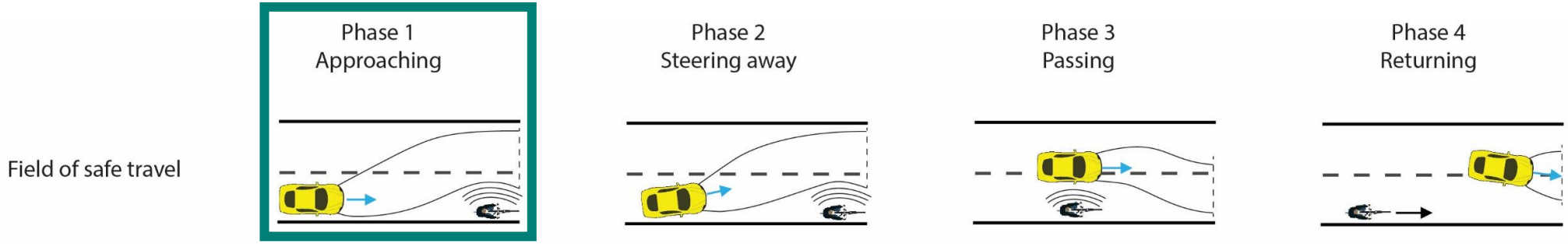
MICA

Modeling Interaction between Cyclists and Automobiles

Chalmers & Veoneer | 2020-11-04

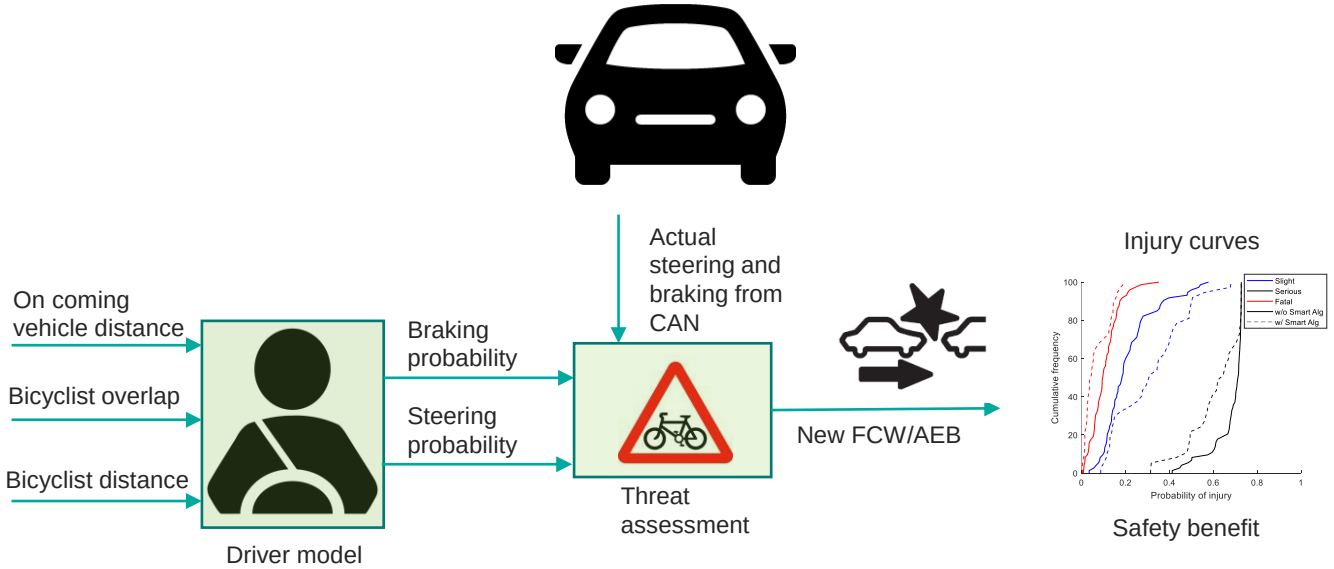
Overtaking a Cyclist

https://www.youtube.com/watch?v=043iIHmC6s8



[Dozza et al., 2016]

