HOW DO PERCEIVED SAFETY AND EXPERIENCED INCIDENTS INFLUENCE ROUTE CHOICE FOR CYCLISTS?[1]

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Introduction

Cycling is growing in popularity due to health benefits, cost and energy efficiency, and so forth (Kang & Fricker, 2018). However, increased cycling activity also increases the number of interactions with other road users, and safety concerns have been raised due to conflicts with motor vehicles and pedestrians. In an urban environment, cyclists have route choices that can include dedicated cycling facilities, and facilities shared with either pedestrians or motor vehicles. Hence, perceived safety and traveler comfort are potentially important factors in the routing decisions of cyclists (Lingwood, 2004; Allen-Munley& Daniel, 2006).

The objective of this research is to investigate how cyclists' perception of safety and experienced incidents, among other factors, influence route selection. Past research has focused on bicycle-motor vehicle conflicts; this study also considers conflicts with pedestrians. Stated preference survey data from 340 travelers on the University of British Columbia (UBC) campus are analyzed, comparing routes on pedestrian- and motor vehicle-dominated facilities. The results provide insights into how cyclists make trade-offs between convenience and safety when considering a pedestrian-dominated shared space. This information will be of interest to policymakers and transportation agencies managing similar areas for elevating safety and comfort levels of interactions among non-motorized road users.

Methodology

The data were collected through an intercept survey conducted on UBC Vancouver campus. The survey questionnaire investigated perceptions of comfort and safety of on-campus travel, along with experienced conflicts and collisions. The survey was conducted during the last week of October 2017, starting on Wednesday (25th October) and continued into the first week of November 2017, until Thursday (2nd November). Saturday and Sunday were skipped as the school was not in session. The hours of recruiting survey participants mostly ranged from 10:30 AM to 3:30 PM, with the exception of first day when it was conducted from 2:00 PM to 6:30 PM. On each collection day, a temporary kiosk was set up at three different non-motorized locations that experience high volume of travellers of different modes. The objective of the survey was to collect a sample of the population that comprised of people studying and working on the UBC campus. The surveyors intercepted and requested the travelers to participate in the survey. Before taking part in the survey, potential participants were provided with a consent form that identified the investigators, the objectives, available gifts, approximate duration of the questionnaire, and whom to contact if they had complaints related to the survey. The survey was presented upon gaining approval from the participants. Two surveyors used digital tablets to record the participants' responses. The data collected through this survey over the seven days at three different locations received 337 responses and entailed gender information, route characteristics, indicators of perceived safety concern and comfort level, prior experience in conflict engagement, and so forth.

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UBC served as a convenient area of focus for this research due to the existing conditions of increasing cyclist and pedestrian activity. In response to the increased travel demand posed by the population growth, UBC Campus and Community Planning (C+CP) has improved the walking and cycling facilities to enhance non-motorized travel options on and around campus. The improvement in facilities has prompted a surge in the number of cyclists and pedestrians, consequently increasing the reported conflicts between these modes on campus. Contrary to expectation, these conflicts are also reported in the designated 'Pedestrian Priority Zone (PPZ)', which is a specific area with high density of pedestrians and hence they have the right of way while the cyclists are expected to travel slower. The increased activity from cyclists and pedestrians could place extra pressure on limited public rights-of-way and their increased interactions leading to corresponding conflicts will amplify the safety concern and change the dynamics of route choice decisions. UBC Vancouver campus presents some elements that make it very similar to a municipality. In contrast to the typical campus, UBC owns and regulates the land which allows UBC's Campus and Community Planning to have control of the development as well as the design of the urban environment. Ultimately, the UBC Vancouver campus can be considered a small municipality or a laboratory where planners can understand and respond to various matters.

