Exploring the X-Minute City by Travel Purpose in Montréal, Canada

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Findings

To achieve the x-minute city, we need to understand which destinations are currently reachable or can be reached by sustainable modes within a defined travel time threshold. We find that concentrating on a set of destinations (Leisure and Shopping) and disregarding work trips from the definition of x-minute city can potentially make this concept a more attainable one for 15- and 30-minute city concepts in the North American context. For shopping trips, near half of the current car trips can be replaced by sustainable modes and still be carried out in less than 15 minutes, whilst around 70% of car trips can be replaced by sustainable modes and conducted in less than 30 minutes. Incorporating public transport as a sustainable mode in the x-minute city definition will make it a more achievable one for a specific set of destinations and encouraging sustainable travel behavior requires attention to the importance of local accessibility.

1. QUESTIONS

The "15-Minute City" planning strategy proposes that residents should reach their daily destinations (work, food, health, education, and leisure) within 15 minutes of travel time (TT) by an active travel mode (cycling or walking) (Moreno 2020). In parallel, other calls from Australia promoted the 30-minute city as a more attainable planning goal and included public transit as a complimentary mode to walking and cycling (Levinson 2019). Researchers have concentrated on the built environment aspects that can help achieve the x-minute city concept (Lu and Diab 2023), with little concentration on existing travel behavior. Reaching all intended destinations within a travel time of 15 or 30 minutes using sustainable transportation methods such as cycling, walking, and public transit is impractical in the context of North America (Birkenfeld et al. 2023). To make the x-minute city an attainable planning goal, this study investigates the travel time distribution to various destinations by sustainable modes in Montréal, Canada to identify the feasibility of changing the x-minute city definition through the expansion of the set of modes used and concentrating on specific destinations.

2. METHODS

We use data from the 2018 Montréal Origin-Destination (O-D) survey which is administered every 5 years by the regional public transport planning authority in the Montréal metropolitan region. In this survey, a travel diary recording the most recent weekday trips is collected from a 4% random sample of households in Montréal. Only home-based trips with valid O-D pairs that were made within Montréal's metropolitan area boundary were considered for the analysis. We exclude trips with other as a purpose or which were carried out to pick up or drop off someone or those longer than 90 minutes. We include only trips made by people between 17 and 85 years old. Overall, we analyze
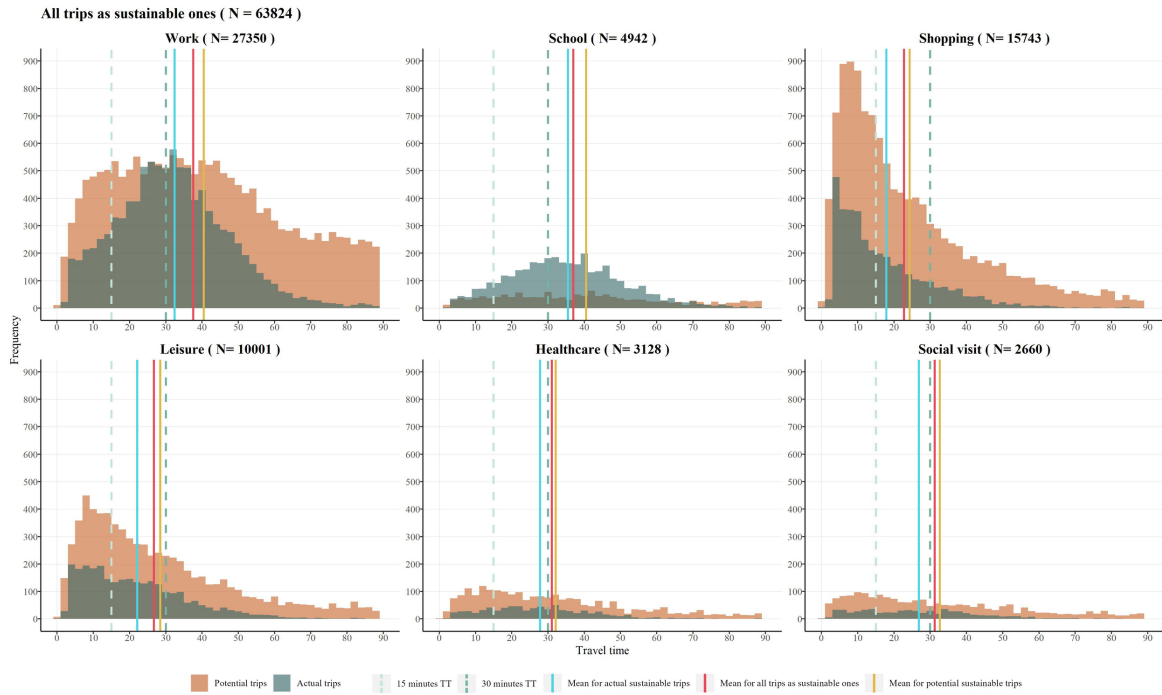
Figure 1. Histograms for actual and potential TT by sustainable trips for different purposes

