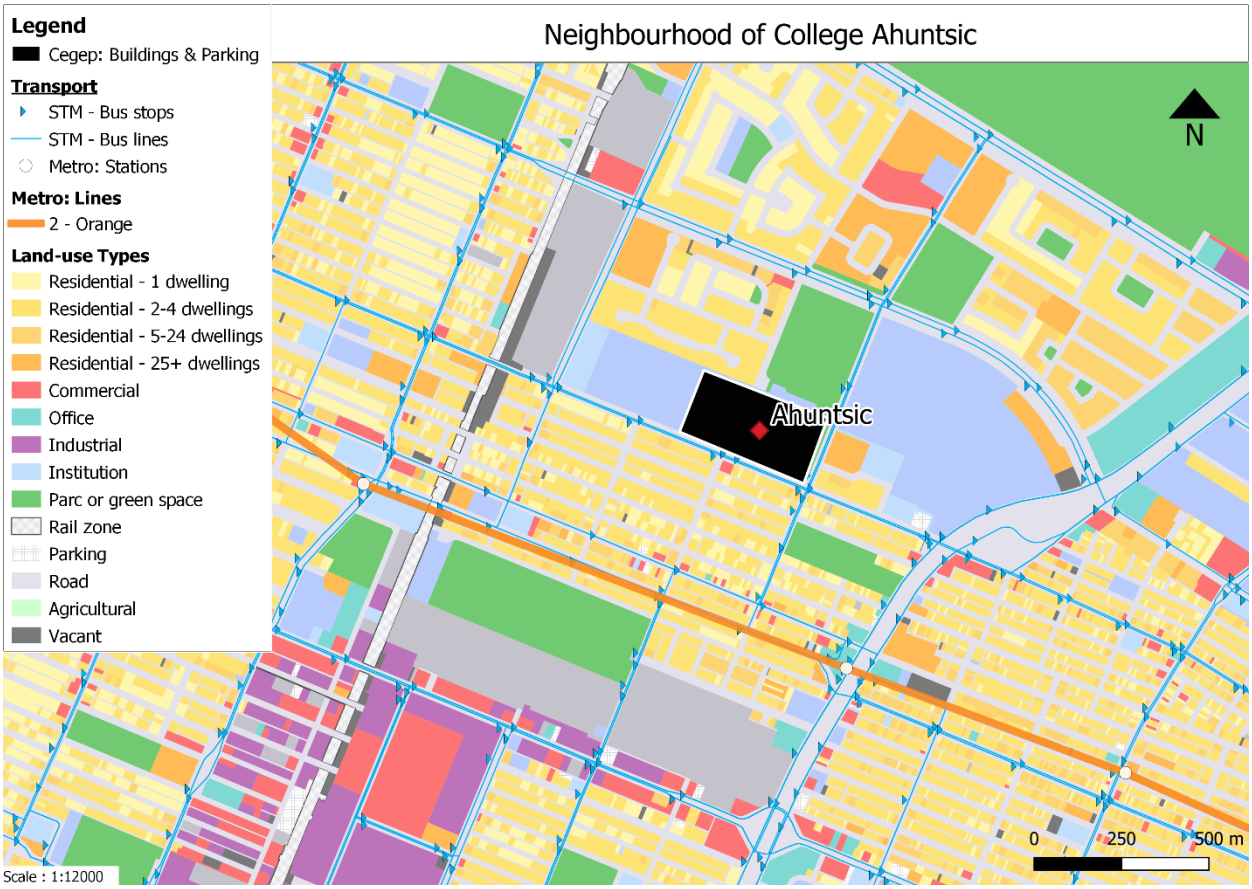


Figure 3 : Map of Collège Ahuntsic surrounding neighbourhood, Montréal

3.3.1.2 Cégep Édouard-Montpetit

Cégep Édouard-Montpetit is the largest cégep on the South Shore of Montréal, with a student population of 7,270 for the winter semester 2018 with 45 per cent enrolled in a technical program and 49 per cent in a pre-university program (Cégep Édouard-Montpetit, 2019). It is in the city of Longueuil, the second-largest suburb of the Montreal Metropolitan Area, with a population of 244,000 (ISQ, 2019) and has a wide regional attractivity on the South Shore. It is surrounded by a residential neighbourhood composed of mainly single-family homes along with other institutions and parks. Despite having a relatively central location in Longueuil, it is mostly served by the bus network. The closest and only metro station on the South Shore is at a walking distance of 3.3 kilometres (40 minutes) or 15 minutes by bus. As an important trip generator on the South Shore, the cégep is well served by numerous bus lines of the Réseau de Transport de Longueuil (RTL), with high frequency service (< 15 minutes) during morning and afternoon peak periods. For students, parking is available but requires an annual permit costing between $270 and $395 (Cégep Édouard-Montpetit, 2021). Daily parking cost is $10. Parking can also be found on nearby streets but is likely crowded during school days.

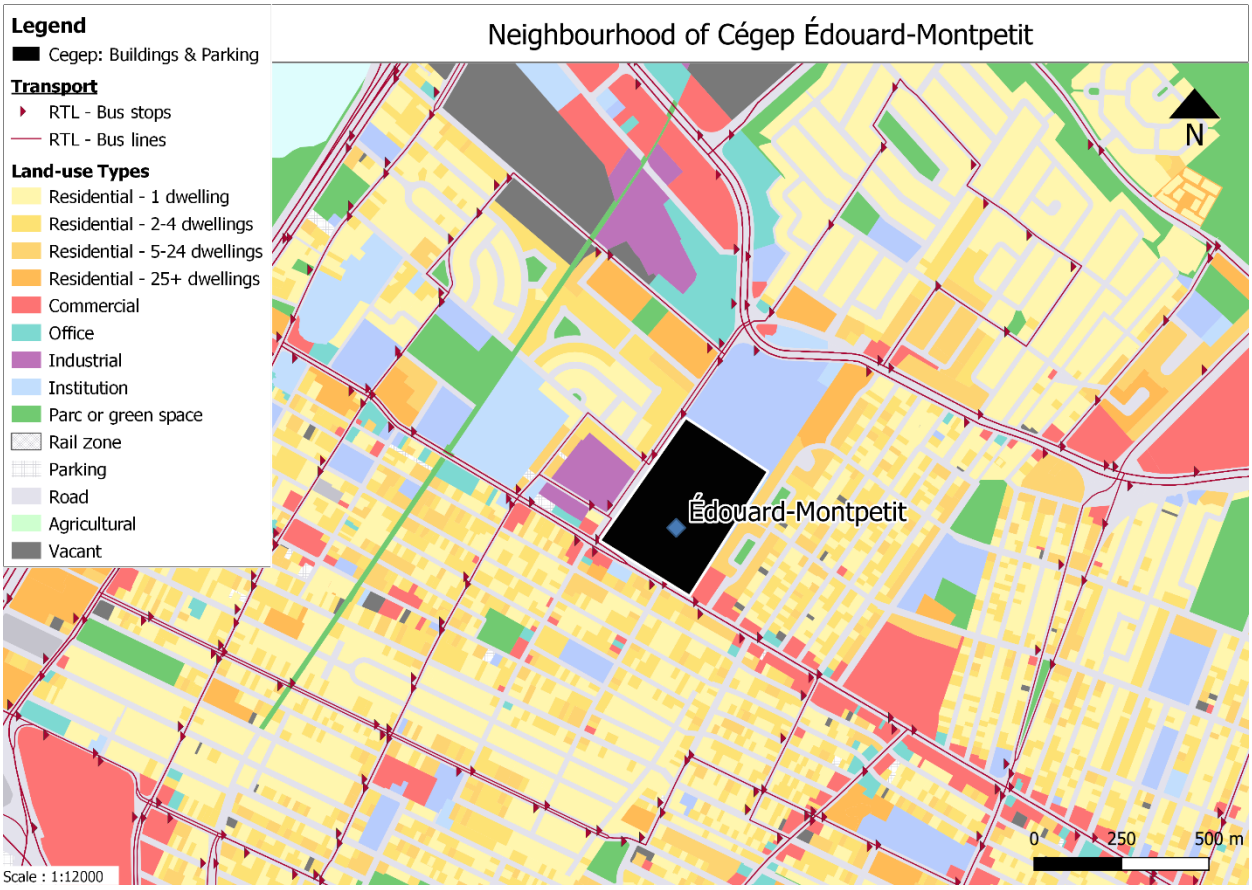


Figure 4: Map of Cégep Édouard-Montpetit surrounding neighbourhood, Longueuil

3.3.1.3 Collège Montmorency

Collège Montmorency is the only cégep in the suburb city of Laval, located on the island north of the Island of Montreal. For the winter semester 2018, total enrollment was 7,610, with 46 per cent in a technical program and 49 per cent in a pre-university program (Collège Montmorency, 2019). It is only one of two cégep for the entire North Shore suburbs and thus has a wide regional attractivity. With a population of 433,000, Laval is the largest suburb of Montreal (ISQ, 2019). In terms of transport, the institution is located across the street from Montmorency metro station, the terminus station of the orange line and one of three metro stations in Laval. It is also well served by the bus network of the Société de transport de Laval (STL), because Montmorency Station is the most important bus terminus in Laval, with convergence of numerous bus lines from all over the city. For students, parking is available but requires an annual permit. Unlike the two other cégeps, student parking permits are awarded through a lottery at the beginning of each semester (Collège Montmorency, 2021). Daily parking cost is $10. Parking can also be found on nearby streets but is likely crowded during school days and likely used by workers parking near Montmorency station before taking the Metro for the rest of their commute toward Montreal's city centre.

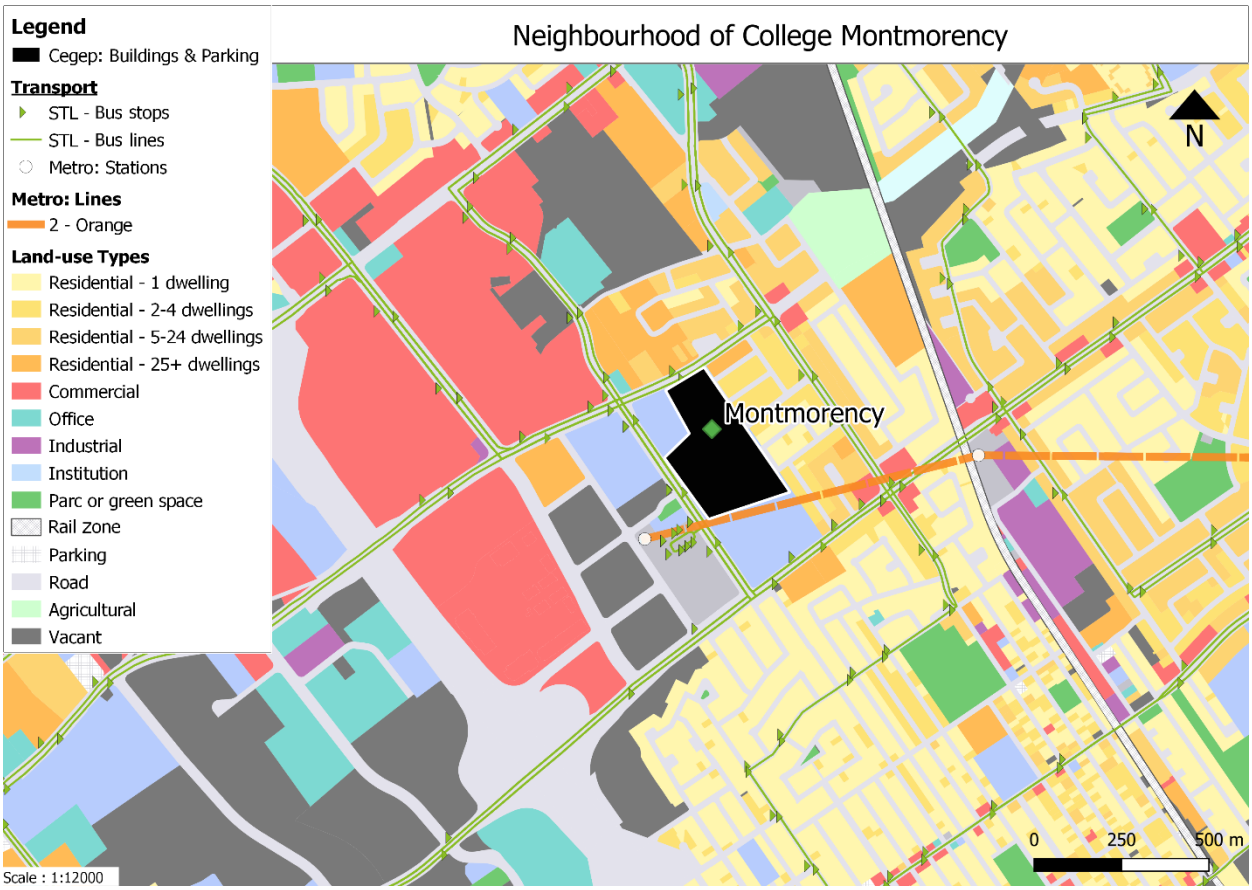


Figure 5: Map of College Montmorency surrounding neighbourhood, Laval

3.4 Statistical methods for comparing proportion between groups

To enhance the analysis of survey responses and respondents' characteristics, many statistics will be compared between subgroups. Two methods of grouping are used throughout the analysis: the first groups respondents based on their residential location neighbourhood type described in section 3.2. The second uses a latent class analysis to identify three mobility types based on modes of transportation used for regular trips. The method is described in section 4.6.1. For both grouping variables, any respondent cannot be in more than one group, making those groups independent from a statistical perspective. To assess whether the difference in frequency distribution (count) observed between groups for a categorial variable of interest (e.g., proportion owning a full driver's licence) is statistically significant, Pearson's Chi-Square test of independent is used. If the test is not significant, the null hypothesis cannot be rejected and the observed differences between groups for the variable of interest are due to chances. If the test is significant at a given criteria (e.g., $p < .05$), then the variable used for grouping (e.g., neighbourhood type or mobility type) is not independent from the variable of interest (e.g., proportion owning a driver's licence). If that is the case, post hoc tests are used to assess which sub-groups are statistically different from the entire sample.

