Understanding Driver-AV Interaction Using Neuroergonomics

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SHAPE-IT

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Project aims & objectives

- Understand the **cognitive processes** underlying driver-AV interaction
- Assess driver-AV interaction using **neurophysiological measurement**
- Derive recommendations for design of **predictable AVs**

Key concepts

- Mental workload
- Attention
- Transition of control

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Methods (A)

- Driving simulator & test track experiments

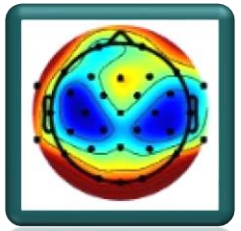
Driving simulator @Ulm University

AV prototype & test track @Bosch Renningen

Methods (B)

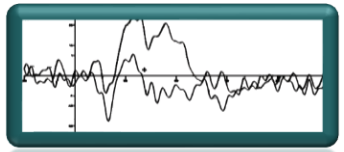
- Electroencephalography (EEG)

Oscillatory brain activity
(e.g., alpha and theta brain waves)



Event-related potentials (ERPs)

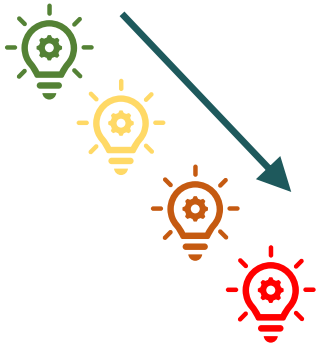
(e.g., P3 component)



Findings so far – experiment 1

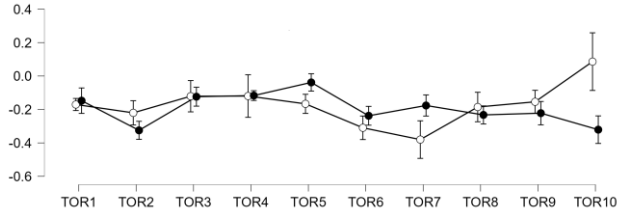
Ambient light conveying **reliability** of an AV helps drivers **perform better** after a take over request without increasing their **mental workload**

High reliability



Low reliability

A)



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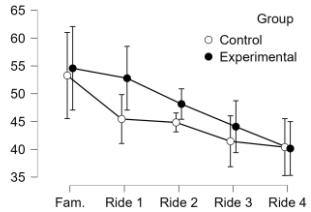

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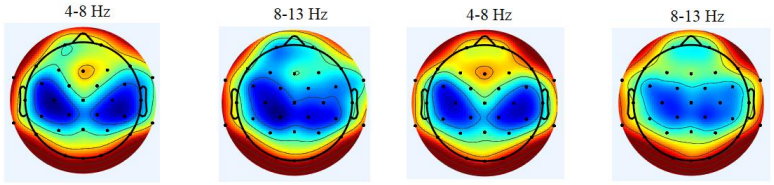


(a) Drivers without the ambient light (b) Drivers with the ambient light

A) Vehicle jerk - performance
B) Self-report mental workload
C) Alpha and theta power

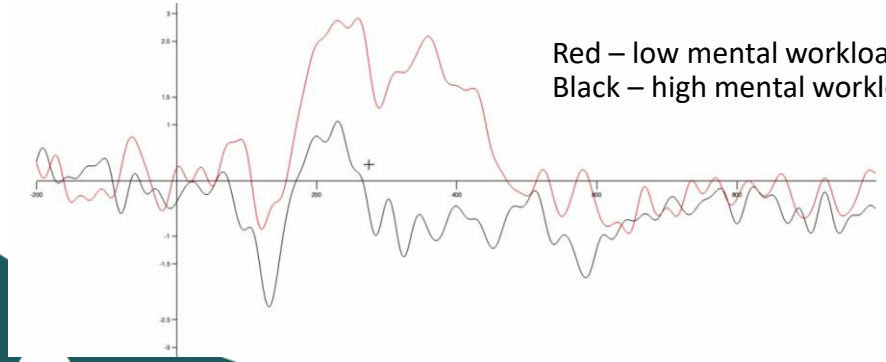
Current focus – experiment 2

Do drivers **allocate** their **attentional** resources differently when driving an SAE **L2** and SAE **L3** AV?

Expected results:

Brain response to disturbing sounds on L2 is different than on L3

- Three stage model of distraction

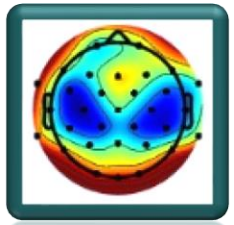


Red – low mental workload
Black – high mental workload

Challenges & future orientation

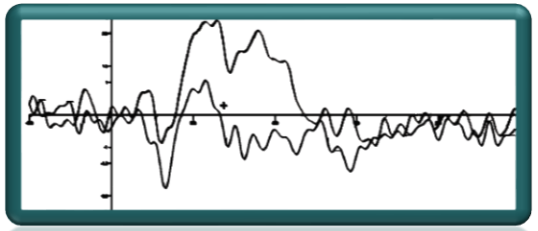
- Are all the methods we use **valid** and **reliable**?

→ Evaluation and validation of methods assessing driver's state



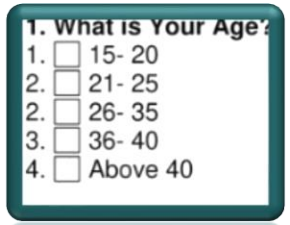
Oscillatory EEG

X



Event-related potentials

X



Self-report data

X

Behavioural data

Thank you for your attention

Questions?

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