Connected Motorcycle Consortium

Motorcycle HMI Design for Cooperative Intelligent Transport Systems (C-ITS)

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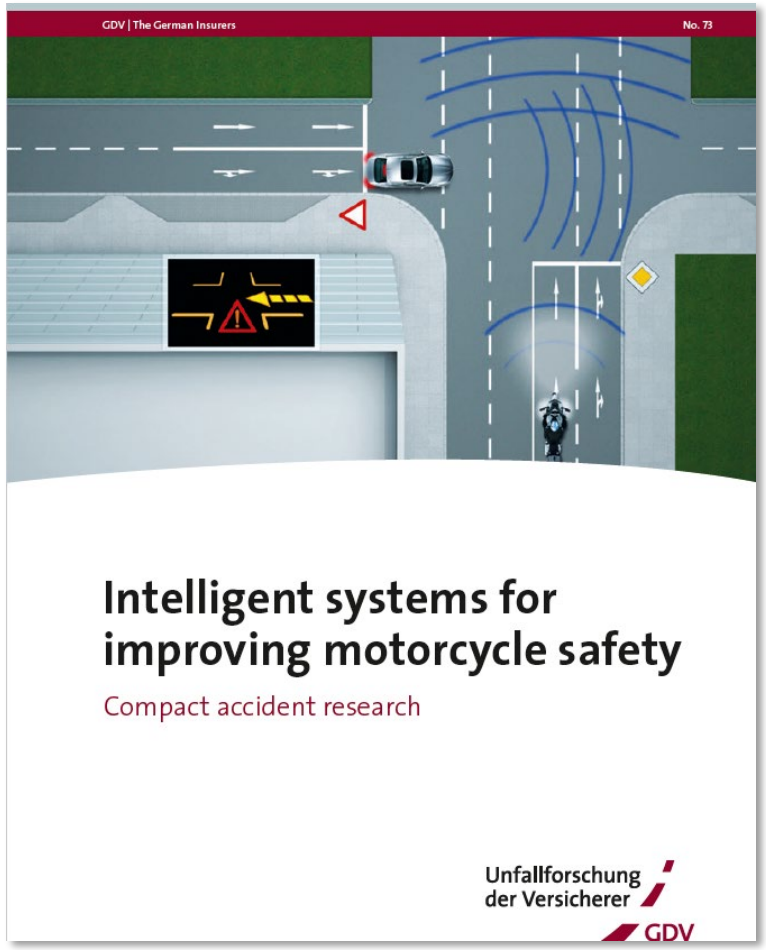
Agenda

- **CMC Task group HMI for C-ITS**
- **Study on information timing**
  - Background
  - Methods
  - Results
  - Discussion
- **Conclusion**

Connected Motorcycle Consortium (CMC)

CMC aims at integrating motorcycles in a world of future connected mobility

CMC Task group HMI for C-ITS



"[…] When developing ITS systems for powered two wheel vehicles, it is crucial to devote particular attention to the human-machine interface in order, for example, to avoid distracting riders and to increase the degree to which these systems are accepted by riders. The distinctive nature of riding powered two wheel vehicles has to be taken into account, since riding a single-track vehicle is very different from driving a car. […]"

(German Insurance Association GDV, 2018; p. 13)

CMC Task group HMI for C-ITS

Our work…

- **Create application-independent HMI specifications**
  - As a baseline to start from
  - Including e.g. guidelines from the automotive sector

- **Conduct studies**
  - On topics that are perceived as highly relevant / PTW specific
  - From online surveys to simulator and test track studies