Results

The Pedestrian Priority Zone (PPZ) is observed to be the high-risk area for pedestrian-cyclist conflicts as both modes share the limited space. The pedestrians have the right of way in PPZ, but the concentration of conflicts indicates that cyclists do not refrain from entering the PPZ even though they may be uncomfortable due to frequent interactions with pedestrians. The decision of using the PPZ as a thoroughfare may be ascribed to the lack of viable alternative routes. During the survey, the respondents were asked to identify such alternative option by selecting one of three routes for a possible cycling trip on a fair-weather weekday during the school session.

The three different routes offered to participants are shown in Figure 1:

- Route 1 (Paths) – Alleys narrow paths, this path was selected to identify potential users that avoid traffic
- Route 2 (Main Mall) – Part of the PPZ, multi-use path with high pedestrian traffic
- Route 3 (East Mall) – One of the peripheral routes around the PPZ, a typical neighbourhood street, currently cyclists share the road with motor vehicles

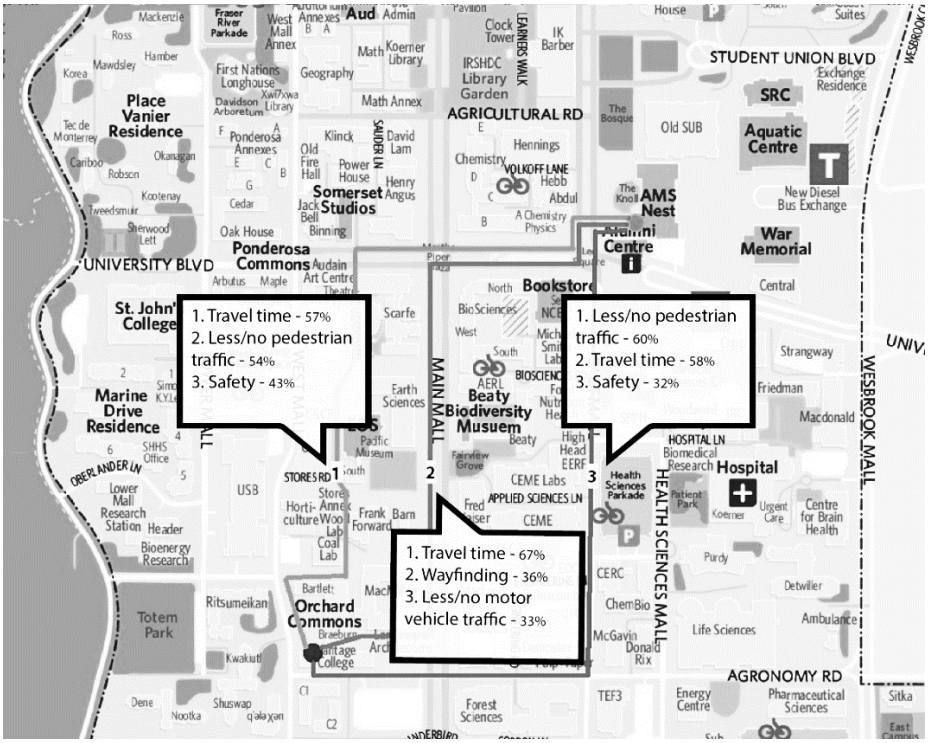

Figure 1. Hypothetical bike routes from Orchard Commons to the AMS Nest and the top-3 criteria for selecting each route

200 respondents, who were cyclists, specified their route choice, where 14% opted for Route 1, 37.5% chose Route 2, and 36.5% favored Route 3. A similar proportion of cyclists chose Main Mall and East Mall for their hypothetical trip. However, their motivations for choosing each route were somewhat different. The response from survey regarding the perceived influential factors governing route choice is shown in Table 1 and top factors are shown in Figure 1. One deciding factor was travel time, which incidentally every group considered as a top-three criterion. Apart from this, cyclists selecting Main Mall considered this route easier for navigation due to the lack of motor vehicles. On the contrary, cyclists preferred East Mall due to less or no pedestrian traffic, which translates to fewer interactions and hence creating a perception of safety. These rationales are validated from the survey response shown in Figures 2 and 3 where the Main Mall group feel less safe cycling on streets that is also used by motor-vehicles compared to cycling on non-motor-vehicle paths. On the contrary, the East Mall group feels safer cycling on streets rather than non-motor-vehicle paths.

