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Evaluating the Functions of Pedestrian Streets through Systematic User Observation

[1]Sheikh-Mohamad-Zadeh, A., [2]Waygood, O. E. D., [3*]Saunier, N.
*lead presenter
[1]abbas.sheikh-mohammad-zadeh@polymtl.ca, Polytechnique Montreal, Canada
[2]owen.waygood@polymtl.ca, Polytechnique Montreal, Canada
[3]nicolas.saunier@polymtl.ca, Polytechnique Montreal, Canada

Introduction

Pedestrian streets, also known as car-free streets, are urban public spaces designated for pedestrians that sometimes allow non-motorized vehicles like bicycles and scooters, while access by motorized vehicles is restricted or prohibited. These streets are created to enhance urban life by promoting social, cultural, leisure, and commercial activities. By providing a safe and pleasant environment, pedestrian streets can reduce noise, air pollution, and temperature in city centers, and promote sustainable development and public health.

However, the pedestrianization process may impact the street functions (i.e., mobility, access, and place) as it involves restricting the access of motor vehicles, often adding street furniture, and changing the space layout. Evaluating the potential impacts on the functions of pedestrian streets is imperative for traffic engineers and urban planners. These evaluations allow them to refine the regulations, the positioning of the urban furniture, and the space layout in the pedestrian streets. This study aims to demonstrate the capacity of direct observation in evaluating pedestrian streets, focusing on a case study in Montreal, Canada.

Research Methodology

This study employs a comprehensive and systematic approach to observe and evaluate the use of pedestrian streets. The methodology involves direct observation of street users through video recordings, which are analyzed to extract detailed information about street users' characteristics, movements, interactions, and activities. The case study focuses on a pedestrian street in Montreal, Canada, observed over a day in June 2021 and another in July 2021.

The study relies on the framework developed in [1], which defines spatial units (screenlines and zones) to capture the movements of people and their activities. Video analysis is performed using two open-source projects, *Traffic Intelligence* and *Studio* [2], which facilitates the extraction and analysis of street user movements. The indicators used in the study include the number and proportion of street users, their speed, the number of people accessing buildings, and the number of people engaged in activities.

Results

The results of the study indicate significant changes in street usage patterns between June and July. In terms of the mobility function, the number of pedestrians decreased by 34%, and the number of cyclists dropped by 52% (see Figure 1). Despite the notable reduction in the number

of street users overall, the share of transport modes remained largely unchanged, with a slight shift from cycling to walking.

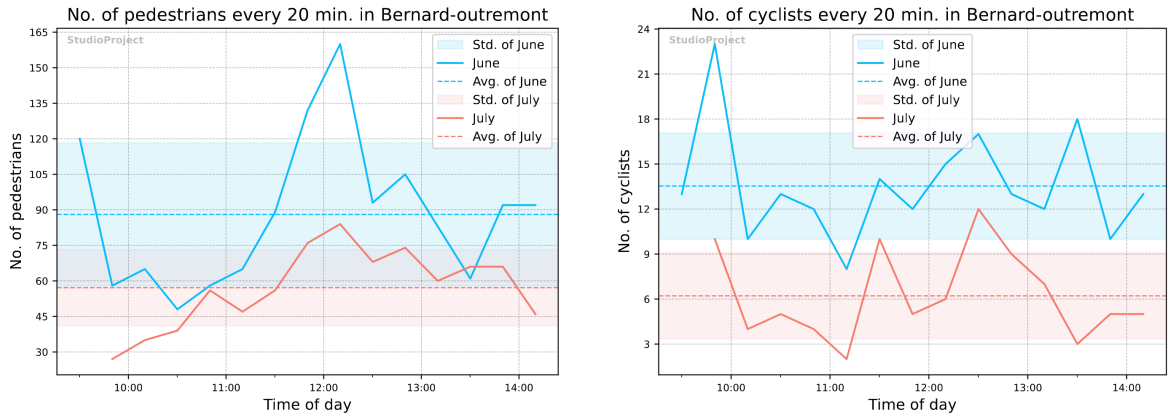

Figure 1 Number of pedestrians and cyclists over time in June and July

The study also found demographic differences in street users. Women represented a higher proportion of pedestrians compared to men, while male cyclists outnumbered female cyclists. The number of children using the street decreased significantly in July, likely due to school vacations. The study also observed changes in the temporal distribution of street use, with peak usage shifting from morning to noon in July.

