UDRIVE

European Naturalistic Driving Study

Driver-Cyclist Interactions

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Background & Overview

- Decreasing: Total number road crashes Europe
- NOT decreasing: crashes involving bicycles
- Cars/trucks vs. bikes: severy injuries, fatalities

- Analysis 1: Safety Critical Events
- Analysis 2: Right turn manoeuvre
- Analysis 3: Overtaking manoeuvre

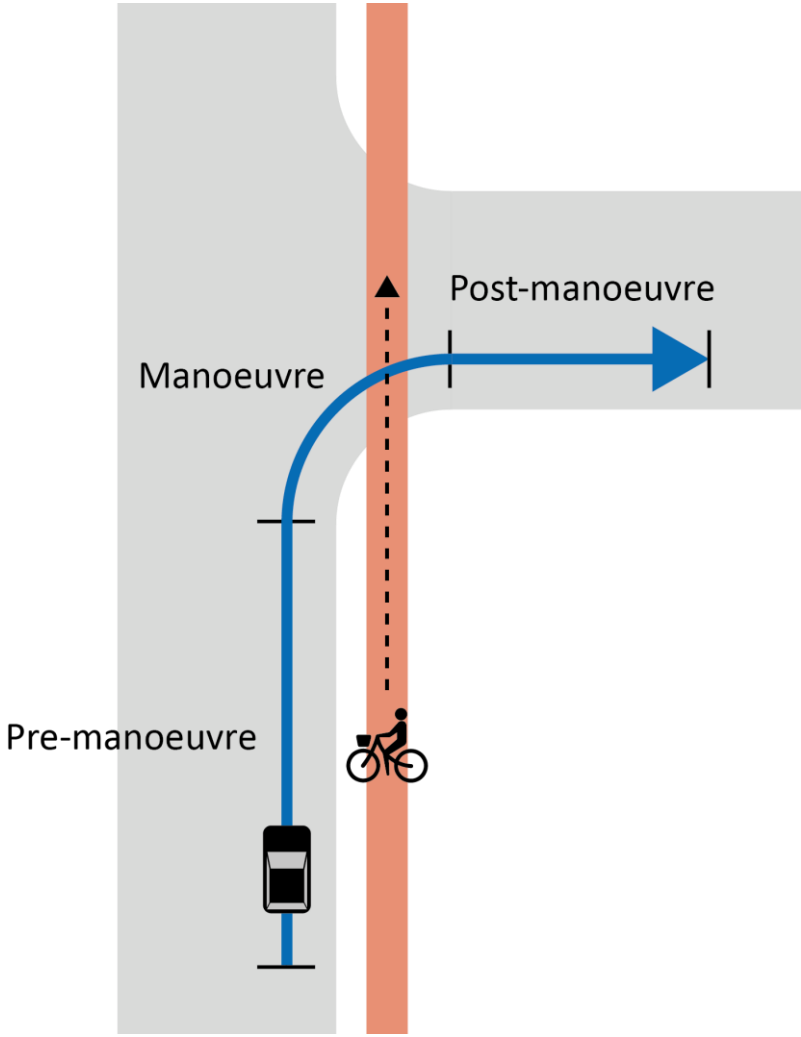
Right turn manoeuvre

(UK: left turn)

Do drivers check their blind spot? When?
Which factors influence this behaviour?

Method

- Identify manoeuvres
  - Based on GPS heading
  - Urban intersections and roundabouts
  - Speed limit <= 50 km/h
  - Segment: 6 sec pre manoeuvre, 3 sec post
- Sample size (2/2017)
  - 87 Car drivers (UK, PL, FR)
    - Left: 18465, Right: 8076, Roundabout: 9271
  - 31 Truck drivers (NL)
    - Right: 10122, Roundabout: 4374
  - Each driver: 15 intersections, 15 roundabouts
  - Total selection: 3540 segments.
- Annotation
  - Gaze direction
  - Non-driving behaviour
  - Infrastructure & Environment
  - Presence road users



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Expected results (annotation ongoing)

Independent variable		Car drivers				Truck drivers			
		Intersection		Roundabout		Intersection		Roundabout	
		Looked	*N*	Looked	*N*	Looked	*N*	Looked	*N*
Age	High	%	X	%	X	%	X	%	X
	Low	%	X	%	X	%	X	%	X
Experience	High	%	X	%	X	%	X	%	X
	Low	%	X	%	X	%	X	%	X
Gender	Male	%	X	%	X	%	X	%	X
	Female	%	X	%	X	%	X	%	X
Nationality	NL	%	X	%	X	%	X	%	X
	UK	%	X	%	X	-	-	-	-
	GER	%	X	%	X	-	-	-	-
	FR	%	X	%	X	-	-	-	-
	PL	%	X	%	X	-	-	-	-

Education: Do certain people require more/focused training?