Master plan



Alexander Rasch
Chalmers

Prateek Thalya
Veoneer

Jordanka Kovaceva
Chalmers

Data: test-track experiment

Modelling Interaction between
Cyclists and Automobiles

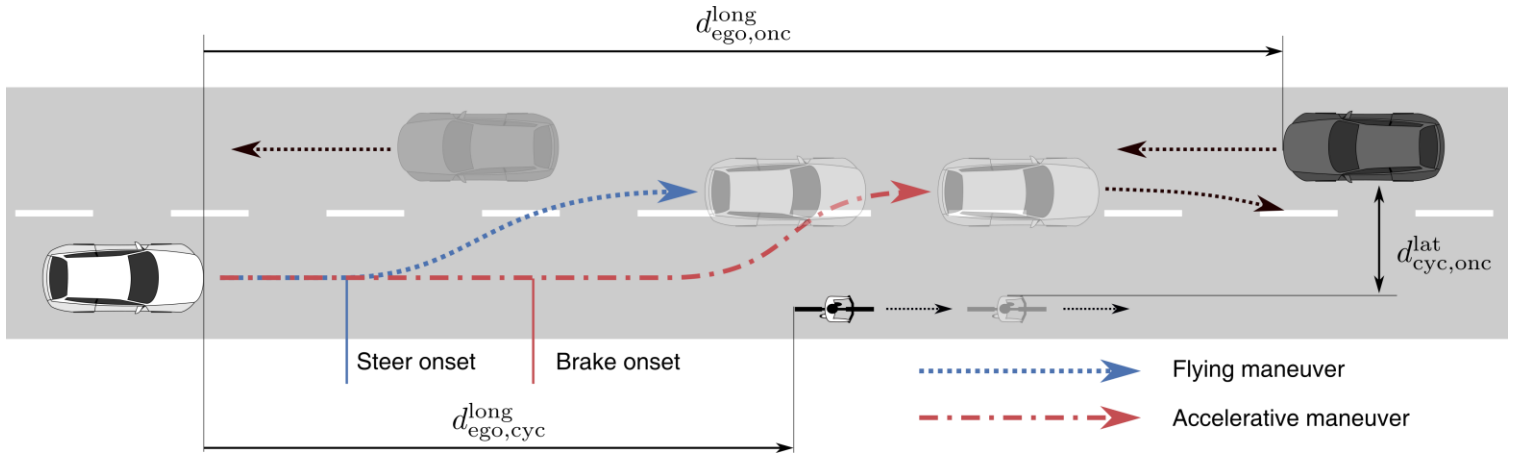
Drivers in Interaction with
Vulnerable road users

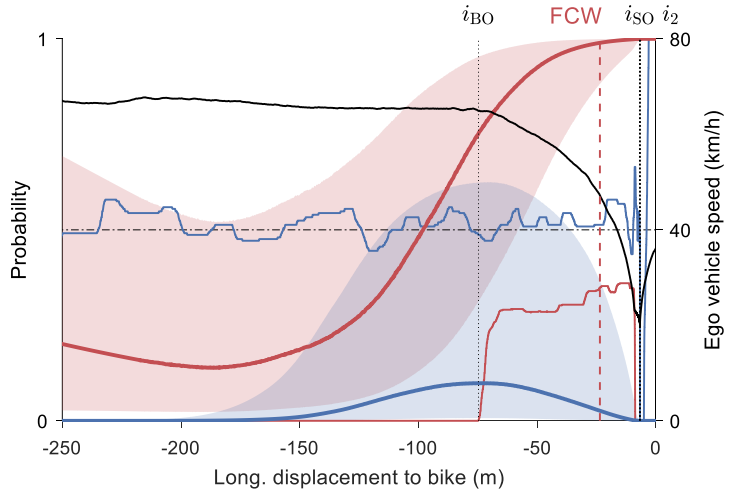
https://www.youtube.com/watch?v=AixQ189hMi4