For continuous variable (e.g., age), the mean difference between group is compared with the Kruskal-Wallis non-parametric significance test. If the test is significant at a given criteria (e.g., p-value < .05), then

the differences between each subgroup observed mean value is not due to chance. Throughout the result section, all results discussed are significant at $p < .05$ unless otherwise stated.

4 WEB SURVEY RESULTS

4.1 Driver's licensing

The first mobility-related question being investigated is driver's licensing. What proportion of respondents have a driver's licence, what distinguishes those with a licence and those without and what are the intentions of those who currently don't own a licence?

Figure 6 shows the proportion of survey participants having a driver's licence, along with the intention of acquiring a probationary license within one year for those who do not have one. A learner's licence indicates that the person has started the process of acquiring a licence but cannot drive alone, while a probationary licence allows one to drive alone but with some restrictions on alcohol consumption (zero tolerance) and reduced bracket of demerit points. Counting full and probationary licences, 68.3 per cent of respondent have a driver's licence.

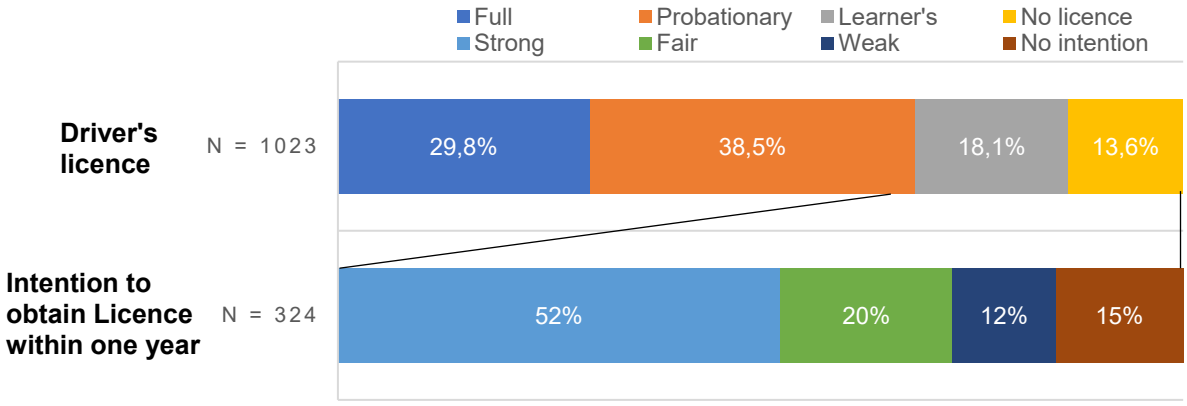


Figure 6 : Driver's licence among respondents and intention to obtain one within a year

To give a sense of comparison, the licensing statistics from the web survey are compared to the official statistics from the provincial agency responsible for issuing licences (*Société d'assurance automobile du Québec*, SAAQ). The official statistics are estimations by age and by year obtained by combining the number of driver's licence owners (probationary and full licences) open-data (SAAQ, 2019) and the between-census population estimations downloaded from the *Institut de la Statistique du Québec (ISQ, 2021).* The statistics are presented in Figure 7.

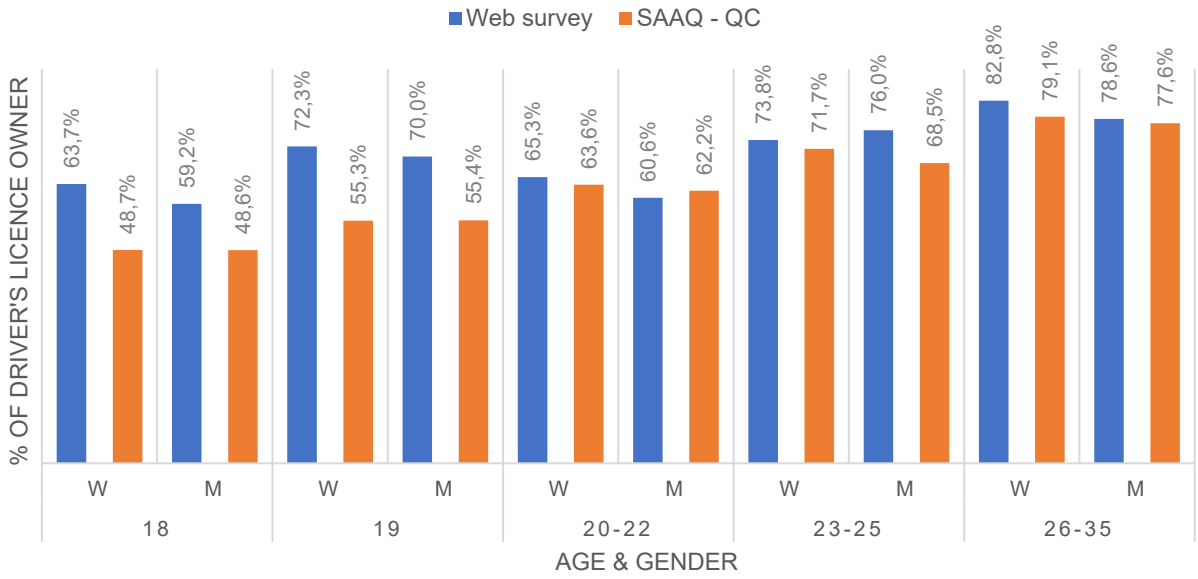


Figure 7: Proportion of licence owners (probationary and full licences), by age and gender from the web survey compared to official statistics from the SAAQ for the entire province in 2018.

For men and women aged 18 and 19, the licensing rate for the surveyed students is higher then the estimated rate for the Province of Québec as a whole. The numbers are similar for those aged 20 to 22 and are slightly higher for those aged 23 to 25 and 26 to 35.

Furthermore, the licensing rate of the surveyed population is higher for women than men for all age groups except those aged 23 to 25. The official statistics indicate that the rates are similar for those aged 18 to 19, but slightly higher for women aged 20-22, 23-25 and 26-35 than for men.

To gain some perspective on the decision of those young adults to obtain a licence, the link with the built environment characteristic in their home neighbourhood is investigated by comparing driver's licence type proportion across three neighbourhood types. The results are illustrated in Figure 8.

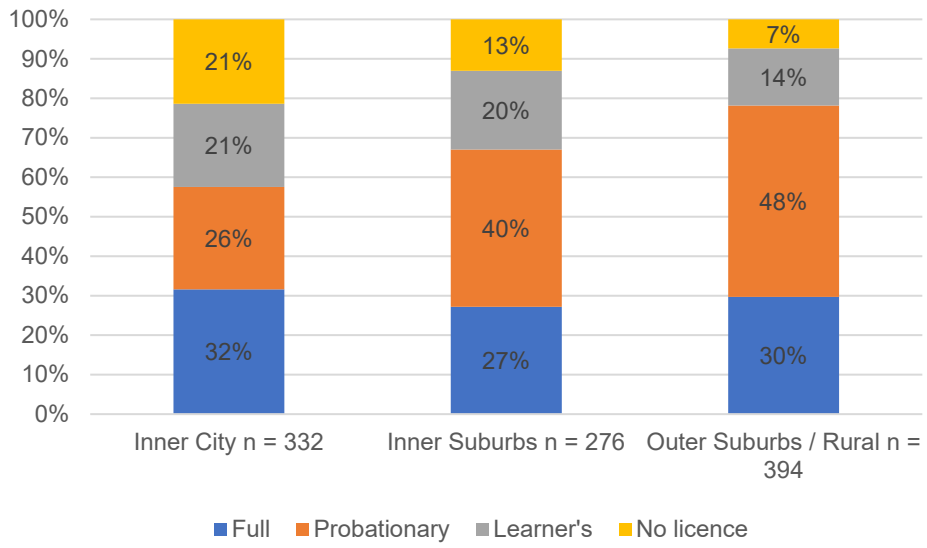


Figure 8 : Licensing proportion by density-based neighbourhood type (see Table 1 for the 3 types)

Chi-square post-hoc tests indicate that there are no differences for the proportion of students owning a full or a learner's licence between the three neighbourhood types. For probationary licences, those living in an inner-city neighbourhood have a lower propensity to own one and those living in outer suburbs/rural area have a higher propensity.

The situation is the opposite for the proportion of students having no licence at all. The proportion of inner-city students without a licence is higher and those living in outer suburbs/rural areas have a lower proportion than the entire sample.

This seems to confirm that a driver's licence is less perceived as a necessity in urban than suburban and rural settings.

4.2 Car accessibility

While later in life, most people will have access to a vehicle through ownership, at their current life-stage, many young adults might have different levels of access to a family household vehicle. Figure 9 shows the type of accessibility to a vehicle that the licence owner participants have (n = 699). The majority possess their own vehicles (54 per cent) while 38 per cent have varying level of access to their household car and less than 10 per cent have occasional or no access to a vehicle.

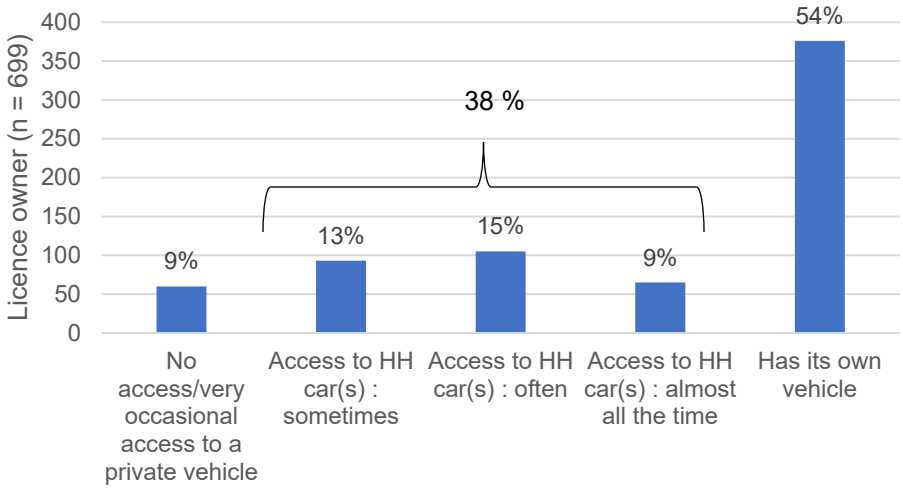


Figure 9 : Access to a vehicle

These numbers vary based on where the respondents live. Figure 10 shows the distribution of respondents based on home neighbourhood types.