Independent variable		Car drivers				Truck drivers			
		Intersection		Roundabout		Intersection		Roundabout	
		Looked	*N*	Looked	*N*	Looked	*N*	Looked	*N*
Intersection type	X	%	X	-	-	%	X	-	-
	T	%	X	-	-	%	X	-	-
	Y	%	X	-	-	%	X	-	-
Traffic flow	Free flow	%	X	%	X	%	X	%	X
	Stop and go	%	X	%	X	%	X	%	X
Priority regulation	Unregulated	%	X	%	X	%	X	%	X
	Signs	%	X	%	X	%	X	%	X
	Traffic lights w/ conflicts	%	X	%	X	%	X	%	X
	Traffic lights w/o conflicts	%	X	%	X	%	X	%	X
Cyclist facilities	None	%	X	%	X	%	X	%	X
	Adjacent cycle lane	%	X	%	X	%	X	%	X
	1 way cycle lane	%	X	%	X	%	X	%	X
	2 way cycle lane	%	X	%	X	%	X	%	X
Visual obstacles	Not present	%	X	%	X	%	X	%	X
	Present	%	X	%	X	%	X	%	X

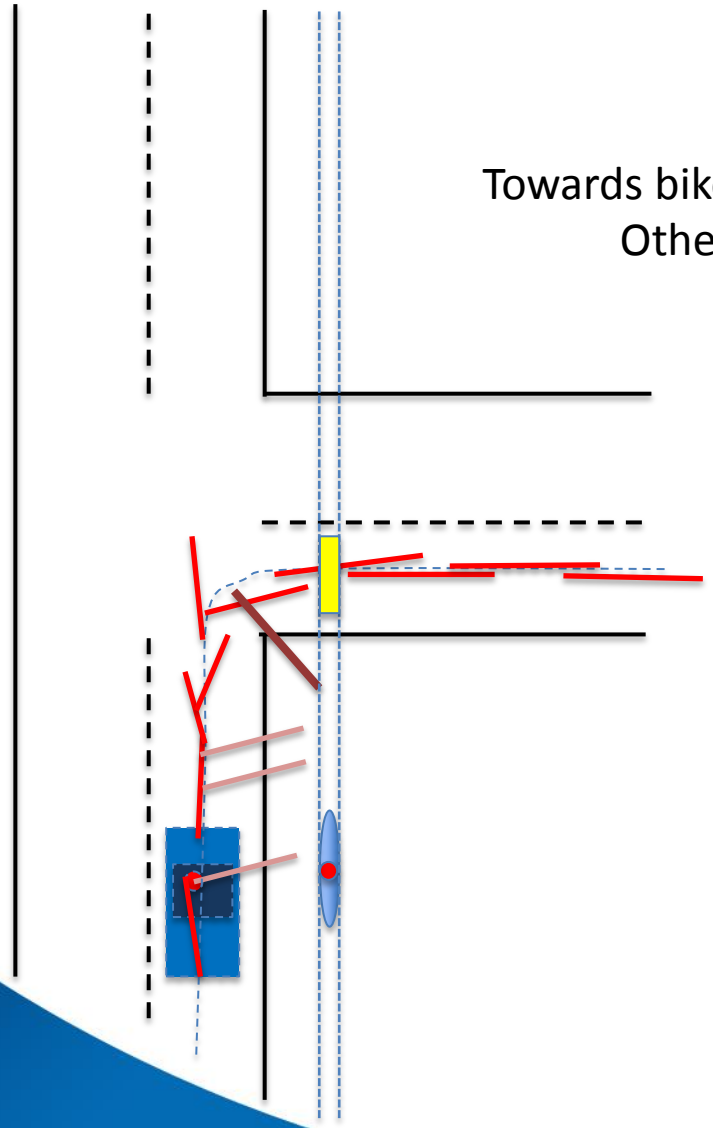
Infrastructure: which designs improve blind spot checking behaviour?