Table 1. Factors for selecting cycling trip routes

Influential factors	**Route 1 (Low pedestrian traffic street) (N=28)**	**Route 2 (Pedestrian zone) (N=75)**	**Route 3 (High motor vehicle traffic street) (N=73)**
Travel time	57%	67%	58%
Safety	43%	31%	32%

Hills	7%	19%	11%
Less/no motor vehicle traffic	18%	33%	12%
Less/no pedestrian traffic	54%	7%	60%
Wayfinding	4%	36%	18%
Other	7%	7%	5%

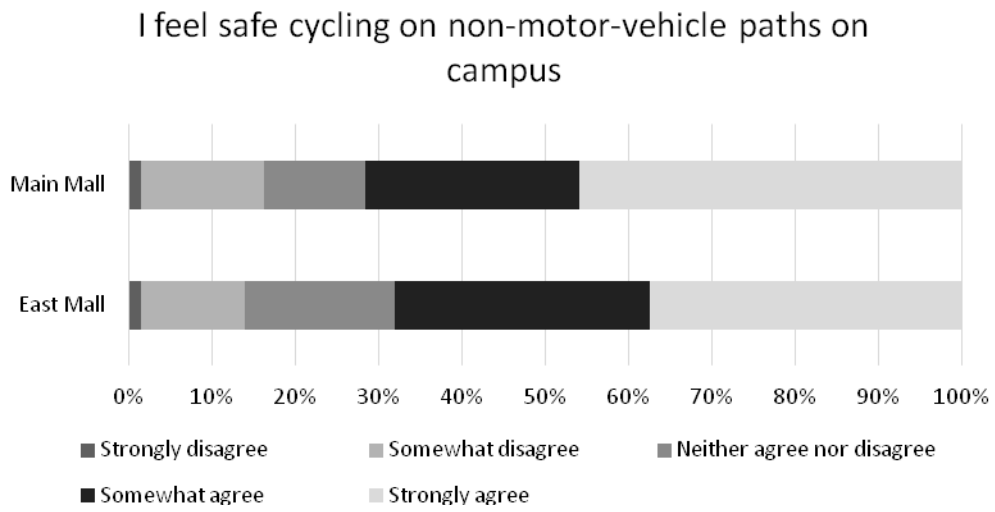

Figure 2. Perceived safety by cyclists on different locations

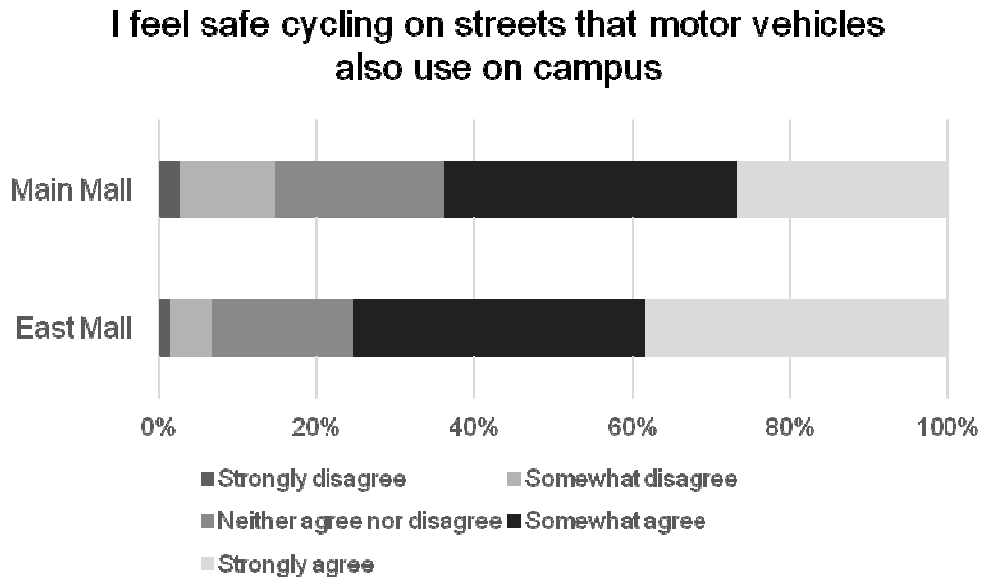

Figure 3. Perceived safety by cyclists on different locations

Wayfinding also appears to be an issue, as 67% of the East Mall group find it easy to navigate on campus but only 51% of the Main Mall group agrees. Additionally, the percentage from Main Mall group that disagreed to that statement doubles in reference to the East Mall group (19% for the Main Mall group to 10% for East Mall group). This is also validated by the fact that the Main Mall group is choosing that route because of wayfinding. Comparing cyclists to pedestrians, wayfinding appears to be more of an issue for cyclists, instead of pedestrians. Cyclists find it less easy to navigate on campus. Only 57% of the cyclists agree to some extent that they find it easy to navigate on campus, compared to 79% of pedestrians.

Conclusions

- **Enable all ages and all levels of cyclists to choose peripheral routes for their bike trips**

Based on the findings of this survey 47% agree to some extent that they would bike more if there was more exclusive road space allocated for cyclists, the separation between cyclists and motor vehicles appears to be a key component. This would allow more cyclists to use peripheral routes instead of the PPZ.

- **Increase the effectiveness of the Pedestrian Priority Zone**

The goal of the PPZ is to give right of way to the pedestrians and the other users of this shared space are expected to follow this principle for successful implementation of this approach. While cyclists are allowed to cycle along the Pedestrian Priority Zone and bike parking is provided near buildings to encourage cyclists; these zones should not be used as a thoroughfare by cyclists. Cyclists should be using peripheral routes to access destinations outside of the Pedestrian Priority Zone, which will allow them to travel faster, more convenient, and with less traffic.