Study example

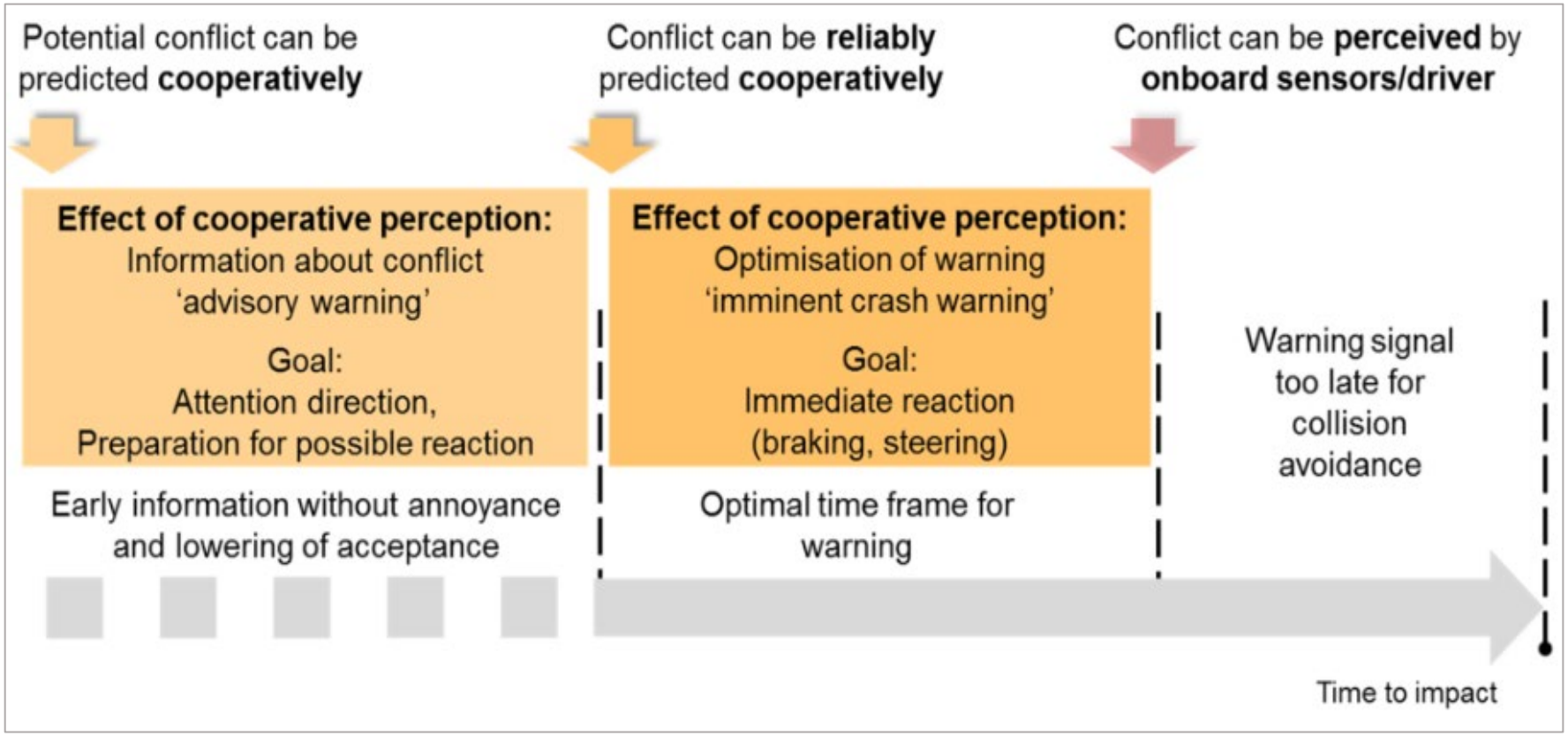
Information timing for motorcycle C-ITS

- Background
- Methods
- Results
- Discussion

Background: systems design

Schematic time frame

* Naujoks & Neukum, 2014; p.159



Methods

DESMORI motorcycle simulator

- Mockup: BMW F 800 R
- 6 DoF Steward platform
- 220° horizontal field of view
- In-helmet sound system
- Body shaker
- Steering torque (up to ~80 Nm)
- TFT-Displays as cockpit and mirrors

Methods

Panel description

- All riders from WIVW rider panel, familiar with the simulator
- *N* = 16 (14 male, 2 female)
- No professional riders
- Mean age: 35 years (*sd* = 14; from 19 to 60)

Methods

Independent variable: information timing

- 3 levels of Time Headway (t_1 = 8 s; t_2 = 11 s; t_3 = 14 s)