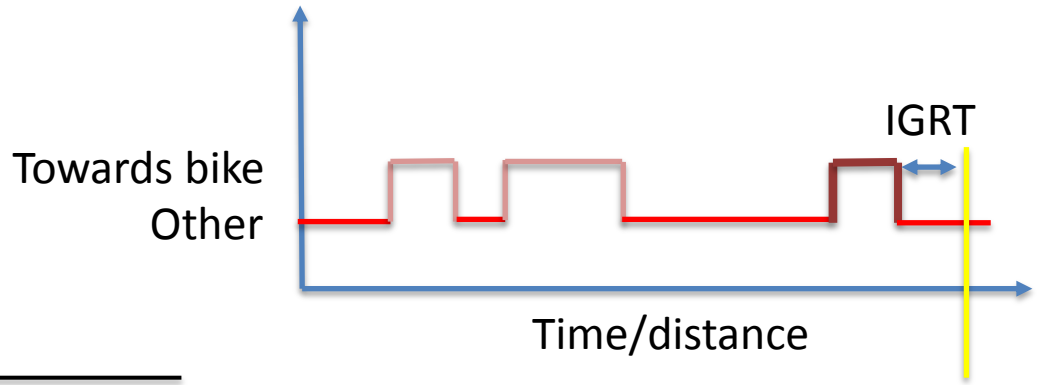
Independent variable		Car drivers				Truck drivers			
		Intersection		Roundabout		Intersection		Roundabout	
		Looked	*N*	Looked	*N*	Looked	*N*	Looked	*N*
VRU presence OWN direction	None	%	X	%	X	%	X	%	X
	Pedestrian	%	X	%	X	%	X	%	X
	Cyclist	%	X	%	X	%	X	%	X
	Ped & Cyc	%	X	%	X	%	X	%	X
Secondary tasks PRE manoeuvre	None	%	X	%	X	%	X	%	X
	Auditory	%	X	%	X	%	X	%	X
	Visual	%	X	%	X	%	X	%	X
	Manual	%	X	%	X	%	X	%	X
	Combination	%	X	%	X	%	X	%	X
Secondary tasks DURING manoeuvre	None	%	X	%	X	%	X	%	X
	Auditory	%	X	%	X	%	X	%	X
	Visual	%	X	%	X	%	X	%	X
	Manual	%	X	%	X	%	X	%	X
	Combination	%	X	%	X	%	X	%	X

Technology: warning drivers about VRU presence to improve blind spot checking?

Policy: impact of handsfree phone calls on blind spot checking?

WHEN? Intersection Gaze Release Time





- Quantifying the last glance toward the region of potential bicyclist from the right (thick dark red) in relation to encroachment zone (yellow)

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Overtaking manoeuvre

Background

- For safety system developers and infrastructure design
- E-bikes get more prevalent, more bikes in car/truck lanes?
- Existing studies on overtaking: controlled experiments
  - Driving simulator
  - Test tracks
  - On-road*
- New perspective: naturalistic driving data
- Utilize SmartCamera for bicycle identification and lane tracking

* Dozza, M. ; Schindler, R. ; Bianchi Piccinini, G. F. et al. (2016). How do drivers overtake cyclists?. *Accident Analysis and Prevention*. 88 s. 29-36

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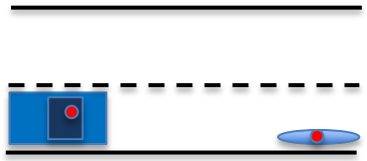
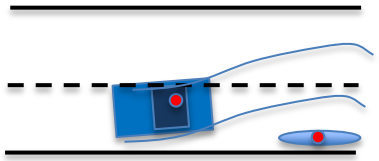
Method