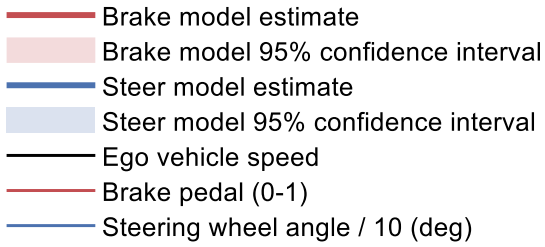
Driver models





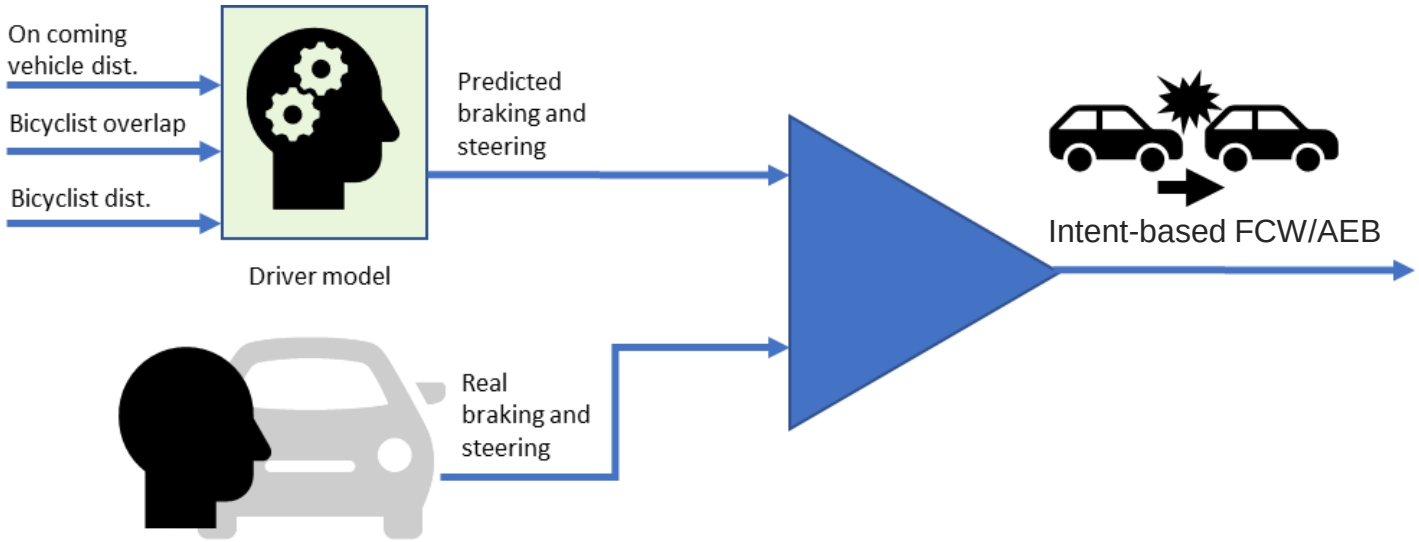



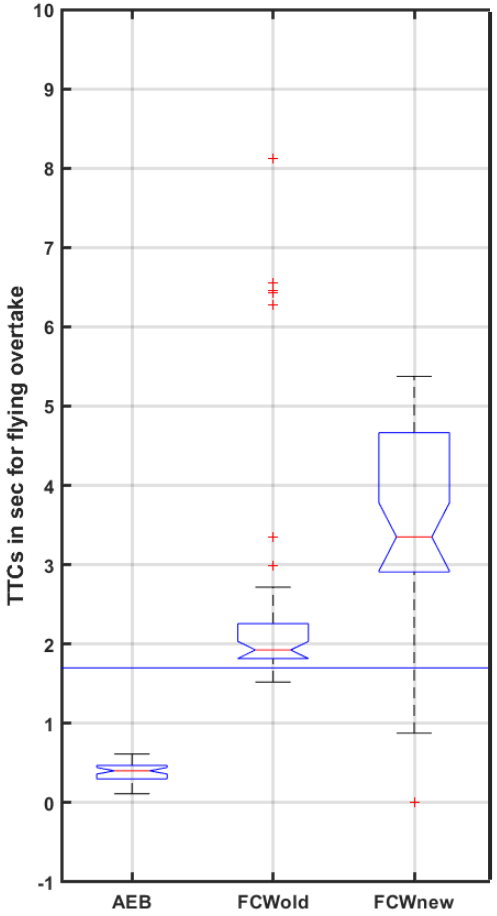




- Rasch A., Boda C.-N., Thalya P., Aderum T., Knauss, A. & Dozza, M. *"How do oncoming traffic and cyclist lane position influence cyclist overtaking by drivers?"* 8th International Cycling Safety Conference, Brisbane, Australia, 18-20 Nov 2019.
- Rasch A., Boda C.-N., Thalya P., Aderum T., Knauss, A. & Dozza, M. (2020) "*How do oncoming traffic and cyclist lane position influence cyclist overtaking by drivers?*". Accident Analysis & Prevention, Vol. 142.
- Rasch, A., & Dozza, M. (2020), *"Modeling drivers' strategy when overtaking cyclists in the presence of oncoming traffic"*, (IEEE Transactions on Intelligent Transportation Systems; in press).