Road Hazard Information

Roadworks Information

Forward Collision Information

Methods

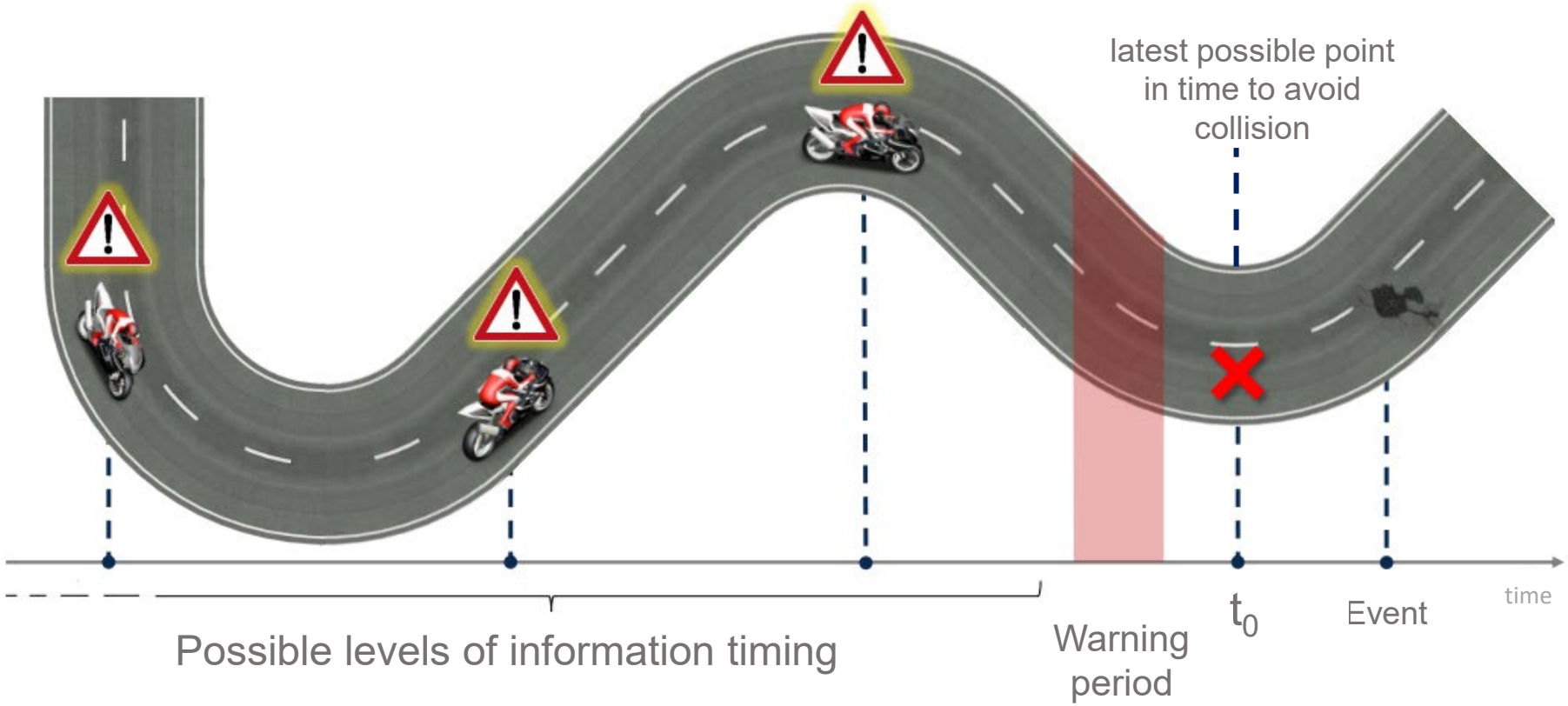
Road Hazard without C-ITS application

Methods

Road Hazard with C-ITS application