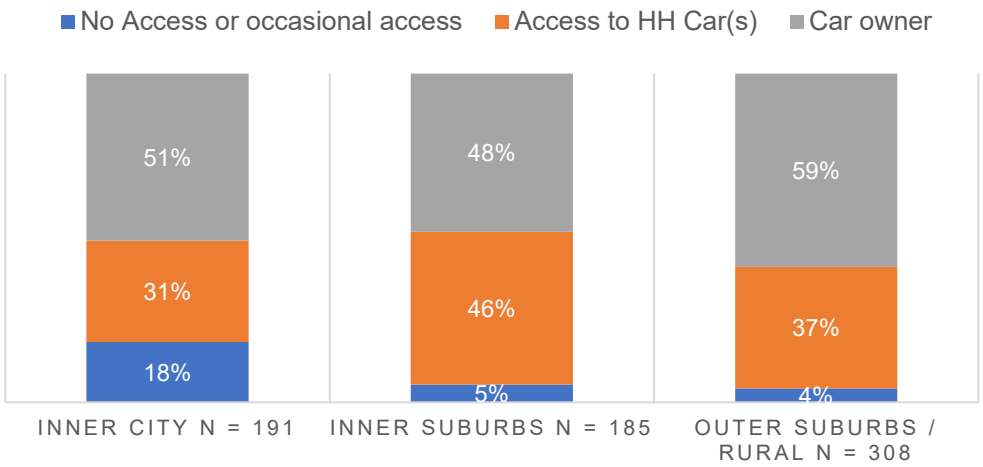


Figure 10 : Distribution of car accessibility by density-based neighbourhood type

Inner city respondents are more likely to have no/occasional access to a vehicle ($p < .001$). Those living in the inner suburbs are more likely to have access to a vehicle through their household (46.8 per cent). Outer suburbs/rural area respondents have the highest proportion of students with their own vehicle, but the difference is not statistically significant ($p = .17$) compared to the entire sample.

4.3 Access to other mobility tools

Mobility tools are those instruments that allow an individual to use a certain mode of transportation. Private car, bicycle and motorcycle and even a driver's licence are considered, in the transportation research literature, as mobility tools, along with tools allowing access to shared mobility options: transit pass, car-sharing membership and bike-sharing membership.

Bicycle

Fewer than half the participants (46 per cent) have a bicycle that they can use for trips. This proportion is not statistically different across neighbourhood types (inner city: 48 per cent, inner suburbs: 42 per cent, outer suburbs/rural: 46 per cent) based on the Chi-square test.

Bike-sharing (BIXI)

When asked about a current subscription to Montreal's bike-sharing system (BIXI) and their intention for the upcoming summers, 91 per cent indicated they had no subscription and had no intention of getting one, five per cent had no subscription at the time of completing the questionnaire and were uncertain of whether they would join or not, two per cent had not yet subscribed but were planning to do so and one per cent had already subscribed. However, all three cégeps are in areas with no or very low density of bike-sharing stations. These cégeps also attract an important suburban student population, which has no access to bike-sharing at their home location. Thus, the bike-sharing system might not serve their mobility needs well.

Transit pass

Participants were asked to indicate what kind of transit pass they had in April 2018 (most completed the survey late April or early May). The distribution is illustrated on Figure 11.

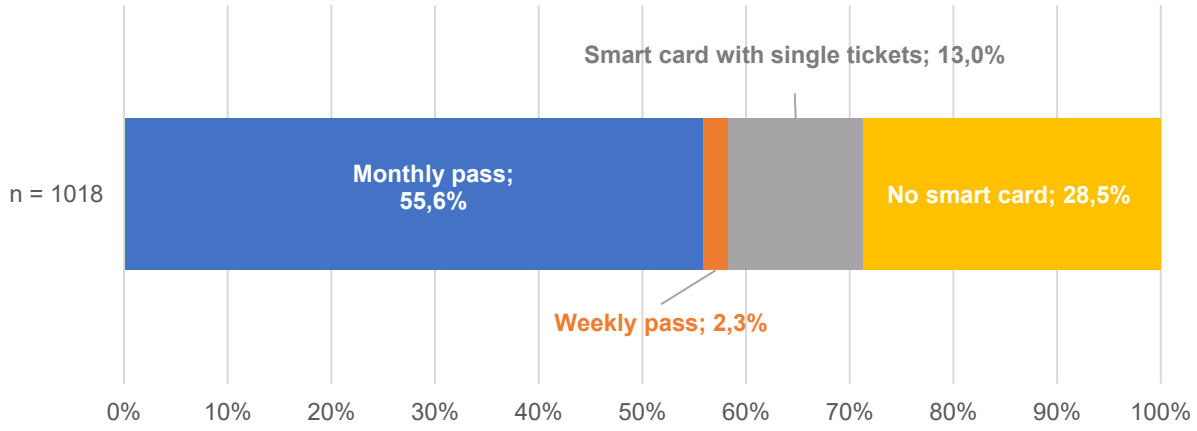


Figure 11 : Transit pass ownership

A followup question asked how many monthly transit passes they had in the last 12 months: 30.5 per cent indicated they never bought a single monthly pass, another 30 per cent bought between one and eight transit passes, 22 per cent between nine and 11 and only 16 per cent had a monthly pass all year.

4.4 Telecommunication tools

Telecommunication tools are an important aspect of today's urban mobility (Gössling, 2018). A smartphone along with a data plan allows people to download apps to get directions (e.g., Google Maps, Waze), view transit schedules and routes (e.g., Transit App), identify the locations of nearby bike-sharing and car-sharing stations or vehicles and even order an on-demand mobility service (e.g., Uber, Taxi, etc.). When commuting using public transportation, smartphones can provide entertainment (readings, mobile games, etc.) and a way to get work done (emails, readings, etc.). The commuting time, which was once considered "downtime," can now be use as productive time. This has changed the dynamic of using public transit (Keseru and Macharis, 2018).

Younger generations are known to be more connected than previous generations. Understanding what, how and when telecommunication tools are used in relation to transportation is thus an important question in understanding the mobility behaviour of the younger millennials investigated in the current study. The first question was: What type of cellphone do they have? Results are presented in Table 2.

Table 2 : Cellphone / smartphone ownership

	no cellphone	regular cellphone	smartphone without data	smartphone with data	NA
n = 1023	36	23	189	769	6
%	3.5%	2.2%	18.5%	75.2%	0.6%

Those having answered owning a smartphone, with or without data, were asked if they had installed common transport-related apps. Results are shown in Table 3.

Table 3 : Transport-related installed apps on smartphone

		% Smartphone owner		Difference
		With data	No data plan	Chi square test[1]
		n = 769	n = 189	p-value
Direction apps	Google Maps	85%	87%	NS
	Apple Plan	30%	21%	< .05
	Waze	21%	7%	<.001
Transit trip-planning apps	Transit app	29%	23%	< .10
	Chrono (ARTM's app)[2]	4%	8%	< .05
	Local transit agency app[3]	22%	25%	NS
Shared mobility and on-demand services	Uber	21%	13%	< .05
	Any taxi app	3%	3%	-
Parking	Stationnement MTL (Parking MTL)	5%	2%	-

[1] P-value of the chi-square test performed to assess if there is a statistical difference between those with data and those without data plans for each installed app.

[2] Chrono is the ARTM's (The Greater Montreal transit planning authority) trip-planning app.

[3] Any of the apps of the four transit operators in the Montreal area (exo, STM, STL, RTL)

Google Maps is by far the most widely installed app. As it comes by default on Android smartphones, this comes as no surprise. Google Maps also provides driving, cycling and walking directions, as well as transit trip planning. Transit App and the local transit agency apps are also popular alternatives for transit trip planning. The relatively new app, Chrono, by the Authorité Régionale de Transport Métropolitain (ARTM) is only marginally used by respondents.

According to a study by the Pew Research Center (2016) in the United States, on-demand ride-hailing services such as those provided by Uber and Lyft are most popular among young adults aged 18 to 29 (compared to any other age group) with 28 per cent reporting having used ride-hailing services. In the current survey, Uber app (the only transportation network company operating in Montreal) is installed by

19.4 per cent of smartphone owners. Furthermore, apps requiring live internet access to be used (Uber, Waze, Transit Apps) tends to be statistically more popular among those with data plans. While having data on your phone is convenient to use those apps, people can access those apps on their cégep wi-fi network when they are within range, and thus plan their trip using those apps even without cellular data.

4.5 Actual mobility behaviour

Mobility behaviour was assessed in two ways. The first question asked what sequence of mode of transportation students used to get to campus. Unfortunately, the question was misunderstood and careful analysis of individual answers revealed that many did not provide the sequence of mode used (e.g., walking to the bus stop, talking the bus, taking the metro, walking to the cégep, which would give the sequence walk-bus-metro-walk), but instead, listing the different mode they sometimes use to commute to school. Due to this inconsistency in the answers, the data from this question could not be analyzed.

The second question asked the frequency of use for a variety of transportation modes. The question was a multiple choices question, with frequency for each mode ranging from *never* to *seven or more times/week*. Figure 8 illustrates the distribution of respondent by frequency of use for each mode.

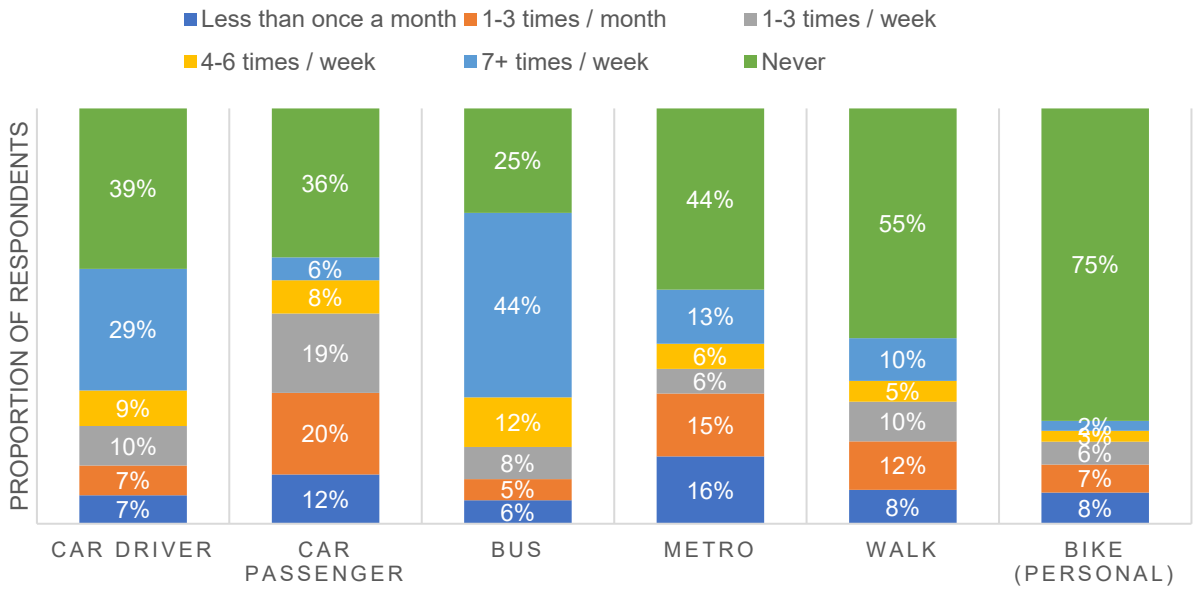


Figure 12 : Frequency of mode use - n = 1023

Distributions of frequency of use for Uber, taxi, commuter train, car-sharing and bike-sharing were excluded from Figure 12 because more than 90 per cent of respondents indicated never using those modes. The bus is the most widely use of all modes, followed by the car as driver and the car as passenger. The metro comes fourth, which can partially be explained by the fact that two out of three cégeps are located in the suburbs, one (Montmorency) across the street from the terminus station of the orange metro line and the other (Édouard Montpetit) located more than 3.5 kilometres away from the only metro station on the South Shore (about 40 minutes at a normal walking pace). For a more complete description of each cégep context, see section 3.3.

4.6 Mobility types analysis

Analyzing the general use of each mode gives us an overview of mode use but doesn't tell us much about individual behaviour. Focusing on the individuals, a segmentation process is used to assess different mobility types based on frequency of use of each mode of transport. The idea of segmentation is to group individuals or objects into segments (group, class or cluster), based on a set of input variables, so that people within a segment are more similar than people from different segments.

4.6.1 Method of analysis

To segment participants into mobility types a latent class analysis (LCA) is performed. LCA is a model-based approach to clustering, which, unlike traditional unsupervised clustering methods, relies on estimated membership probability to classify cases into the appropriate segments (Magidson and Vermunt, 2002). Unlike traditional clustering methods such as the well-known k-means algorithm, LCA can take as input indicators categorical or ordinal indicators. In the current case, the input variables are ordinal indicators representing frequency of use of six modes of transportation as illustrated in Figure 8. To perform the analysis, the *poLCA* package of the R software is used (Linzer and Lewis, 2011). While the LCA modelling can handle missing values using model-based imputation, some cases had nonetheless to be dropped because they had too many missing variables. All those with four or more missing variables out six were dropped, which left 1,001 cases to be used for the segmentation.