Intent-based FCW/AEB

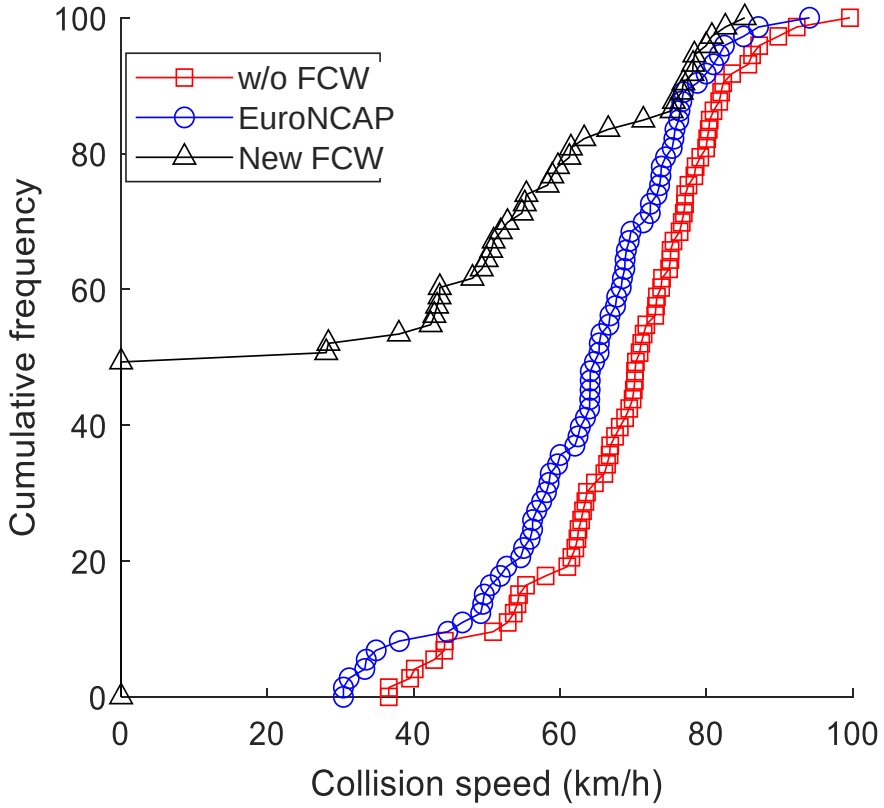




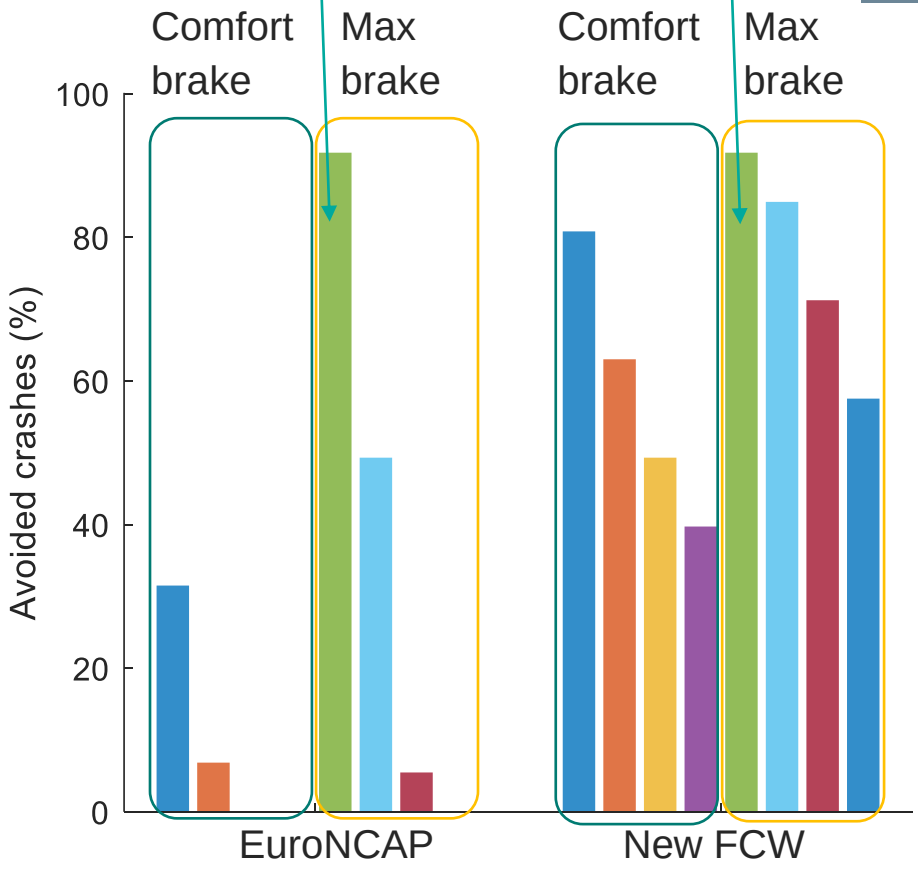
Thalya, P., Kovaceva, J., Knauss, A., Lubbe, N., & Dozza, M. "*Modeling driver behavior in interactions with other road users*", Transportation Research Arena, Helsinki, Finland 27-30 Apr 2020.