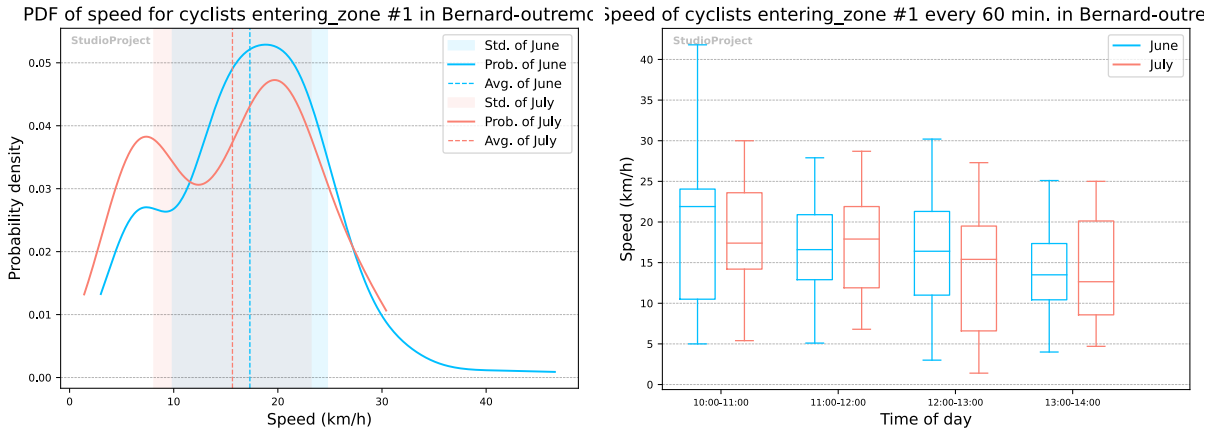

Figure 2 Probability distribution function and box plot of the instantaneous cyclist speeds on a screenline perpendicular to the street

Speed is another important mobility indicator, which can also impact the safety and place function. Although cyclists are required to dismount and walk their bikes, several cyclists continue to ride their bicycles at high speeds (see Figure 2). There is generally a decrease of the median speed in July, but also more variability (as measured by the inter-quartile range).

In terms of activities (place function), shopping and sitting were the most common activities observed in both June and July. The presence of an ice cream shop in the study area attracted many users. However, the installation of a sandbox in July did not attract users, indicating variability in the success of such interventions. The number of people engaged in activities decreased by 50% in July, with a notable decrease in women participating in activities.

The analysis also revealed insights into the access function: while the number of visits to the ice cream shop remained relatively stable between June and July, there was a shift in the peak time (see Figure 3). The study found that more women accessed the shop in June, while the number of men accessing the shop increased in July.

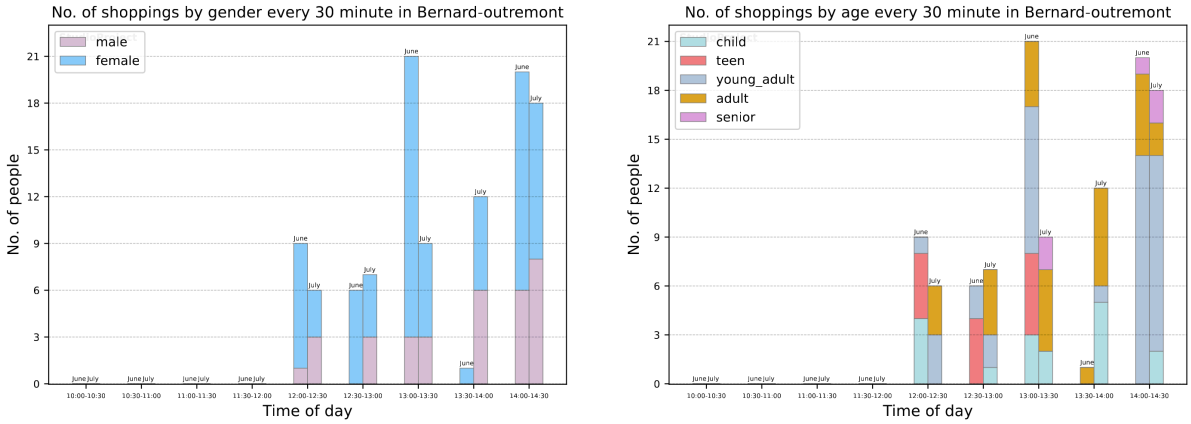

Figure 3 Number of shopping activities over time in June and July

Conclusions

The study's findings underscore the impact of temporal factors, such as summer vacations, on street usage patterns. The decrease in the number of street users in July may be attributed to vacations and school closures, which reduce the number of children and utility cyclists. The stable number of visits to the ice cream shop despite the decrease in overall street users highlights the attractiveness of the pedestrian street for specific activities.

The direct observation method proved effective in providing detailed insights into street use and the tradeoffs between their functions. The use of video recordings allowed for the collection of comprehensive data on street user characteristics, movements, and activities. This method offers several advantages, including the ability to capture detailed information unobtrusively and the capacity to review and analyze data multiple times. However, it also has limitations, such as the challenge of identifying all street users in crowded areas and the time-consuming process of manually extracting characteristics like age and gender from videos.

The empirical findings suggest several implications for urban planners and traffic engineers. The high proportion of elderly users in July indicates a need for more benches and accessible facilities. The significant presence of women walking and shopping highlights the importance of considering gender-specific needs in street design. The findings also suggest that temporary installations, such as sandboxes, may not always attract users and should be carefully planned and evaluated.

References

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2. Sheikh-Mohammad-Zadeh, A., Saunier, N., & Waygood, E. O. D. (2024). STUDIO: A Python graphical tool for analyzing street user observations from video data. *SoftwareX*, *26*, 101742.