



BikeSAFE – Analysis of Safety-Critical Events from Naturalistic Cycling Data

Julia Werneke and Marco Dozza

Driver Distraction and Inattention, Gothenburg, 05/09/2013

CYCLING IS (GETTING) POPULAR AND IT IS ALSO A RISKY ACTIVITY!



“Premium Rush” (2012)

HOW TO INCREASE BICYCLE SAFETY?

It's all about the data!

Epidemiological Data

- Accident databases (e.g., STRADA, GIDAS)



Post-hoc accident data

Empirical Data

- Cycling simulator, lab, test-tracks etc.



Accident/ incidents data in experiment context

Naturalistic Data

- Normal cyclists behavior: interaction with vehicles, pedestrians etc., infrastructure (red light running), inattention & distraction
- Real-life safety-critical events (incidents, accidents) & their contributing factors
- Bicycle dynamics



Accident/ incident and normal behavior in real traffic

BikeSAFE

Naturalistic Cycling Study



Aims

- To adapt the naturalistic methodology to cycling
- To understand cyclists behavior (including distraction and inattention) and interaction with other road users
- To identify accident scenarios from safety-critical events

Safety-critical events are events in which the cyclist feels uncomfortable about her/his own safety while cycling.



Cycling in Gothenburg!



BikeSAFE: Method

PLEASE, GET ON THE BIKE!

INSTRUMENTED BICYCLE

Method







● Cameras



INSTRUMENTED BICYCLE

Method










-  Cameras
-  Push Button to register safety-critical events
-  GPS (10 Hz)
-  Inertial Measurement Units (IMUs) (100 Hz)

INSTRUMENTED BICYCLE

Method



-  Cameras
-  Push Button to register safety-critical events
-  GPS (10 Hz)
-  Inertial Measurement Units (IMUs) (100 Hz)
-  Brake Sensors (100 Hz)
-  Data Logger
-  Switch for Automatic Start and Stop

DESIGN

Method

Design

- 5 instrumented bicycles
- 2 weeks data collection per participant
- August until November 2012

Participants

- N = 16 (8 male, 8 female)
- Age: M = 39.1 years (SD = 11.4 years)
- 93 % commute to or from work for 4-6 days per week by bicycle in summer time



“Please use the bicycle as your own one in your everyday life.”

DATA COLLECTION

Method

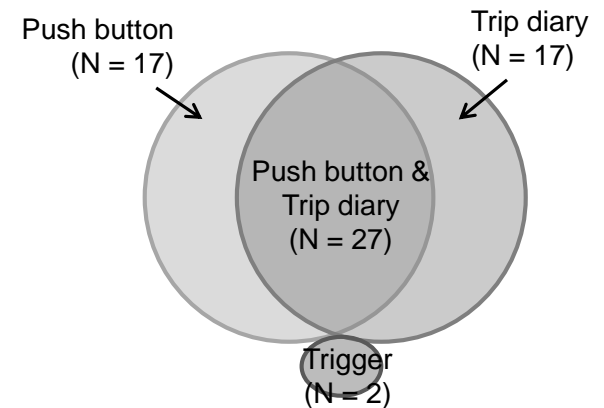


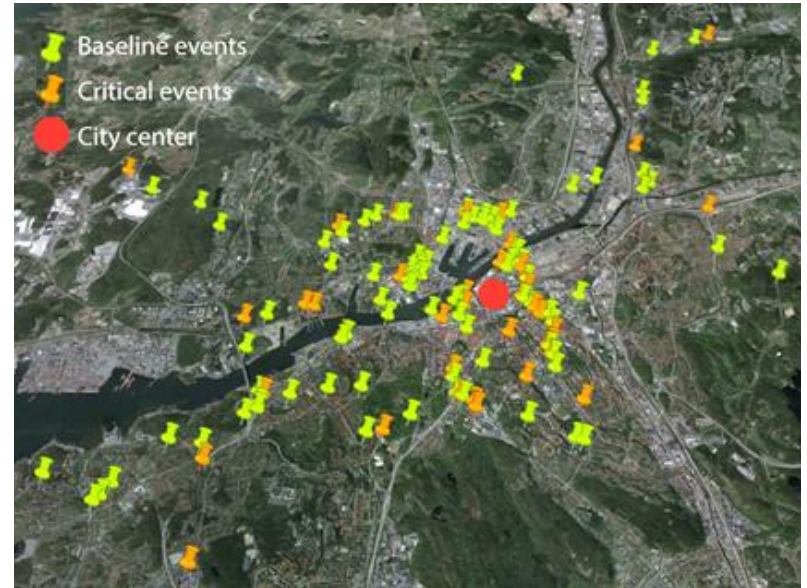
Data Collection

- Bicycle data (e.g., GPS, **safety-critical events** from push button)
- Trip diary (e.g., date, time, purpose, **safety-critical events**)
- Interview regarding safety-critical events (based on the trip diary)
- Demographic questionnaire

In total

- 332 trips (114 h, 1549 km)
- **N = 63 events** (56 critical, 7 crashes with degraded or lost stability)