To determine the best number of class, fit statistics such as the Bayesian information criterion (BIC) or the Akaike information criterion (AIC) that penalize models with a higher number of parameters can be used. The authors of the poLCA package indicate that the BIC is more appropriate for basic latent class models (Linzer and Lewis, 2011).

4.6.2 Results: Three distinct mobility types

Two- to six-class models were tested and were compared using Bayesian information criterion (BIC). The BIC was lowest for the three-class model. The average frequency of use of each mode for the three-class solution is illustrated in Figure 9.

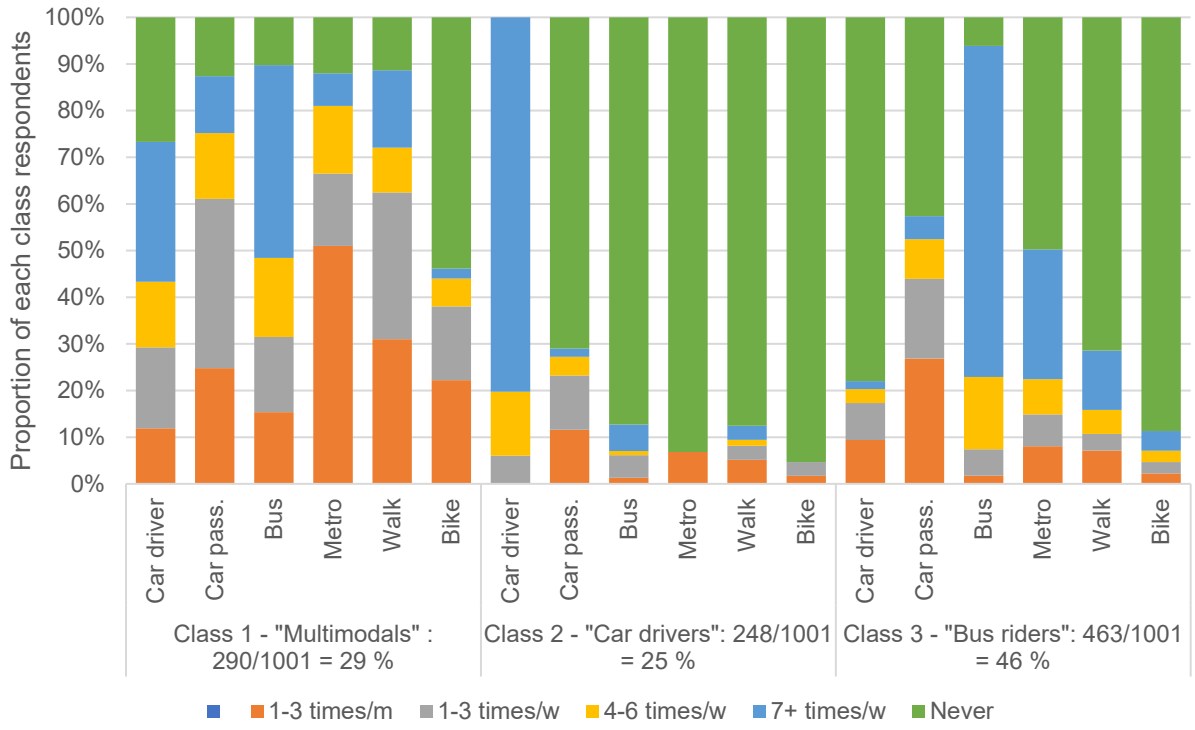


Figure 13 : Frequency of use of transportation mode by latent class

Class 1 (29 per cent) contains the most multimodal users, using most modes on a regular basis. They are the most frequent users of all modes except bus and car as driver. This class is termed “multimodals.” It is the second-largest class.

Class 2 (25 per cent) presents a strong proportion of mostly car drivers (driving more than four times per week) with some very occasional use of other transport modes. More than half of them (53 per cent) reported never using any of the four non-auto modes. This group is simply called “car drivers.”

Class 3 (46 per cent) is the largest class and is dominated by frequent bus riders. People in this group also rely often on being given rides, while never or only occasionally driving. This class is named “bus riders.”

To gain a deeper perspective on each class, sociodemographic, mobility and residential location characteristics of each class are presented in Table 4. Highlighted values in the table indicate that the difference between the proportion or mean value for the mobility type is statistically different than the entire sample.

Table 4 : Sociodemographic and mobility statistics by mobility types

	C1 : Multimodals	**C2 : Drivers**	**C3 : Bus riders**	**TOTAL**

	N (web-survey)	290	248	463	1001
	Sociodemographics				
	N (focus groups)	11	5	16	32
	Average age	20.0	21.33	20.0	20.3
	% Women	73.5%	73.3%	73.1%	73%
Program type	Pre-university	54.3%	29.1%	51.1%	45%
	Technical	45.7%	70.9%	48.9%	52%
Employment status	No job	26%	12%	30%	24%
	Part-time	64%	74%	64%	66%
	Full-time	10%	14%	**7%**	9%
Household composition	Alone	2%	4%	2%	3%
	With partner/sharing	12%	16%	11%	13%
	With one parent	23%	17%	19%	20%
	With both parents	58%	57%	64%	60%
	Other	4%	6%	3%	4%
Cégep	Ahuntsic	22.8%	16.5%	27.4%	23%
	Édouard-Montpetit	44.5%	56.0%	43.8%	47%
	Montmorency	32.8%	27.4%	28.7%	29%
	Mobility characteristics				
Car accessibility	No licence	31%	0%	49%	32%
	No access or occasional access	7%	0%	8%	6%
	Access to HH car(s)	29%	11%	32%	26%
	Has own vehicle	34%	88%	11%	37%
Driver's license	No licence	11%	0%	22%	14%
	Learner's	19%	0%	27%	18%
	Probationary	45%	37%	36%	39%
	Full	24%	63%	15%	30%
Transit pass	No pass, no Opus card	20%	80%	6%	29%
	Opus card with single tickets	22%	13%	8%	13%
	Weekly pass	2%	0%	4%	2%
	Monthly pass	56%	6%	83%	56%
Bike ownership	Yes	63%	32%	42%	46%
Neighbourhood type	Inner city	38%	19%	38%	33%
	Inner suburbs	24%	28%	30%	28%
	Outer suburbs/rural	38%	54%	32%	39%

Notes: a coloured background indicates that the class proportion is statistically different than the entire sample based on the chi-square post hoc test.

Legend: Statistically HIGHER | Statistically LOWER

Class 1, the "multimodals":

In terms of sociodemographic characteristics, this group is not statistically different from the entire sample on any aspects. Mobility-wise, they differ from the two other groups only in terms of transit pass holdings and bike ownership. The multimodals are less likely to have no smart (Opus) card and more likely to have a smart (Opus) card with single tickets. A higher proportion of them own a bike that they can use for theirs daily trips.

Class 2, the "car drivers":

This group is statistically a bit older than the two other groups. A higher proportion of them follow a technical program. More of them have a part-time job. This could either be a cause (working allows them to pay for their car) or a consequence (they need a car to get to work) or a combination of both. While they appear to be more likely to live alone, with a partner or with roommates compared to the two other groups, the difference is not statistically significant. More of them attend the South Shore suburban, Cégep Édouard-Montpetit and a lower proportion of them attend Collège Ahuntsic (on the Island of Montreal). This could be explained by the geographical context of Cégep Édouard-Montpetit: it is the least accessible of the three institutions by public transit, while Collège Ahuntsic is the most accessible.

In terms of mobility, unsurprisingly, all of them have a driver's licence, either full (63 per cent) or probationary (37 per cent) and the vast majority have their own car (88 per cent). Only six per cent hold a monthly transit pass compare to and 80 per cent who don't even own a smart card to load transit passes and tickets. They are the least likely to own a bike for getting around. A statistically higher proportion of them live in the outer suburbs/rural and lower proportion in inner-city neighbourhoods

Class 3, the "bus riders":

The bus riders are the same age as the entire sample. A higher proportion has no job. A higher proportion are attending Collège Ahuntsic, the more urban of the three cégeps.

In terms of mobility characteristics, they are more likely to have no driver's licence (49 per cent) or a learner's licence (27 per cent) and only 11 per cent have their own car. A statistically higher proportion of licence holders of that group have access to a family car either sometimes (15 per cent) or often (13 per cent) than the entire sample. Unsurprisingly, 83 per cent have a monthly transit pass. In terms of where they live, they are the group least likely to live in an outer suburb/rural context.

Geographic distribution of the three mobility types

To illustrate the geographic distribution of the three mobility types relative to each cégep, three maps showing respondents' home location along with standard deviational ellipse (SDE) are created. A SDE is a measure of spatial dispersion to assess the spatial distribution of point coordinates. In the current case, the coordinates represent the main home location[1] of each respondent in each of the three mobility classes for each cégep. The ellipses are computed using QGIS Standard Deviational Ellipse plug-in, which uses Yuill (1971)'s algorithm so that the area within the ellipse boundaries contains 66 per cent (one

[1] Some respondents declared living with separated parents, and thus having "two" homes. The home they declared living at for most school days was selected for this analysis.

standard deviation) of the input points. The distributions for Collège Ahuntsic are illustrated in Figure 14, for Cégep Édouard-Montpetit in Figure 15 and for Collège Montmorency in Figure 16.

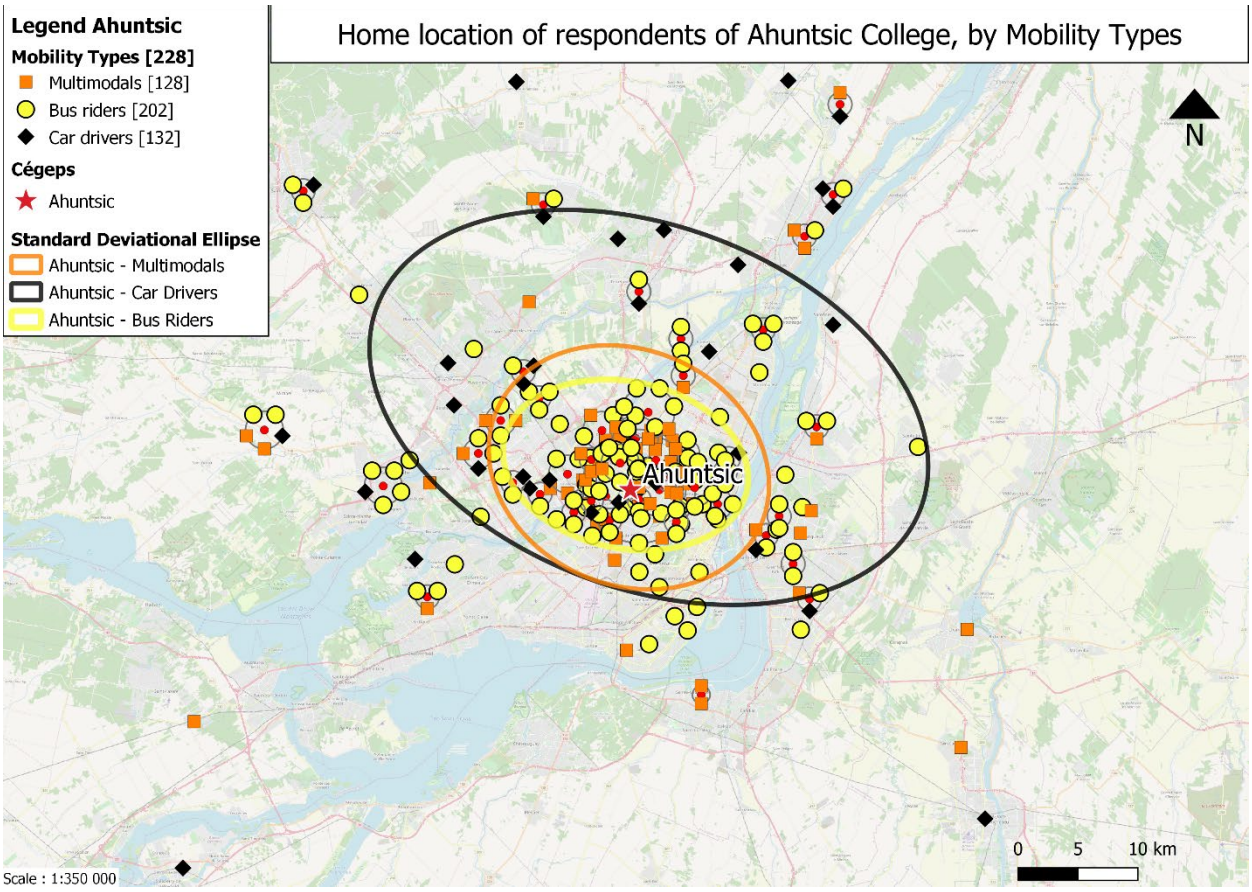


Figure 14 : Distribution of Collège Ahuntsic respondents' home location by mobility type, with standard deviational ellipse (SDE) for each type.