63,824 home-based trips made for six purposes by walking (N=6,746), cycling (N=1,673), public transit (N=12,808), and car (N=42,597). TT for *actual trips* by sustainable modes (walking, cycling, and public transit) were calculated using the r5r package in R (Pereira et al. 2021), supported by OpenStreetMap networks and General Transit Feed Specification (GTFS) data. The same package was used to calculate the fastest travel time/mode if a car trip would have been replaced by a sustainable mode. We use the term *potential trips* to refer to the trips which have the same O-D coordinates as the ones originally done by car, but have the TT of the fastest sustainable mode. Finally, we collected Walk Score data using an API from walkscore.com to account for local accessibility.

3. FINDINGS

Figure 1 displays TT histograms of actual (N=21,227) and potential (N=42,597) sustainable trips by purpose: work, school (college level), shopping, leisure, healthcare, and social. Around 14% of the trips to work were conducted by sustainable transport in less than 15 minutes of travel time, while 16% of the work trips conducted by car can be reached by a sustainable transport mode within that time threshold. Including work trips clearly hinders the possibility of achieving a 15-minute city concept in the North American context due to the complex and specialized nature of work activities.

Meanwhile, for shopping and leisure trips, the percentage of potential trips that can be made in less than 15 minutes of travel time were around 43% and 34% respectively, while the actual trips made in less than 15 minutes of travel time with a sustainable mode were 55% and 40%.

Table 1. Percentage of trips within 15 and 30 minutes of travel time for different purposes

Trip Purpose	Shopping		Leisure		Work	
Travel Time	15 min	30 min	15 min	30 min	15 min	30 min
Actual Trips (Sustainable mode)	54.7%	83.5%	39.8%	75.0%	13.6%	47.1%
Potential Trips	43.4%	71.2%	33.5%	62.6%	16.2%	38.2%

The expansion of TT to 30 minutes accommodates a remarkably high percentage of both actual and potential trips for shopping and leisure purposes (Table 1). However, the percentage work trips achievable in less than 30 minutes by sustainable modes remains below 50%, stressing on the difficulty of involving work trips in the definition of the 15- or 30-minute city.

Such a high percentage of actual and potential trips place shopping and leisure trips in the forefront for redefining the x-minute city concept. School (college level and higher), social visits, and healthcare trips represented a small number of trips compared to other purposes and had small percentages below the 15-minutes and 30-minutes threshold by a sustainable or potential sustainable mode, indicating that including these destinations in the concept's definition might be counter-productive due to their small numbers and spatial dispersal.