- Identification of three overtaking phases and lateral clearance

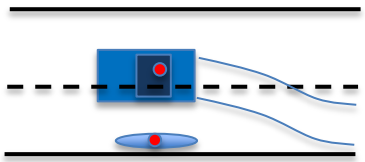
1: Approaching



2: Steering away

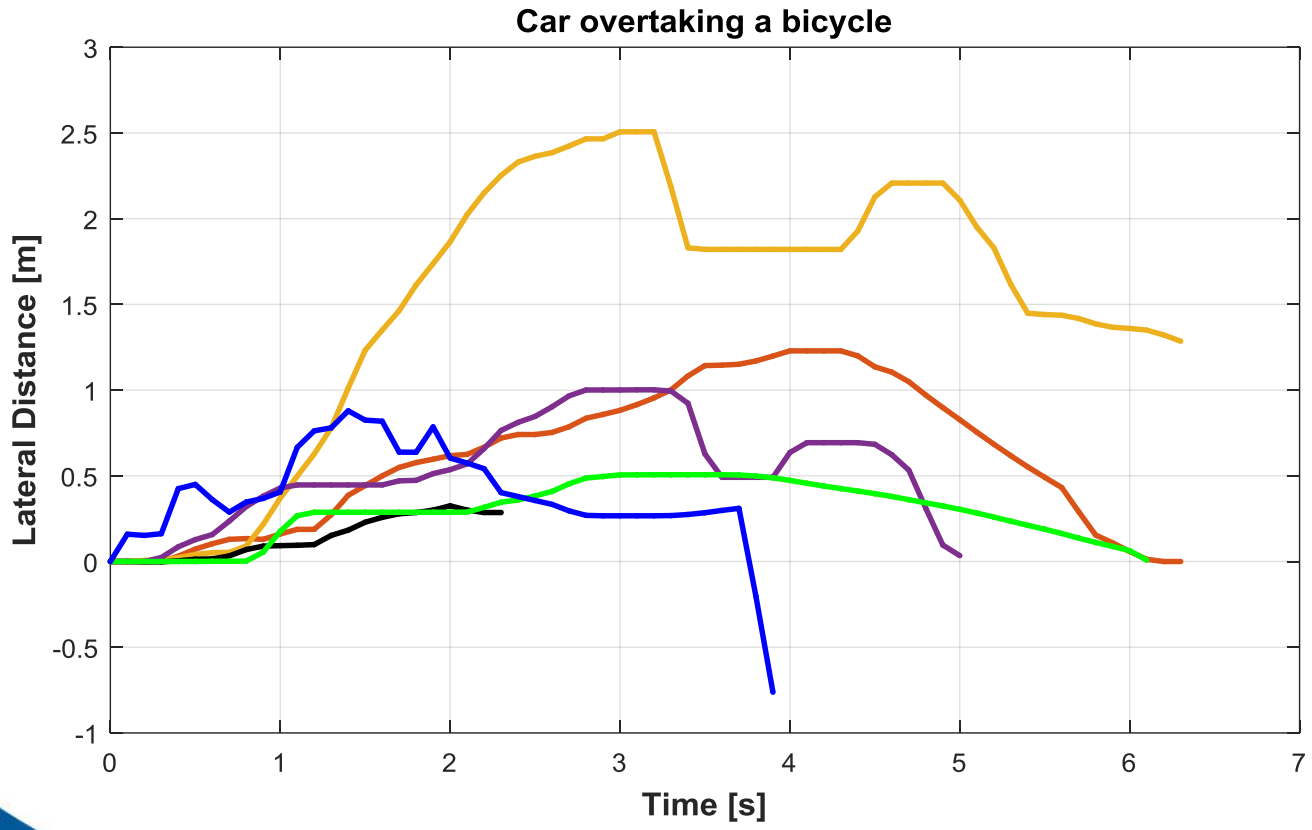


3: Passing



Preliminary results

- Six overtaking manoeuvres (UK, FR, PL)
- From start phase 2 (steering away) to end phase 3 (passing)



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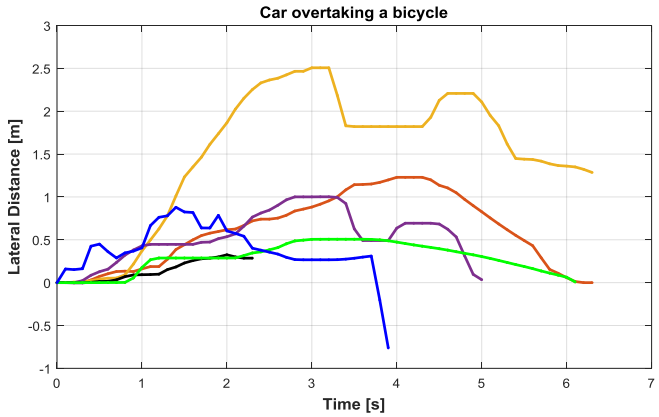

- Curve variation:
  - Road/lane width?
  - Proximity other road infrastructure?
  - Oncoming vehicle present?
  - Comfort boundaries?
  - Perception of the experience of the bicyclist?

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Q&A

Right turn manoeuvre
Overtaking manoeuvre

Suggested topics

Implications on:

- Education
- Policy
- Technology
- Infrastructure

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