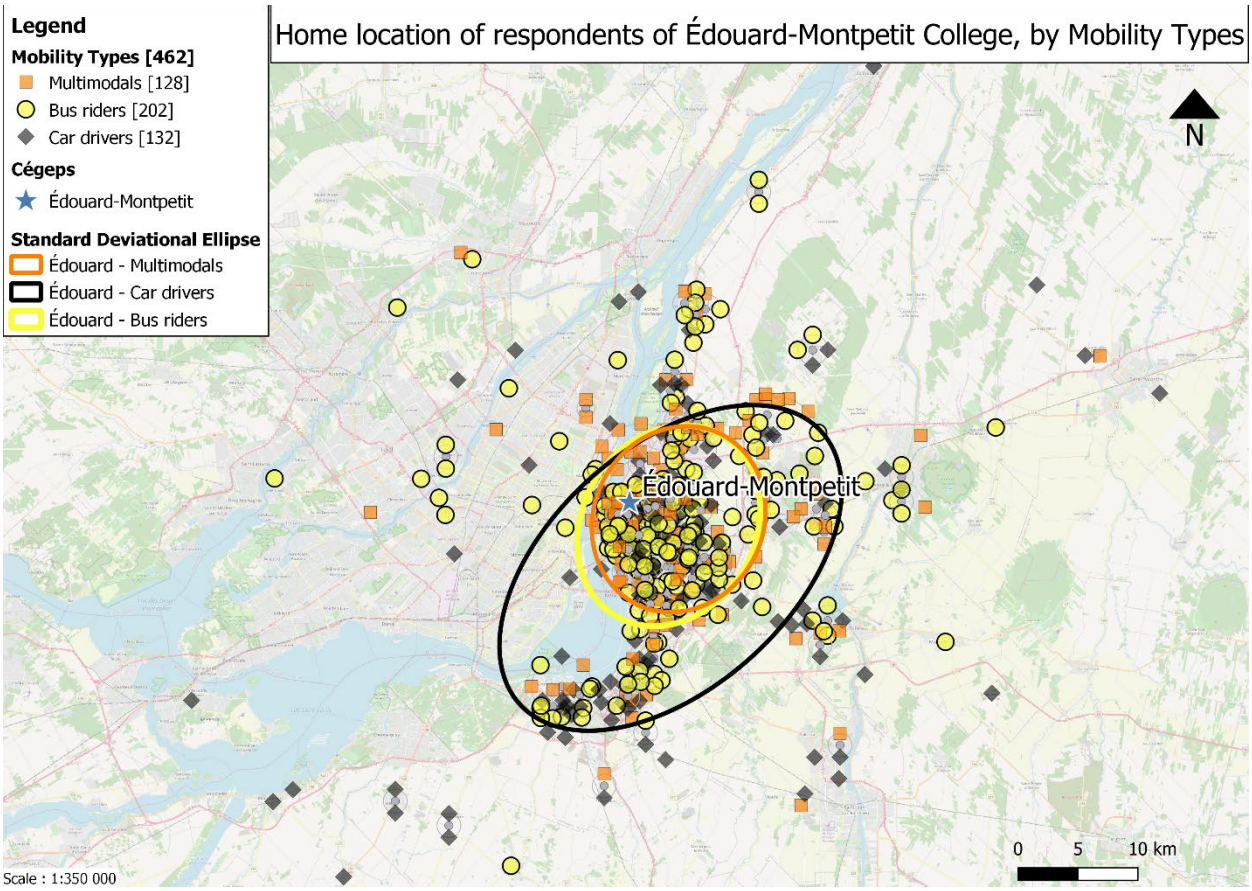


Figure 15 : Distribution of Cégep Édouard-Montpetit respondents' home location by mobility type, with standard deviational ellipse (SDE) for each type.

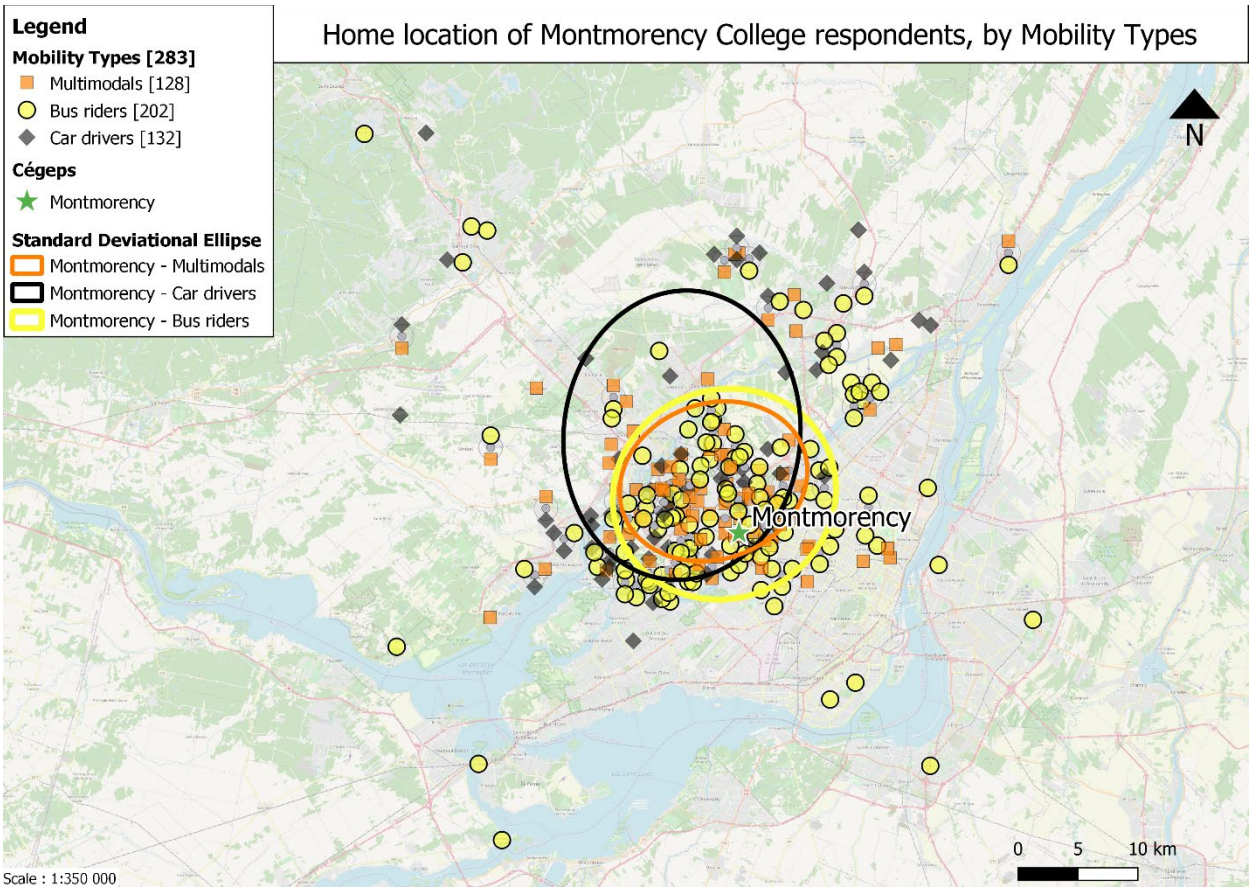


Figure 16 : Distribution of Collège Montmorency respondents' home locations by mobility type, with standard deviational ellipse (SDE) for each type.

To further help the analysis, mean Euclidean distance between residential locations to each respondent's cégep are presented in Table 5.

Table 5 : Average Euclidean distance between respondents' home location and their cégep.

[KM]	C1: Multimodals	C2: Car drivers	C3: Bus riders	Avg dist. by cégep
Ahuntsic	10.71	22.84	9.90	12.34
Édouard-Montpetit	8.81	15.40	9.73	11.10
Montmorency	8.84	14.39	10.49	10.84
Avg dist. by class	9.25	16.37	10.00	11.32

For all three institutions, those classified as "car drivers" are more spread out as illustrated by the larger standard deviation ellipses in Figure 14, Figure 15 and Figure 16, confirmed by a statistically higher average distance (16.4 km) to their respective cégep. The difference is most striking for those attending Collège Ahuntsic (22.8 km) with some of the *car drivers* type even located outside the map boundaries. It is worth noting that Collège Ahuntsic has some programs offered only in a limited number of collegial institutions in the Montreal metropolitan area, such as a police technical program and thus might be attracting students located further away.

As for multimodals and bus riders, both groups show dispersion ellipses very similar in size and orientation for Édouard-Montpetit and have a mean home-cégep distance that is not statistically different. For Montmorency students, bus riders seem slightly more dispersed than the multimodal group and are located on average 1.65 kilometres further away. However, this difference is marginally significant at $p < .10$. Finally, for those attending College Ahuntsic, it is the opposite, with the multimodals slightly more dispersed based on their deviational ellipse. However, the mean distance to the cégep is not statistically different between multimodals and bus riders.

Overall, this analysis illustrates that a larger proportion of those classified as "car drivers" who rely almost exclusively on the car to get around tend to live further away from their collegial institution in suburbs where alternatives to the automobile might be scant (54 per cent live in low-density outer suburbs/rural neighbourhoods compared to 38 per cent for multimodals and 32 per cent for bus riders. See Table 4 for details). Those few respondents living very far away might skew the distribution and have an excessive effect on the mean. The median distance between home and respective cégep for car drivers was calculated and is also statistically higher for this group for all three cégeps, but to a lower extent.

However, it is worth noting that a large proportion of car drivers also live in the same neighbourhood as the multimodals and bus riders. In fact, 40 per cent of the car drivers live closer to their respective cégep than the mean home-cégep distance for the multimodals and bus riders combined. This indicates that those 40 per cent of car drivers could potentially choose to use alternative transportation modes for their daily trips, including to get to school, but decide not to. Alternatively, this could also indicate that some of the multimodals and bus riders groups residing far away from their cégep might prefer to use a car if they had the opportunity.

To gain a deeper understanding of who is in a situation of choice for each mobility type (for example, who currently driving has, in fact, access to good quality public transit), competitiveness indicators between public transit and the car should be computed. This is, however, beyond the scope of the current study and should be investigated in future research.

