CYCLIST BEHAVIOR AT DISCONTINUITIES IN THE CYCLING NETWORK

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Introduction

- Transportation engineers and planners are focusing on improving:
  - cycling mode share
  - cyclist safety
- The World Health Organization reported that about 1.25 million people die each year as a result of road traffic crashes (1)
  - half of which are vulnerable road users
- In Canada, 3.2 % of all traffic fatalities involved cyclists (2)
- 1.3 % of Canadian commuters are cycling to work (2)
Introduction

• To improve safety and cyclist mode share, **cyclist behavior** must be studied throughout the cycling network.

• Many studies have identified some of the reasons for low cycling mode share to be the low objective and perceived safety of cyclists which could be due to the discontinuities in the cycling network \( (6, 7, 8, 9, 10) \).

• Therefore the road network must be designed so it can accommodate different road users safely in different conditions and situations.
  • by better understanding the risks and factors related to discontinuities.
Introduction: Discontinuity in Network

- Cycling network provides connectivity between origin and destinations by means of cycling facilities:
  - separate cycling facility
  - bike lane
  - shared/designated roadway
  - off road
  - etc.
Introduction: Discontinuity in Network

- Cyclists face interruptions in the cycling network: e.g. discontinuities
- Discontinuities include (10):
  - end of a cycling facility
  - change of side of a cycling facility
  - change in cycling facility type
  - intersections
  - re-routing due to construction
  - change in pavement quality
  - variation in motorized traffic volume on roads along bike facilities
  - bus stops that cut off cyclists on the cycling facility
  - parking spaces where vehicles cut off cyclists on the cycling facility
- Discontinuities have only recently been introduced as a measure of cycling network performance (10)
Background

• Discontinuity: end of cycling facility

End of cycling facility at Chemin de la Côte-Sainte-Catherine and Avenue Villeneuve, Montreal, QC (Google street view)
Background

- Discontinuity: change in cycling facility side

End of cycling facility at Saint Catherine Street West and Boulevard de Maisonneuve Ouest, Montreal, QC (Google street view)
Background

- Discontinuity: change in cycling facility type

End of cycling facility at Boulevard Pierre Bernard and Rousseau Street, Montreal, QC (Google street view)
Objectives of Current Study

- Cyclist behavior and safety at discontinuities has not been studied in the past
- Understand the microscopic impacts of discontinuities in the cycling network in terms of behaviour and safety
- The methodology is based on
  - video analysis
  - comparing cyclist behaviour at sites with and without discontinuities (control)
  - motion pattern learning
  - surrogate measures of safety
Methodology

1. Identify points of discontinuity
2. Collect video data at discontinuity and control sites
   a) change in cycling facility side
   b) change in type of cycling facility
3. Extract and classify road user trajectories from video data
4. Analyse cyclist behaviour using motion pattern learning
5. Study various strategies adopted by cyclists when faced with discontinuities
6. Assess cyclist safety through speed and other surrogate measures of safety
Methodology

- Identify points of discontinuity in Montreal using methodology proposed in (10).

End of cycling facilities and changes in cycling facility type in Montreal, QC
Methodology

• Collect video data at eight locations with four discontinuity and four control sites: four of the locations are presented here.

Location of two discontinuity and control sites selected for video data collection in Montreal, QC
Methodology

Locations for video data collection: Change in cycling facility side
Methodology

Locations for video data collection: Change in cycling facility type and End of cycling facility
Methodology

Video analysis steps for obtaining road user type and trajectory

Video analysis

Feature tracking

Feature grouping

Road user classification

Classified trajectories

Trajectory clustering

Motion patterns with high cyclist proportions

Cyclist behaviour analysis

ICTCT, Lund 2016
Methodology

- Motion pattern learning: clustering of the dataset into more homogeneous subsets using the longest common subsequence (LCSS) similarity measure
Discussion of Results: Cyclist Behavior

Cyclist maneuvers at site with discontinuity (left) and control site (right)
Cyclist Behavior at Discontinuity

Cyclist maneuvers at site with discontinuity: Movements from Southwest to Northeast
Cyclist Behavior at Control Site

Cyclist maneuvers at control site: Movements from Northeast to Southwest
Cyclist Behavior at Discontinuity

Cyclist maneuvers at control site: Movements from Northeast to Southwest
Discussion of Results: Cyclist Behavior

- Turning left from separate cycling facility into designated roadway
  - left: two way road
  - right: one way road

Cyclist maneuvers at side with discontinuity (left) and control site (right)
Discussion of Results: Cyclist Behavior

- Left: turning left from road into separate cycling facility
- Right: turning left from separate cycling facility to separate cycling facility
Next Step

• Assess cyclist safety by:
  • obtaining speed information of all road users from the collected video data for safety analysis
  • obtain conflict measures between cyclist and other road users
Conclusion

- Although many studies have looked into cyclist behaviour in different situations and conditions, discontinuities have been overlooked.
- The use of cyclist trajectory clustering provided valuable information on the microscopic maneuvers of cyclists.
- More maneuvers were observed by cyclists at discontinuities.
- Given the variability in cyclist maneuvers, vehicles and pedestrian face unexpected movements from cyclists.
- Future work: analyzing more sites to draw stronger conclusions.
References

Questions?

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