Research conducted in a multi-use path in Vancouver (Robson square) suggests that dismount signs for cyclists may discourage cyclists from cycling in that area (Essa, Hussein, & Sayed, 2018). This research also concluded that the dismount sign decreased pedestrian-cyclist conflicts significantly. A different study has shown that people continue to cycle even if they know a ban is in effect, though they appear to be more cautious (Davies et al., 1999). Additionally, visible signs on and around the pavement of the shared space may be introduced to raise awareness of pedestrians and cyclists that they need to be attention while travelling in the limited right of way areas.

- **Make wayfinding easier for cyclists**

Wayfinding and navigation for cyclists on campus appeared to be an issue in this study. Efforts to better communicate cycling routes and improving the cycling network on campus can help move cyclists away from the pedestrian priority zone towards the peripheral routes. Signage designed explicitly for cyclists can be a potential option to reduce the number of cyclists that use the pedestrian priority zone.

References

Allen-Munley, C., & Daniel, J. (2006). Urban bicycle route safety rating model application in Jersey City, New Jersey. Journal of transportation engineering, 132(6), 499-507.

Essa, M., Hussein, M., & Sayed, T. (2018). Behavioral and Safety Analysis of Pedestrian–Bike Shared Space of Robson Street in Vancouver. Presented at the Transportation Research Board 97th Annual Meeting, Transportation Research Board. Retrieved from https://trid.trb.org/view/1495805

Kang, L., & Fricker, J. D. (2018). Bicycle-Route Choice Model Incorporating Distance and Perceived Risk. Journal of Urban Planning and Development, 144(4), 04018041.

Lingwood, P. (2004). Promoting walking and cycling as an alternative to using cars: Perception of safety is biggest obstacle. BMJ: British Medical Journal, 329(7476), 1237.