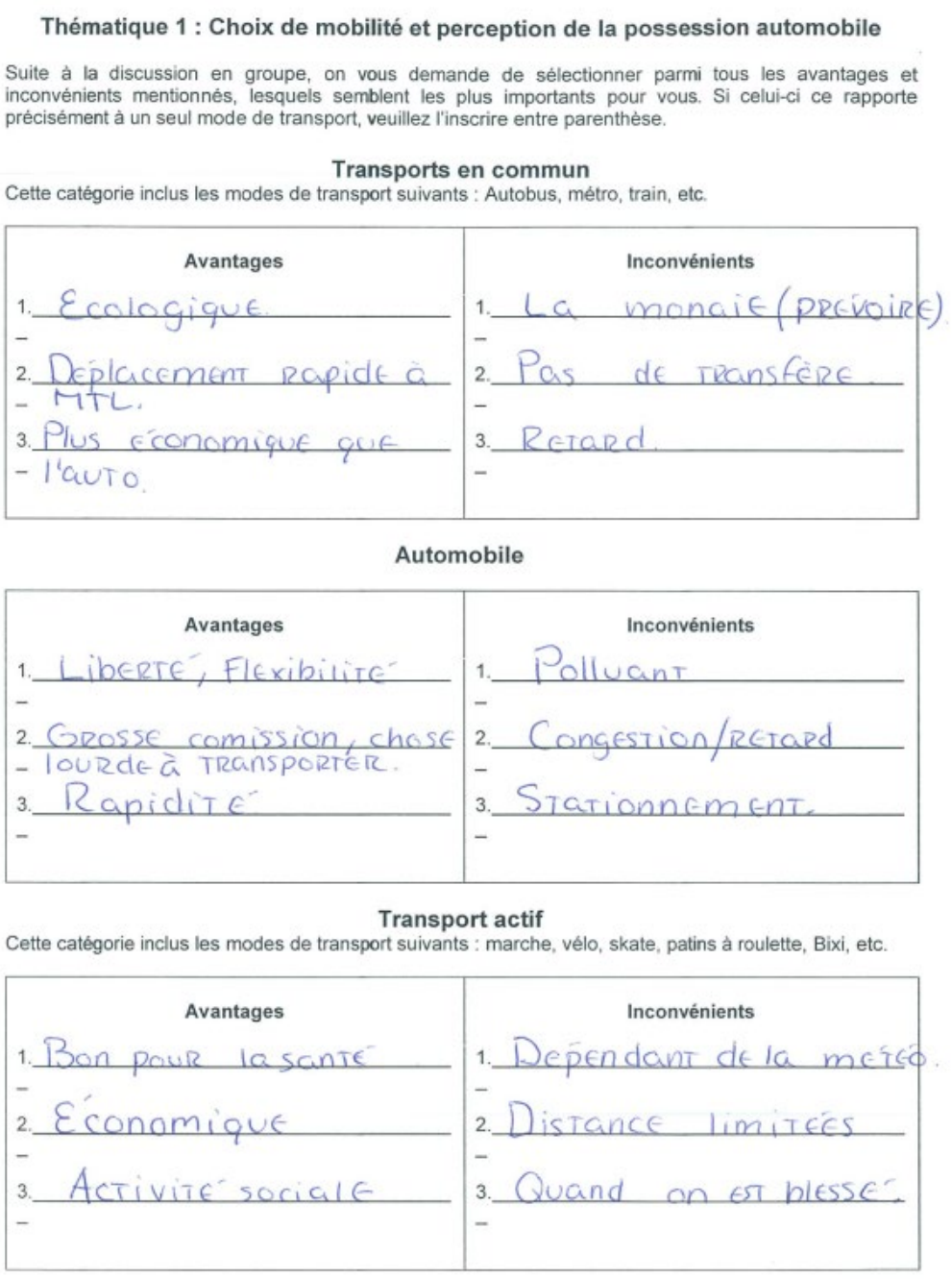
5 FOCUS GROUPS RESULTS

5.1 Beliefs regarding transportation modes

The first topic investigated during the focus groups was beliefs about transportation modes. In the well-established "theory of planned behaviour," behavioral beliefs are important as they underpin and shape attitudes toward intention to perform a behaviour, such as driving to school or using public transit (Ajzen, 1985, 1991). Three modes were discussed in the following order: public transportation, car (as driver or passenger) and active transportation (walking and cycling). For each mode, participants were first asked to describe the perceived positive and negative aspects of using the mode. Each conversation lasted from 10 to 15 minutes and all were rich in anecdotes and personal experiences. During the discussion, an assistant wrote down the positive and negative aspects mentioned, and the list was projected on a screen for everyone to see. After the conversation about a mode had reached an equilibrium where no new aspects were being mentioned, respondents were asked to write in their participant's guide what they felt were the three main advantages and three main disadvantages for the mode. Then the conversation moved to the next mode.

5.1.1 Method of analysis

Since the participants were asked to write short answers, a classification method was needed to identify the most recurring aspects. An example of written answers (in French) is illustrated in Figure 11.



Thématique 1 : Choix de mobilité et perception de la possession automobile

Suite à la discussion en groupe, on vous demande de sélectionner parmi tous les avantages et inconvénients mentionnés, lesquels semblent les plus importants pour vous. Si celui-ci ce rapporte précisément à un seul mode de transport, veuillez l'inscrire entre parenthèse.

Transports en commun

Cette catégorie inclus les modes de transport suivants : Autobus, métro, train, etc.

Avantages	Inconvénients
1. Écologique.	1. La monaie (prévoire)
2. Déplacement rapide à MTL.	2. Pas de transfère
3. Plus économique que l'auto.	3. Retard.

Automobile

Avantages	Inconvénients
1. Liberté, Flexibilité	1. Polluant
2. Grosse comission, chose lourde à transporter.	2. Congestion/Retard
3. Rapidité	3. Stationnement.

Transport actif

Cette catégorie inclus les modes de transport suivants : marche, vélo, skate, patins à roulette, Bixi, etc.

Avantages	Inconvénients
1. Bon pour la santé	1. Dépendant de la météo.
2. Économique	2. Distance limitées
3. Activité sociale	3. Quand on est blessé.

Figure 17 : Example of written answers to perceived aspects of each mode in the participant's guide

To analyze the written data collected in the participant's guide, semantic analysis was conducted using a three-step process.

Step 1: Codification

An expert (the main author) listed in an Excel spreadsheet all the participants' answers for each of the six mode/aspects combination (pros/cons for public transport, pros/cons for the car, pros/cons for active transport). The list was sent to two independent judges familiar with the semantic analysis process[2].

Step 2: Creation of categories and classifications

The two judges independently elaborated a set of classification categories of answers (e.g., safety, convenience, price, congestion, etc.) for each of the six mode/aspects combinations. They then classified all the answers (32 participants' three answers by mode/aspects combination) within those categories and sent back their results to the expert.

Step 3: Evaluation and choice of final categories

Based on the work of the two judges, the expert proposed a final set of classification categories that was presented to the two judges in a meeting. Once consensus was reached for a common set, the two judges returned to the list of answers and classified them within this final set of categories. Discrepancies between the classification are noted and a second round of discussions between the expert and the two judges was conducted to find a consensus for classification of the most contentious answers.

5.1.2 Results

The top five most common categories for each of the six mode/aspects combinations are reported in Table 6 (public transportation), Table 7 (car) and Table 8 (active transportation). The percentage used to rank each category is equal to the sum of the proportion of the 32 participants having written an aspect. Because each participant was asked to name the three top perceived advantages and disadvantages, which were later classified by larger categories, percentages above 100 per cent means some participants wrote different answers that were later classified in the same category. For example, one participant wrote as first perceived positive aspects of the car "Freedom" and "Flexible" as second. Both answers were later classified in the same category: "In a car, I'm more autonomous, free, flexible in terms of time, destinations and route choice."

Table 6 : Beliefs about public transportation (bus, metro, train combined) – n = 32

Top 5 advantages	
%	Category
95%	Using PT allows me to be more eco-friendly, more space-efficient and contributing to reducing road traffic
59%	Using PT is financially cheaper
56%	Using PT is quicker, allows me to save time and avoid road traffic
44%	Using PT allows me to use my in-transit time for other activities
28%	Using PT makes me feel safer (less stress and less responsibility towards the trip)
Top 5 disadvantages	
%	Category
81%	PT is unreliable, which is preventing me from planning my trip duration and getting to my destination on time

[2] The judges were Anne-Sophie Gousse-Lessard, PhD, and associate professor at l'Institut des sciences de l'environnement de l'UQAM (ISE) and Claudia Déménée, associate professor at the School of Design of Université Laval.

64%	PT services do not offer enough flexibility in terms of frequency and schedule, making it harder to get around
61%	PT can sometimes be crowded and uncomfortable
53%	If I choose to use PT, it takes more time
19%	PT transit network is spatially limited, affecting my trip opportunities

By far, the most common perceived benefit to using public transportation is its potential to reduce common collective consequences associated with car use: environmental impact, space and road traffic. This indicates that participants have a good understanding of car-related consequences and that they view their own use of public transportation as contributing to reducing collective consequences of excessive car use.

This is followed by more personal benefits: low financial cost of using public transit and, interestingly, the idea that public transportation can be quicker than car by avoiding traffic. In the discussion, such advantages were reported in reference to the Montreal Metro, but also to buses making use of dedicated bus lanes on highways and artery roads during peak periods.

In terms of disadvantages, the common beliefs that PT is unreliable is the most cited. This is in line with other research on beliefs regarding car versus public transportation where the car is almost always perceived to be more reliable. One possible explanation, according to Bates et al. (2001), could be transit schedules that raise expectations and set comparison standards for punctuality. Any deviation from waiting time and travel duration might be interpreted as unreliability while, in fact, there could be consistent delays (on a given route, the bus could always be two minutes late). The car, which has no fixed schedule, is not held at the same standard of punctuality, even though incidental traffic and searching for parking can add quite a lot of variability in car travel times. When that is the case, the car is not blamed, but rather traffic or parking.

In total, three of the five most common cited negative beliefs regarding public transportation are related to time: unreliability, lack of flexibility and longer trips.

Table 7 : Beliefs about the car – n = 32

Top 5 advantages	
%	Category
141%	In a car, I'm more autonomous, free, flexible in terms of time, destinations and route choice
80%	In a car, I get around faster and more efficiently because of more direct routes
48%	In a car, I have my intimacy, my space, my bubble, allowing me to feel safer
30%	In a car, I'm comfortable.
Top 5 disadvantages	
%	Category
109%	The car and everything that comes with it is expensive
70%	By using a car, I contribute to GHG emissions and have important carbon footprint
44%	By using a car, I contribute to traffic and suffer from traffic
27%	In a car, I feel less safe, more stressed and more at risk to have an accident
20%	When using a car, I have to manage parking
20%	Driving requires me to be careful, aware and prevent me from doing other activities

Unsurprisingly, the most common positive belief about the car is the feeling of autonomy and flexibility that it provides. The percentage of respondent in this category indicates that some might have mentioned two different elements (e.g., autonomy and flexibility) that were later classified in the same category during the inter-judge codification process. This category is followed by the belief that a car allows them to get around faster and more efficiently. The car is perceived to provide personal space, protection and comfort by fewer than half the respondents. One possible explanation why these weren't more common among the answers could be attributed to the low proportion of regular car drivers in the focus group. While the car's quickness and efficiency can be perceived even by occasional drivers, the "cocooning" the car provides could be felt more strongly by those finding themselves almost daily behind the wheel (Hiscock et al., 2002).

In terms of disadvantages, the car is perceived by all to be very expensive. Some even used two of their three answers to mention the numerous costs of the car (for example, one indicated the "high cost" of the car as one disadvantage and the "unforeseen $" of the car as another). The cost being the most negative perceived aspects could be potentially explained by the fact that 28 per cent of focus group participants had no job and 72 per cent had only a part-time job. The environmental impact of the car comes second, at 70 per cent, which is followed by contributing to and suffering from traffic. This is in line with the most common category of perceived advantage to using public transit, which pooled aspects falling in those two categories together.

Table 8 : Beliefs about active transportation – n = 32

Top 5 advantages	
%	Category
134%	Getting around by foot or bike contributes to my physical and mental well-being
55%	Getting around by foot or bike is cheap
52%	Getting around by foot or bike, I can help reduce the negative impacts of transport
48%	Biking and walking are flexible and accessible, increasing my feeling of freedom
33%	Getting around by foot or bike, I don't add to road traffic and I avoid it, which allows me to be faster
Top 4 disadvantages	
%	Category
89%	Getting around by foot or bike, I feel less safe and more vulnerable
77%	Getting around by foot or bike, I'm dependent on the weather and I'm not protected against the elements
45%	Walking or biking prevents me from travelling large distance
39%	I'm less inclined to get around by foot or bike because of a lack of adequate infrastructure

The most cited perceived benefits to walking or biking for getting around relate to physical or mental health and well-being, with some mentioning both, which explains the 134 per cent. This is followed by the low cost of active transportation, which is similar in proportion to those mentioning the low cost of public transit and in line with the high cost being the most mentioned disadvantage of the car. Several participants mentioned general aspects of reduction of negative impacts of transport (environment, health, etc.) which were grouped together in a single category. Almost half the participants mentioned some aspects that were linked to feeling of freedom, flexibility and accessibility.

In terms of disadvantage, it is interesting to note that almost 90 per cent mentioned feelings of unsafeness and vulnerability when using those modes. From the discussion, those feelings were linked to road traffic and mixing with the cars on bicycle. But also, mostly for women, there was some perception of being vulnerable to strangers and crimes when using active transportation, mostly at night.

Interestingly, while a large proportion of participants live in suburban types of neighbourhoods, the perception of being vulnerable to bad weather (winter and rain) was mentioned more often than aspects relating to distance (long distance can prohibit active transportation).

5.2 Future aspiration and mobility

This section was done in collaboration with Catherine Morency[3], Owen Waygood[3] and Anne-Sophie Gousse-Lessard[4].

5.2.1 Method of analysis

This analysis makes use of aspirations for future lifestyle and mobility (neighbourhood type, household style, car ownership and mode choice preference). These were not discussed during the focus group sessions but rather collected in writing in a participant's questionnaire through open-ended questions in an effort to preserve authenticity of answers for such personal questions. While the questions contained some examples of things to consider, participants were free to answer in whatever way they wished. Some formulated paragraphs and complete sentences of up to 70 words for a single question while others chose a bullet point approach, answering the same question with fewer than 10 words. As a first step, each participant's entire description (across all questions) was read several times by the first author to gain an overall understanding of each individual's aspiration patterns. This preliminary process highlighted several intra-individual contradictions. For example, some described their future ideal neighbourhood as suburban or rural while simultaneously wanting to get by mostly by foot or cycling. To investigate further those possible contradictions, answers were copied in a comparative table, allowing them to be identified and grouped. Then, for each question, answers were compared across all participants to identify recurring key words and characteristics and thus identify emerging categories for each question. The final categories for each topic (neighbourhood type, neighbourhood characteristics, work/home proximity, car ownership and preferred travel mode choice) were selected following back-and-forth discussions between three of the authors.