Plotting the distribution of Walk Score at trips' origins against actual (sustainable mode) and potential (car trips replaced by sustainable modes) TT to the six destinations (Figure 2) shows that half of the actual sustainable trips fall in high Walk Score zones (with the median value ranging between 82 and 89 for the different destinations). This shows how higher local accessibility zones are encouraging travel via sustainable modes. Meanwhile, potential trips have a visible dispersity across the Walk Score spectrum. Looking at the trips falling above the Walk Score median values for sustainable trips with a TT less than 15 and 30 minutes, we find that a very small percentage of potential trips fall in that area. For example, the median Walk Score is 87 for actual sustainable shopping trips. Considering origins with a similar or higher Walk Score, less than 5% and 8% of the total potential shopping trips could be performed in a TT less than 15 and 30 minutes, respectively. To attract the remaining trips that can be carried out in these TT thresholds, land use management strategies including mixed-use and higher density developments need to take place. This will in turn increase the local accessibility of car users, potentially encouraging them to switch to a sustainable mode.

Our analysis shows that the 15-minute city is clearly unattainable using its existing definition of reaching all destinations by walking and cycling. We call for an expansion of the modes used to include public transit. We suggest concentrating on a set of desired destinations (Leisure and Shopping) that has a high actual and potential sustainable number of trips to develop policies that can encourage mode switching for car users. Land use management strategies that increase density, diversity and have attractive designs are necessary to increase local accessibility, which will serve as a catalyst for the realization of
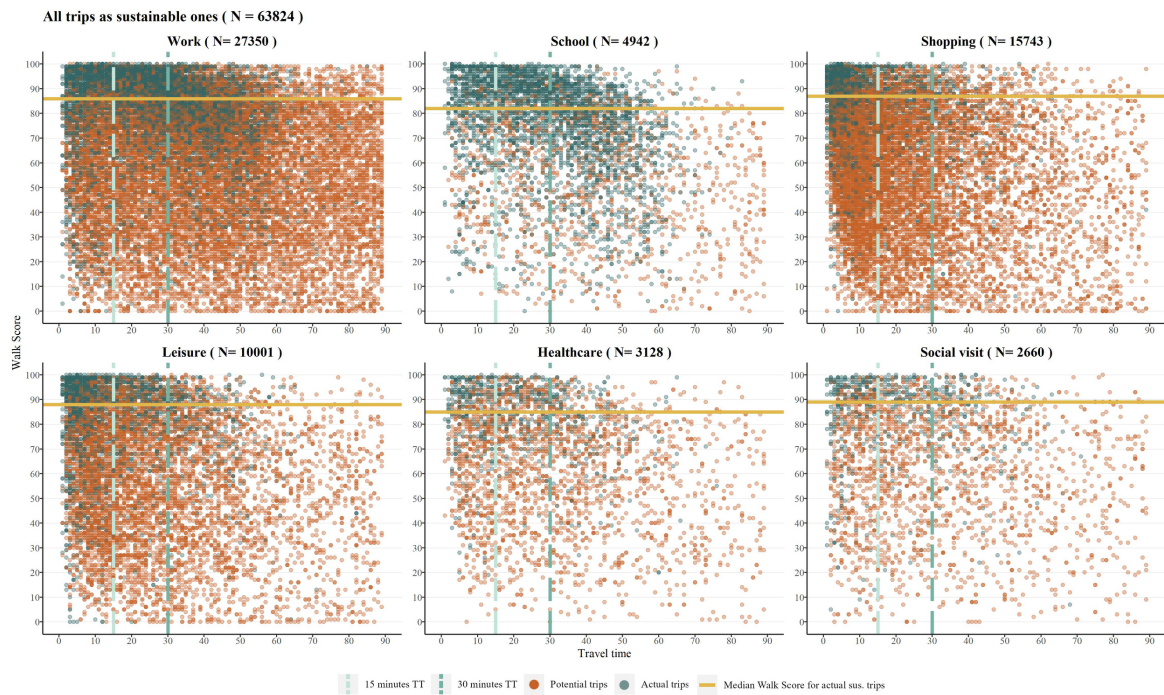
Figure 2. TT and Walk Score scatter plots for actual and potential sustainable trips for different purposes

potential sustainable mode trips. Allowing for the development of leisure and shopping destinations that cater to the specific needs of the population could help attract more people into the 15- and 30-minute TT threshold. Future research can incorporate statistical models that control for other cofounding variables to further investigate the relationship between local accessibility and traveling using sustainable modes.

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