Kovaceva J., Thalya P., Lubbe N., Knauss A., Dozza M. "*A new framework for modelling road-user interaction and evaluating active safety systems*". 7th International Cycling Safety Conference, Barcelona, Spain, Oct. 10-11, 2018.

Safety-benefit analysis



An ideal driver (super attentive and super performant) would get the same benefit independently of the FCW algo.



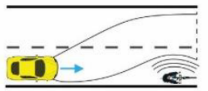
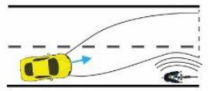
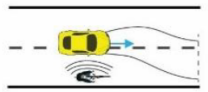
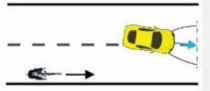
Kovaceva J., Bärgman J., Dozza M., "*Enabling counterfactual analyses to estimate the safety benefit of advanced driving assistance systems: A comparison of driver models using naturalistic and test-track data from cyclist-overtaking maneuvers*", (TRF in press)

Lesson learned

- The most critical interaction in an overtaking manoeuvre is between the vehicle overtaking and the ***oncoming traffic***.
- The approaching phase may *not* be the **riskiest phase** of an overtaking manoeuvre.
- *Automated emergency steering and* ***lateral control systems*** have a great potential to increase overtaking safety.
- As an overtaking manoeuvre develops ***passive safety systems*** become an important complement to active safety because kinematics become critical.
- Data from situations with critical kinematics require ***new methodologies*** so that the testing can be ecologically valid and safe.
- More ***naturalistic data*** with higher sensor resolution is needed to validate our models and make it possible to run accurate safety-benefit analyses.
- Most of the safety benefit analyses focus on true positives and ***neglect false positives***
- For ***automated vehicles*** to safely overtake without surprising or scaring any road users (including the driver/passenger), understanding the relation to oncoming traffic is crucial.
- As a driver moves from the approaching phase to the following overtaking phases, the ***requirements*** for sensor technology and wireless communication may drastically increase.

MICA 2

- Same PhD students
- 5 more partners
- All phases of overtaking maneuver
- New work on crash causation mechanisms for each phase
- Both braking and steering systems (active safety)
- Introduces passive safety systems
- New focus on methodologies: augmented reality, robot bike, bike simulator.
- New data combinations including insurance data and site-based naturalistic data

	PHASE 1 APPROACHING	PHASE 2 STEER AWAY	PHASE 3 PASSING	PHASE 4 RETURNING
				
REAR-END	AEB/FCW/AES VRU airbags	-	-	-
HEAD-ON	-	AEB/AES Frontal impact	-	AES
SIDE-SWIPE	-	-	AES/LCW VRU side protection	AES/LCW VRU side protection

Scientific contributions

Licentiate thesis:

- J. Kovaceva, "*Understanding and modelling car drivers overtaking cyclists: Toward the inclusion of driver models in virtual safety assessment of advanced driving assistance systems*", (2019), Licentiate thesis, Chalmers University of Technology, Gothenburg, Sweden.

Journal papers:

- Rasch A., Boda C.-N., Thalya P., Aderum T., Knauss, A. & Dozza, M. (2020) "*How do oncoming traffic and cyclist lane position influence cyclist overtaking by drivers?".* Accident Analysis & Prevention, Vol. 142.
- J. Kovaceva, J. Bärgman, M. Dozza, "*Enabling counterfactual analyses to estimate the safety benefit of advanced driving assistance systems: A comparison of driver models using naturalistic and test-track data from cyclist-overtaking maneuvers*", (TRF; in press)
- Rasch, A., & Dozza, M.. *"Modeling drivers' strategy when overtaking cyclists in the presence of oncoming traffic"*, (IEEE Transactions on Intelligent Transportation Systems; in press).
- J. Kovaceva, J. Bärgman, M. Dozza, "*The potential safety benefit of collision warning system for car to cyclist overtaking scenario*", (Submitted).
- Thalya P., Lubbe N., and Dozza M., "How can driver models inform threat assessment for active safety? Implementation and evaluation of a new forward collision warning system.", (in preparation)

Contributions to conferences:

- Thalya, P., Kovaceva, J., Knauss, A., Lubbe, N., & Dozza, M. "*Modeling driver behavior in interactions with other road users*", Transportation Research Arena, Helsinki, Finland 27-30 Apr 2020.
- Kovaceva J., Thalya P., Lubbe N., Knauss A., Dozza M. "*A new framework for modelling road-user interaction and evaluating active safety systems*". 7th International Cycling Safety Conference, Barcelona, Spain, Oct. 10-11, 2018.