Participants' answers for each topic were then classified in the final categories. Ambiguous answers were discussed by two of the authors until consensus was reached for classification. To confirm the classification, a third author who did not take part in the category identification process was asked to independently classify each answer in the final categories. This independent classification served as validation for the classification by the first two authors, and the most ambiguous answers were discussed once more until a final consensus was reached. In some cases, the responses were deemed unclassifiable and so were not included.

[3] Department of civil, geological and mining engineering, Polytechnique Montréal

[4] Institut des sciences de l'environnement (ISE), UQAM

Finally, classified answers for each topic were compare using a "contradiction matrix" in order to quantify the overall level of concordance or dissonance across all participants but also within each participant's overall aspiration description.

5.2.2 Results

5.2.2.1 Description of aspirations

Two main aspirations were analyzed: types of neighbourhood participants picture themselves living in after 10 years and their preferred mode of transport for conducting their future daily activities. Three categories emerged for residential location: central neighbourhoods/downtown, suburbs/inner suburbs, outer suburbs/rural. For preferred future travel modes, some specified a single mode for all destinations, several modes for all activities or specific modes for each activity type. Thus, all answers were classified into three categories: (1) active travel/public transit as main mode with no/some car use, (2) car as main mode with some active travel/public transit use, (3) car only with no mention of any other modes. Table 9 shows the classification of participants in those desired neighbourhood categories and preferred mobility categories along with other personal and household characteristics.

Although there was no difference in the mean age for each neighbourhood type, women were less likely to aspire to live in a central location then men. Among those preferring an outer suburbs/rural setting, a larger share already had a driver's licence compared to the overall sample. Those enrolled in a technical program were less prone to aspire to live in an urban environment. Interestingly, those with a licence but without access to a car all desired to live in the suburbs or outer suburbs/rural areas. In terms of actual residential location versus desired future location, 10/14 aspiring to outer suburbs/rural living presently live in a high-density urban area (> 3500 people per km^2). Finally, those walking or taking public transit to school also had a stronger preference for suburban/rural living locations.

Table 9 : Desired neighbourhood types and mobility categories compared to current characteristics. (The numbers represent the number of answers.)

		Desired neighbourhood type			Desired mobility categories			
Current characteristics		Urban / central	Suburbs, inner suburbs	Rural, outer suburbs	Multimodal - Mainly AT/PT with some car use	Multimodal - Mainly car with some AT/PT	Car only	**Total Focus Group**
	n	**7**	**11**	**14**	**10**	**14**	**8**	**32**
Age	Mean	20.8	19.2	21.6	22.5	20	19.5	20.5
Gender	Women	3	8	11	7	8	7	22
	Men	4	3	3	3	6	1	10
	% Women	43%	73%	79%	70%	57%	88%	69%
Driver's licence	No licence	4	6	3	3	4	6	13
	Licence	3	5	11	7	10	2	19
	% Licensed	43%	45%	79%	70%	71%	25%	59%
Program type	Pre-university	5	6	4	4	6	5	**15**
	Technical	2	5	9	6	8	2	**16**

Car access	No licence	4	6	3	3	4	6	13
	No car access		1	4	3	1	1	5
	Access to HH car often		2	1		2	1	3
	Own vehicle	3	2	6	4	7		11
Current mobility type	C1: "Multimodals"	3	3	5	6	5	0	11
	C2: "Car drivers"	1	1	3	0	5	0	5
	C3: "Bus riders"	3	7	6	4	4	8	17
Current neighbourhood type	High density	3	3	10	6	6	4	16
	Medium density	2	5	1	2	3	3	8
	Low density	2	3	3	2	5	1	8
Commute mode for cégep	Walking		1	2	**2**	**1**		3
	Public transit	4	8	9	6	8	7	21
	Car driver	3	1	3	2	5		7
	Other		1				**1**	1

For desired mobility categories, no difference is observed in the mean age for each category. While women are spread evenly across all categories, men seem to prefer a more multimodal future lifestyle with only one out 10 indicating a preference for car-only mobility. Almost half of those currently not owning a driver's licence aspire to a car-only mobility while this is the case of only 10 per cent (2/19) of those already owning a licence. Interestingly, all of those already having their own vehicle (with some using it to go to school) aspire to a multimodal future, either car-based or AT/PT based. This is also confirmed by the fact that none of the car-drivers mobility type picture themselves using car only. On the contrary, all those who aspire to be car-only users are in the "bus users" class. This indicates that they might currently be feeling constrained in their mobility behaviour and thus aspire to the freedom and independence they perceive the car could provide.

To the question of whether they would possess a car in their desired future, only two of 32 mentioned they would prefer not to own one, instead stating they would rely on friends or car-sharing to get by. While the car seems to be perceived as a necessary tool across desired neighbourhood types, more than half (16/30) explicitly mentioned they would really like their future car to be electric/hybrid/ecological. On the other hand, only four mentioned they would like to have a luxury car or named a specific luxury car brand (Audi, BMW, Mercedes, etc.).

Overall, classification along mobility categories appears slightly at odds with classification of preferred residential settings. This observation prompted a deeper analysis of concordance/dissonance between the type of desired neighbourhood, aspired mobility preferences (including car ownership), desired relative home/work location (proximity) and preferred neighbourhood characteristics.

5.2.2.2 Concordance/dissonance analysis

As a final analysis, apparent dissonance in aspired residential location and mobility observed in Table 7 is investigated more deeply. The level of dissonance/concordance between some aspirations was assessed

using differentiate scores. Desired neighbourhood types are compared to desired travel mode choice and then to desired work location relative to home. Central/urban neighbourhood types and characteristics (close proximity to work and opportunity for AT/PT based multimodality) are given a score of 1, inner suburb settings and associated characteristics (medium proximity to work and the possibility to be car-based multimodals) are given the score of 2 and the outer suburbs/rural settings and its associated characteristics (long distance from work and having to rely mostly on car to get around) are given the score of 3. Dissonance scores are computed by subtracting proximity score/mobility score to future neighbourhood score. The resulting concordance/dissonance matrix is shown on Table 10 with "pXX" numbers representing focus group participants' ID.

Table 10 : Concordance/dissonance matrix of aspirations

			Desired neighbourhood types		
			Score = 1	Score = 2	Score = 3
			Central city / downtown	Suburbs, inner suburbs	Rural, outer suburbs
A) Work location relative to home	S = 1	Very close, walkable/cyclable in less than 15 min.	p21, p31	p26, p32	p1, p7, p11
	S = 2	Close, less than 30 min. by car and less than 45 by any AT/TC	p8, p12, p20, p25, p33, p35	p6, p13, p16, p19, p22	p5, p10, p24
	S = 3	30 + min. / 10 + km. By car		p15, p28	p3, p9, p14, p18, p29, p30
	No preference			p23, p27	p2, p17
B) Preferred travel mode choice	S = 1	Multimodal - Mainly AT/PT with some car use	p8, p20, p31, p35	p15*, p32	p1, p10*, p17, p18, p24
	S = 2	Multimodal - Mainly car with some AT/PT	p21, p25, p33	p16, p19, p22, p23	p3, p5, p7, p9, p11, p29, p30
	S = 3	Car only	p12	p6, p13, p26, p27, p28	p2, p14

Color Legend:

Dissonance score	-2	-1	+1	+2

The strongest apparent dissonance appears among those who aspire to live in an outer suburb or rural neighbourhood ("village" and French words for "countryside" were commonly used to describe neighbourhood type 3). Indeed, 5/14 them stated they would like to get by mostly by active travel and public transit (dissonance score = +2) and another 6/14 showed medium dissonance (+1) by desiring a car-

based multimodal lifestyle. Similarly, three out of 14 indicated a preference for living "close to work" or "within walkable/cyclable distance" (dissonance score = +2) and another three presented a medium positive dissonance (+1) by stating they would like to live a medium distance (< 30 minutes by car and/or less than 45 minutes by transit) from their future workplace.

The opposite dissonance (- 2) was not as significant as only one person (p12) desiring an urban location also stated a car-only future mobility.

Another important aspect that reinforces the observed "positive dissonance" of an important share of participants aspiring to an outer suburbs/rural home location was the described neighbourhood characteristics. While it was not possible to fit the classification of such characteristics in the concordance/dissonance matrix of Table 10, extracts from participants' answers show the extent of this dissonance. For example, many of them mentioned they would like the proximity of public transit, bike path, restaurants, shops and bars in their neighbourhood. The most striking example comes from *p5* (Woman, 19) who described her desired neighbourhood by (Q2):

> *"Suburbs/countryside. Close to a highway. Quiet and safe. All of the amenities of a city, but more peaceful."*[5]

And from *p10* (Woman, 18) who wrote (Q2):

> *"In a village, not a big city, not too deep in the countryside. If possible, with a lot of public transit, with shared mobility offers like in Montreal. A lively place, animated (festive), attractive, beautiful, safe. With lots of green spaces, parks, nature preserves, etc. Bike paths."*

And who would like to get by "As much as possible by foot or public transit" (Q5) because she

"Preferred not to own a car. Accessing by carpooling or car-sharing" (Q6) to her destinations."

A third example of this desire for living in rural area but with the transportation opportunity you usually find in a central neighbourhood comes from participant 24 who is much older (Woman, 34, currently living in a central neighbourhood) (Q2):

> *"In the countryside to try to be auto-sufficient as much as possible, to breathe better (less pollution), to be in nature all days. Transport would be by bike or electric car to get to the nearby village (10-15 min. by car)."*

She answered the question about preferred mode of transport in her future lifestyle (Q5) as: "Everything would be close and could be reached by foot." She also stated she would like to own "An electric car or nothing." (Q6).

Finally, *p17* (F, 26) who mentioned she would like to be "In the suburbs or directly in the countryside…" (Q2) and that she would like to get by "As much as possible by active travel" (Q5) and that the most important element in her future residential location choice (Q7) was to be "Far from the city, but with good access."

5.2.3 Discussion about aspirations

The data collected from the focus group session helps to understand the complex and sometimes conflicting aspirations of some of the millennial generation. In terms of future ideal residential location,

[5] All quotes were translated from French by the author to reflect as best as possible the original statement.

most participants (78 per cent) mentioned they would prefer to live in the suburbs, outer suburbs or even rural areas. While only reporting on their aspired residential location, this is in contrast with the re-urbanization trend of young adults observed in Montreal over the past two decades (Moos, 2014). Interestingly, among those aspiring to such future residential location, almost all currently live in a dense urban environment, either on the Island of Montreal or in the most inner suburbs.

This strong desire across many participants for living far from the city in a neighbourhood "peaceful, quiet and safe" seems also to be at odds with the type of mobility style they aspire to. Indeed, 75 per cent of the focus group sample described either an active travel/public transport–based multimodality or a car-based multimodality with some use of other modes. The contradiction emerged clearly while looking at the dissonance scores calculated with a concordance/dissonance matrix of aspirations (Table 8). Overall, 45 per cent of participants seems to idealistically picture themselves living either in suburbs or rural areas while still having the opportunity to rely on other modes than the car to get by. The strongest cases of dissonance were women aspiring to live far from the city, near nature, and get by exclusively without a car.

Living in a less dense area and being able to walk to work is, of course, possible. An individual in a rural area may work in an agricultural job. Someone in a suburban area may live close enough to some businesses. We term this a "dissonance" because the likelihood of being able to walk to work is lower in such areas.

On the other side, travelling purely by car while living central is possible. However, in all likelihood, someone living centrally will walk to a local store or coffee shop, or take public transport when going out (to avoid parking problems, for example).

To explore the relationship between actual and desired mobility behaviour, results from a latent class segmentation modelling on actual mode use frequencies indicates that most focus group participants are currently "multimodals users" (11/32) or "bus riders" (16/32) (with minimal car use), the rest being of the type "car-drivers" (5/32). While all the current "multimodals" mobility type expressed the desire to pursue this multimodal lifestyle in the prospective exercise, half those currently classified as "bus riders" aspired to a car-only future mobility. It is possible that those current bus riders are captive of public transit. In their case, the apparent freedom of the car might prompt them to aspire for a car-centred mobility in the future.

Furthermore, mismatch between the type of aspired neighbourhood and the characteristics employed to describe those neighbourhoods was also observed. The idea that you could get the transport accessibility, proximity to services, jobs and commercial opportunities and the "animated" vibe of a central urban and dense neighbourhood within some rural "village" or distant residential suburbs also emerged from the analysis.