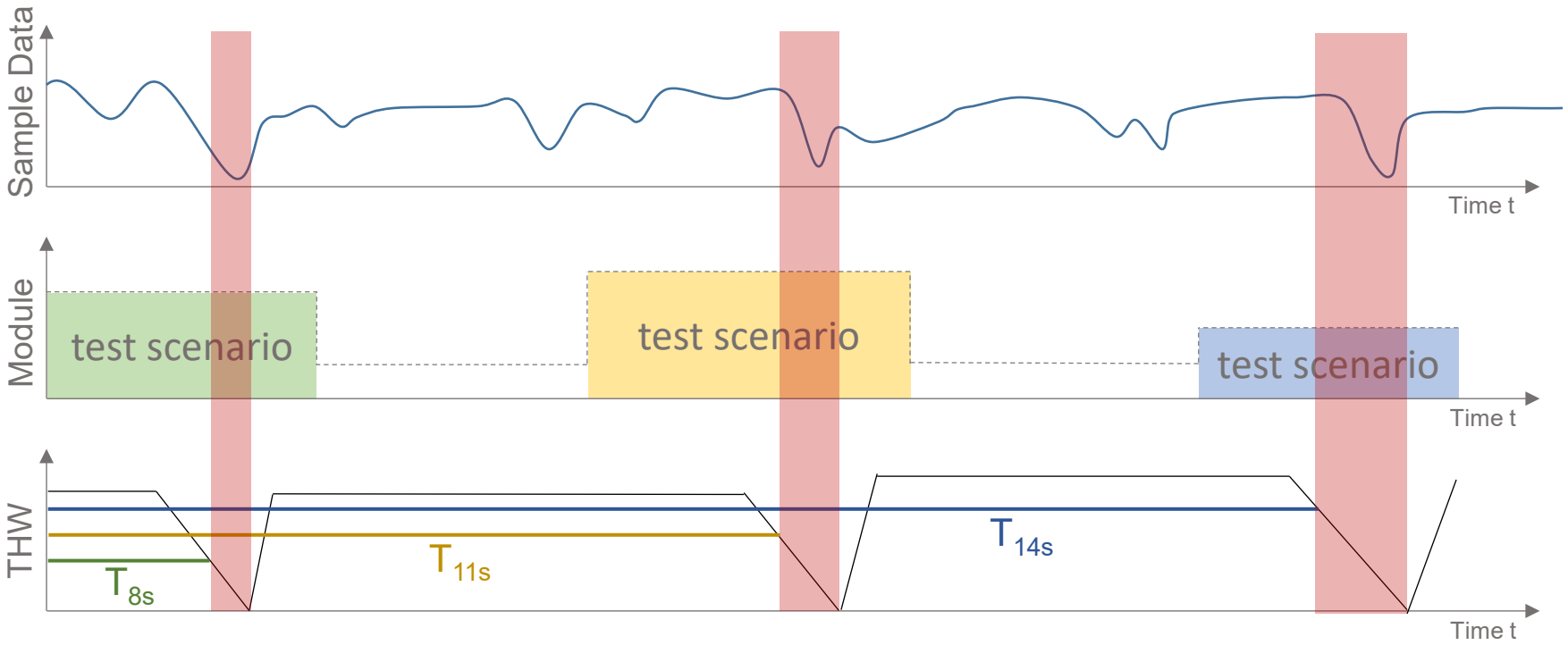
Methods

Independent variable: information timing



Methods

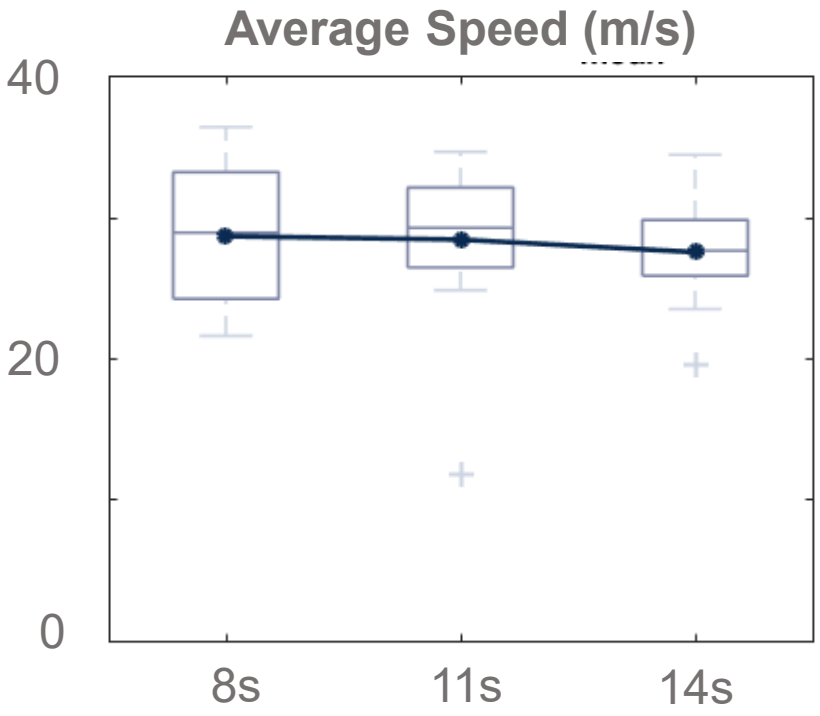
time intervall: [Time Headway = T_i , min(Time Headway)]