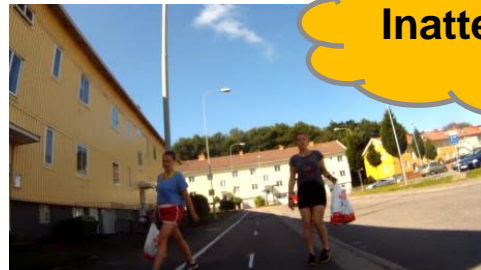


BikeSAFE

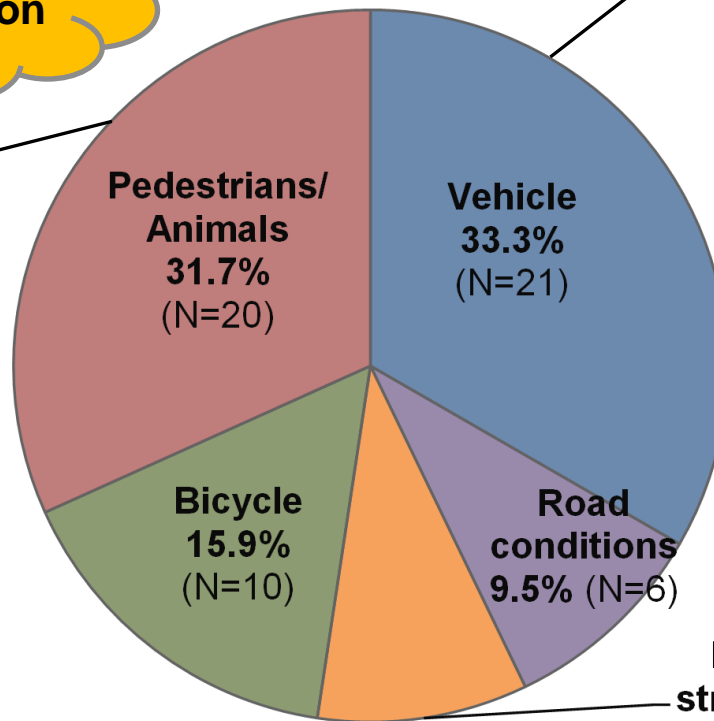
SAFETY-CRITICAL EVENTS

CONFLICTS IN THE EVENTS

N = 63



- 78% of events inattentive pedestrians walking on or crossing bike path



- 86% close to intersection
→ 45% visual occlusion

INATTENTION: PEDESTRIAN

Conflict in the events (N = 63)



DISTRACTION: PEDESTRIAN

Conflict in the events (N = 63)



CONFLICTS IN THE EVENTS

N = 63

Inattention



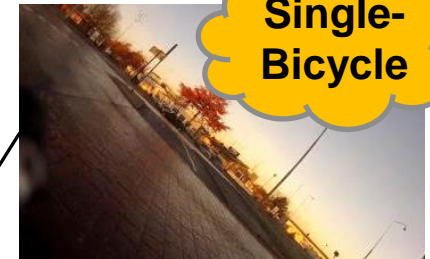
- 78% of events inattentive pedestrians walking on or crossing bike path

Distraction

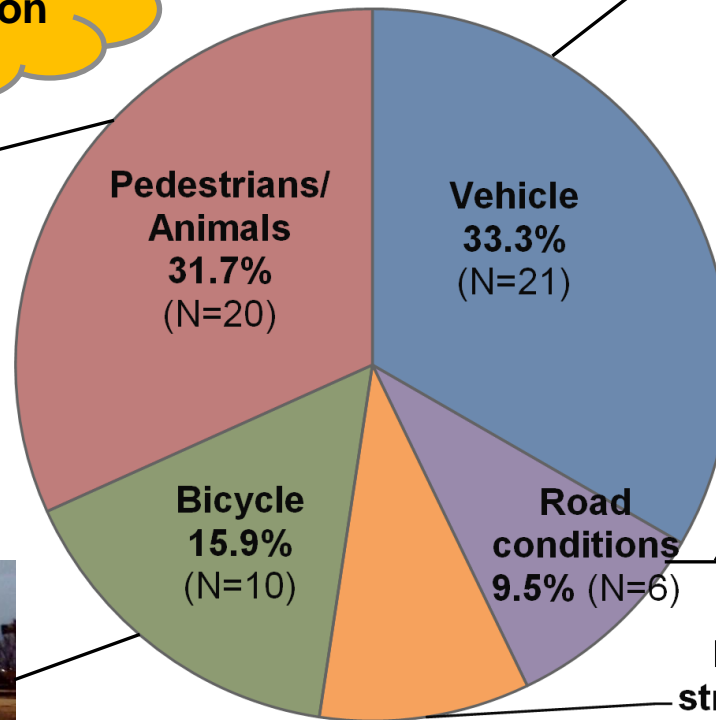


- 86% close to intersection
→ 45% visual occlusion

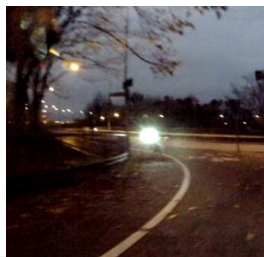
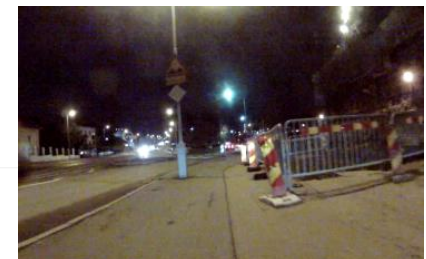
Single-Bicycle



- Slippery road, holes
- 5 crashes (3 lost stability)



Infra-structure conditions



- 60% visual occlusion (hedge, buildings, sharp corners, another cyclist)

- Construction work, traffic signs, iron bar on bicycle lane etc.

DISTRACTION: BICYCLIST

Conflict in the events (N = 63)





Conclusion & Discussion

NATURALISTIC CYCLING DATA

NATURALISTIC CYCLING DATA

Conclusion and Discussion

- Successful in adapting naturalistic methodology for bicycle
- Great method to understand distraction and inattention related crash causation (both the cyclist and other road users)
- To understand interaction with other road users
- To identify accident/incident scenarios which are hard to get from other data sources



NATURALISTIC E-BIKE CYCLING STUDY

Future steps





Thanks for your attention!

julia.werneke@chalmers.se