A final interesting aspect that emerged from the prospective exercise is the explicit mention of an electric/hybrid or "ecological" vehicle by half the participants. This aspiration of an "environmentally friendly car" seems to imply a possible way for them to imagine a future in line with their environmental values but at the same time allowing them to live in some sort of rural haven where they wouldn't have to use it every day. This desire might also have been influenced by a strong push by the provincial government over the past few years to promote and subsidize electric vehicles.

6 DISCUSSION AND POLICY RECOMMENDATIONS

6.1 Web survey

The first thing investigated was the level of access to mobility tools; i.e., instrument (pass, licence, vehicle), allowing one to use a transport mode. In total, 68 per cent of respondent have a driver's licence (either full or probationary) and a comparison by age indicates that this rate is slightly higher than the province's average. Looking at the results by density-based neighbourhood type indicates that those in more central and dense neighbourhoods are less likely to hold a licence than those living further out. Among those with a licence, a majority (54 per cent) have their own vehicle, 38 per cent have varying level of access to a family household vehicle and only 10 per cent have very occasional or no access to a vehicle, a number that goes up to 18 per cent for inner city resident and down to four per cent among outer suburbs/rural residents, thus hinting that with a higher quality and diversity of alternatives to the automobile comes a lower need to have frequent access to a car.

The bike doesn't seem to be a popular option among the studied sample, with 10 per cent declaring using the bike once or more per week for trips and only 46 per cent owning one that they can use for trips, a number similar across neighbourhood types. For Transit, 30 per cent mentioned having never bought a single monthly pass in the past 12 months, 52 per cent bought between one and 11 passes and only 16 per cent indicated having a pass all year. This could mean that, for most students, public transit is mainly used to get to school and the cost of having a pass outside the school period might not be considered worth it. In this sense, offering students a yearly pass for the same price as eight monthly passes could allow them to use transit at no marginal cost during the summer vacations, a potential easy way to increase transit use for this generation.

A smartphone is an increasingly important tool to navigate the urban transportation network, providing direction and transit schedules, and allowing one to unlock a bike-share or car-sharing vehicle. This generation is highly connected, with 94 per cent owning a smartphone and 80 per cent of those having a data plan. The most popular transport-related app is Google Maps, installed by 85 per cent of smartphone owners. It is followed distantly by Transit App (28 per cent), Apple Plan (28 per cent), any local transit agency app (23 per cent) and Uber (19 per cent).

Finally, to gain a deeper understanding of reported mobility behaviour, a latent class analysis (LCA) was performed on variables representing frequency of use of six transport modes: car driver, car as passenger, bus, metro, walking and cycling. The fit statistics pointed to a three-class solution. The main class with 46 per cent of participants was dubbed "bus riders," which was defined as those with frequent use of bus services, metro and car as passenger and occasional use of other modes. The bus riders are less likely to have a job, half of them have no driver's licence and only 11 per cent have their own car while 83 per cent have a monthly transit pass. A lower proportion of them live in outer suburbs/rural neighbourhoods than the two other classes. The second largest class was the "multimodals" (29 per cent), comprising respondents with a diversity of modes used frequently. They are more likely to have a bike and to be enrolled in a pre-university program than the two other classes. About a third of them have their own car and more than half have a monthly transit pass. The last class were the "car drivers," making up 25 per cent of respondents. Those in this class use almost exclusively the car as driver, with occasional use of all other modes. They are statistically older and are more likely to be enrolled in a technical program and to have a part-time job. Evidently, all of them have a driver's licence and almost 90 per cent have their own vehicle. They are more likely to live in the outer suburbs/rural areas and less likely to live in the city than

the two other classes. While this mobility type tends to live further away from their cégep than the other two types, it is worth noting that 40 per cent live closer to their cégep than the mean distance for the two other types combined. This indicates that they are likely to have a similar level of transit accessibility as their peers classified as “multimodals” or “bus riders,” but still decide to drive for most of their daily trips.

A few limitations need to be considered regarding the web survey results. Despite its relatively large size (n = 1,023), the survey is not representative of the youth population (aged 18-25) in general and cannot pretend to be representative of the population of the three cégeps either since it was not possible to assess the representativeness. Some indications points to some groups being under-surveyed. For example, young men represented only 26.4 per cent of respondents despite representing 42 per cent of Quebec’s collegial population. Additionally, the survey was perceived to be long with dropout rates of about 40 per cent. Finally, the web survey’s objective was to collect general information about respondents’ socio-demographic and mobility behaviour and was not used to explore beliefs and perceptions regarding transportation modes. These were instead investigated more deeply in the focus group sessions. The results of the survey were designed to be used to enhance the analysis of the focus group sessions. However, further analysis will be required to extrapolate and link the focus group results to the larger survey sample.

6.2 Focus groups

Two main analyses were conducted with the data collected from the focus group sessions. The first explored beliefs regarding transportation modes using semantic analysis of short written answers about perceived advantages and disadvantages of each mode (car, public transportation, active transportation).

The analysis revealed that environmental concern is quite high among participants as is the idea of avoiding traffic and not contributing to it. Public transportation is perceived positively as reducing both of those consequences. However, the perception of public transportation’s unreliability is strong and could explain why about half of current bus riders aspire to a car-based mobility future. As for the car, its high cost is its main perceived drawback, a result that echoes studies pointing to economic conditions of millennials as a reason they own and drive cars less than previous generations (Klein and Smart, 2017). On the other hand, participants unanimously acknowledged that it provides autonomy, freedom or flexibility in travels. Active travel is widely perceived to be beneficial for physical and mental well-being but is hindered by high feeling of vulnerability (from motorized traffic, but also from strangers) and exposure to hazardous weather.

The second analysis reported the findings from a prospective exercise held at the end of the focus group sessions. First, more than 75 per cent of participants (25/32) indicated a preference for suburban living or even rural settings. This is in line with preferences identified by Delbosc and Naznin (2019a) among young Australians. Despite this, a similar majority (78 per cent) also indicated a preference for a multimodal mobility lifestyle, which also aligns with Delbosc and Naznin (2019a) findings. To investigate this apparent dissonance in aspirations, the innovative use of a concordance/dissonance matrix of aspirations was proposed. This allowed some form of quantification of the dissonance between the participants’ desire for suburban/rural living and aspiration to pursue a multimodal mobility style.

A few limitations need to be considered. First, the focus group part of the survey design was qualitative, which means it was not intended to be representative of all students of the targeted age population segment, but rather to gain insights to guide future research on how millennials’ residential and mobility

patterns might evolve. A second limitation comes from the design structure of the focus groups. It is possible that the topics and direction of discussions about actual mobility perception during the first part of the discussions influenced the formulation of participants' aspirations in the prospective exercise that followed. But since the same discussion questions were asked in the same order in each group, it is assumed that this influence is roughly homogenous across participants and groups. A third limitation comes from using prospective questioning, which makes it impossible to verify which choices the participants will make a few years from now. However, in the widely used Theory of Planned Behaviour (Ajzen, 1991), intention is the strongest predictor of behaviour, even though a gap between intention and behaviour is usually observed. Despite this, this limitation is particularly important regarding the numerous contradictions highlighted by this study: at some point, there will need to be a trade-off between those participants' desired residential location, preferred neighbourhood characteristics and mobility preferences. As previously mentioned, finding this highly accessible and walkable suburban haven might prove almost impossible.

Since lifestyle preferences have been theorized in previous research to be dynamic rather than static (Van Acker et al., 2016), future research should try to quantify this aspirational dissonance and look further into which factors will have more weight in late millennials' decision processes. This could help guide transport and urban-planning policies to ensure the most sustainable lifestyle path for this generation.

6.3 Future research and policy recommendations

Future research should try to investigate more deeply the observed dissonance in mobility and lifestyle aspirations by using quantitative methods such as questionnaire with standardized items and scale to assess if these results are a true phenomenon in the young adult population. Surveys should also be used to validate the most common beliefs identified about transportation modes during the focus groups. These behavioural beliefs are important as they shape attitudes and behavioural control, which are important predictors of intention for use of a mode of transportation (Chng et al., 2018). For example, if people don't believe they will be safe when travelling by bike, it will likely affect their attitudes, and thus intention to use this mode of transportation in the present and future.

Validating those beliefs should then be followed by what type of message could change those negative beliefs regarding public transportation and active travel while enhancing the positive beliefs about those modes. Messages should also be developed and tested to enhance the sense of responsibility for consequences linked to car use while trying to decrease the belief that the car provides the greatest freedom and autonomy of all modes. This belief is theorized to be fuelled by persistent car advertising and popular culture (Gössling, 2017; Stokes and Hallett, 1992), which commonly portray the car as the ultimate symbol of freedom. In line with recommendations from the second research report in this series of three (Laviolette, 2020a, 2020b),regulations should be considered to control car advertising content while also limiting exposure of children to this type of advertising. Such policies could help change the belief among future generations that the car provides freedom in all contexts.

In terms of transport policies, the current research supports the idea that more effort and investment should go to developing communication strategies to steer young adults' aspirations toward more sustainable lifestyles. Influencing young adults *now* in their life-shaping decisions, such as residential location and car ownership, is important because once these decisions are made, they are harder to reverse and will influence their mobility behaviour for a long time. For example, **advertising and awareness campaigns by municipalities**, provincial governments or even residential developers could be

created to show how life in central urban neighbourhoods, or near transit hubs in the suburbs, could still provide peaceful, quiet environments as well as high accessibility to amenities. Such environments would allow them to get by with minimum car use, thus being in line with their high environmental consciousness.

Another policy recommendation is linked to the use of technology in providing precise and real-time information about transit schedules. When the focus groups were held (spring 2018), real-time transit schedules weren't yet rolled out by all Montreal area transit agencies. For this reason, several participants mentioned during the discussion that having such information could help them navigate the transit system. Now that most transit agencies in the Montreal metropolitan area have switched to real-time information for scheduling, it remains essential to make sure that such information is easily available and reliable. This could improve the perceived reliability of bus services. In terms of infrastructure, extending the network of priority bus lanes on many artery roads and highways could help bus services, notably in the suburbs, to be more reliable while offering faster and more competitive travel times. The implementation of new priority bus lanes should also be promoted effectively to make sure current car drivers get the information that those new lanes could improve their travel time by reducing congestion on major roads and highways. As bike ownership was low among the respondents, extending the network of bike-sharing services further to the suburbs and around campuses could help improve bicycle accessibility and lower barrier to cycling. Bike-sharing membership should also be bundled with public transit pass or offered at a discounted rate for cégeps students as is already done by universities in Montréal, thus facilitating even further the use of this mode.

Overall, this research among college students confirms that targeting this demographic segment is highly relevant when putting forward strategies to encourage sustainable mobility behaviour. Having not yet formed strong car travel habits and having yet to make important life decisions, young adults' beliefs, attitudes and perceived social norms could more easily be modified to encourage more multimodal mobility behaviour, thus reducing future car dependency.

Recommendations

Based on this report's findings, we offer four recommendations to encourage a shift toward sustainable mobility behaviour and lifestyle decisions among young adults.

Recommendation 1	**Research**
Federal Provincial	Fund more quantitative research on young adults' beliefs about transportation modes and aspirations for future mobility. This will help identify key barriers to sustainable mobility behaviour and identify the best ways to promote sustainable lifestyles at an early life stage.
Recommendation 2	**Policies and regulations**
Provincial Municipal	Study the possibility of providing automatic and year-round transit passes (with opt-out options) for students of collegial institutions where a public transit service is offered. A current example in Québec is the Laissez-passer universitaire (LPU) at Université Laval, although this initiative does not include the summer months.
Recommendation 3	**Transportation planning — Infrastructure**
Federal Provincial Municipal Public transit authorities and agencies	Extend the network of priority bus lanes on many artery roads and highways, notably in peripheral areas where rail transit is scarce. This would improve bus service reliability while offering faster and more competitive travel times. Extend the network of bike-sharing services in the suburbs and around suburban campuses to improve bicycle accessibility.
Recommendation 4	**Transportation planning — Transportation demand management**
Federal Provincial Municipal Educational Institutions	Develop communication strategies and awareness campaigns targeted at young adults to promote sustainable mobility lifestyles that are less car-dependent. Those campaign should also try to enhance the sense of responsibility for consequences linked to car use, notably environmental consequences, while trying to decrease the belief that the car provides the greatest freedom and autonomy of all modes in all contexts. Develop bicycle initiatives, workshops and introduction classes, possibly in partnership with Vélo-Québec, to improve confidence and feelings of safety among students and help them identify the safest cycling routes to and from campus. Promote transit-schedule and trip-planning app usage through various strategies. Once put in place, promote more extensively the availability of real-time bus information to reduce the perception of unreliability of bus services.

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