Results

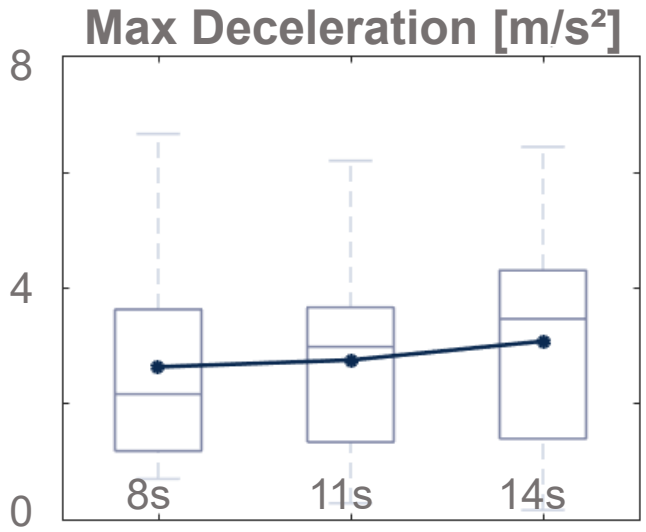
- No significant differences in vehicle speed while information was displayed.
- This holds true for all levels of information timing and C-ITS applications.

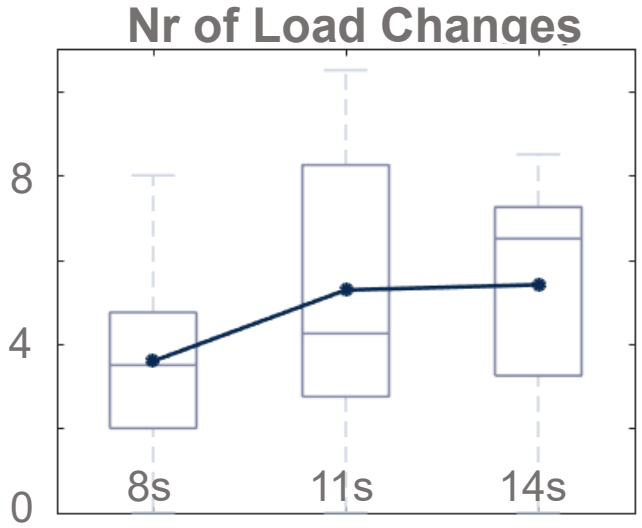
  (F(2,30) < 1)



Results

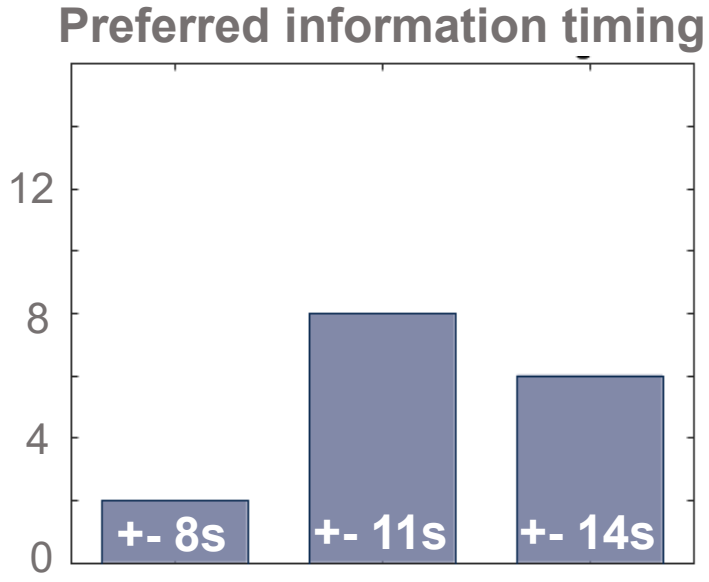
- All levels of information- timing lead to moderate braking manoeuvres. ($F(2,30) < 1$)
- No significant differences in numbers of load changes between issuing of information and event. ($F(2,30) = 2.40$, $p = .108$) $\eta^2_p = 0.088$)

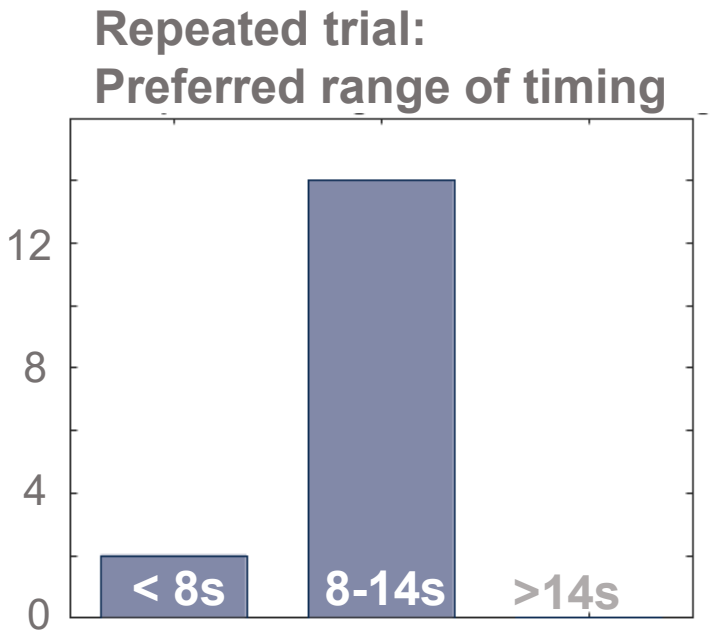




Results

- The 11s information timing is preferred.
- 2 riders would prefer later information presentation than 8s while none prefers earlier than 14s.

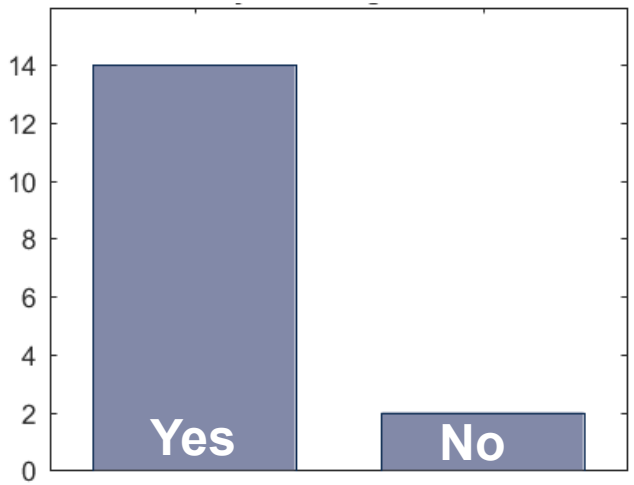




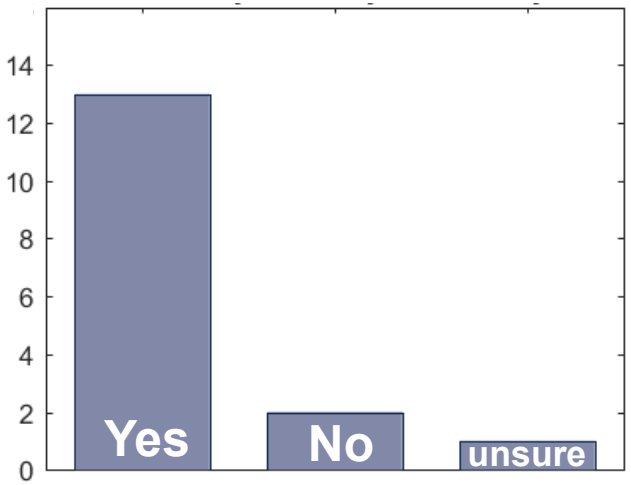
Results

- Majority of riders state to change their behaviour after information presentation.
- Majority would like to use such system.

Did the information affect your riding behaviour?



Would you like to use this assistance system on your bike?



Discussion

- **All timings appropriate as to attention allocation and action preparation**
- **No collisions**
- **No annoyance**
- **Preference for 11s timing**
  - Raised situation awareness…
  - …without creating uncertainty.

Conclusion

Pioneering work

- No motorcycle-specific recommendations for C-ITS application‘s HMI design available so far.
- Simulation delivers empirical evidence for proper HMI design.
- Only when applications are in use, can riding be safer.

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Thank you for your attention

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