Transparency Assessment of Automated Vehicle

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BACKGROUND

- There is yet a data-driven approach to estimating how transparent is the AV*
- The assessment method was developed (**study 1**) and then adapted to the driving simulator study (**study 2**)

FUNCTIONAL TRANSPARENCY

Study 1: online-study

- Defined by actual understanding and time used
- Used to assess three brands of HMIs* (VW, BMW, Tesla)
- Found differences in users with different ADS* experiences

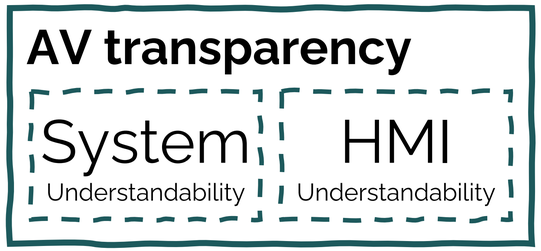
INCLUDING WORKLOAD

Study2: simulator study

- Three different HMI designs
- Transparency assessment with workload measurements (NASA-TLX, EEG, ECG, EDA)
- Under analysis

WORKLOAD MEASUREMENTS

- Determine which objective workload measurement is most sensitive to different HMI designs
- ECG, EDA (EEG could only be used for general evaluation)



$$T_{functional} = AU(1 - \frac{TNPU}{TNPU_{max}})$$
$$\Longrightarrow AU(1 - workload_{norm})$$

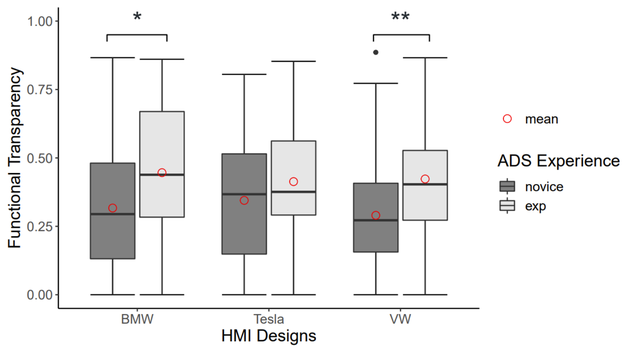


Figure 1. Comparing levels of ADS experience given HMI designs (exp stands for experienced in ADS experience levels).

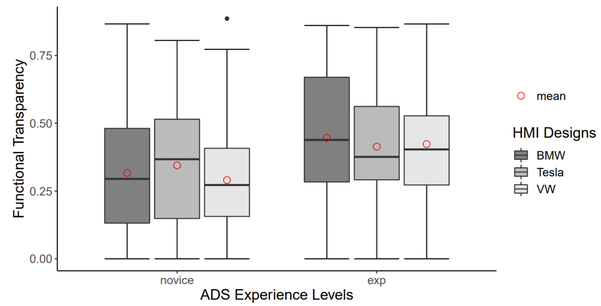


Figure 2. Comparing HMI designs given ADS experience levels (exp stands for experienced in ADS experience levels).

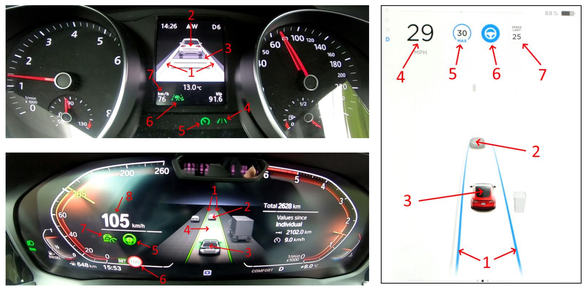


Figure 3. HMI designs used in Study 1.

*AV: automated vehicle; *HMI: human-machine interface; *ADS: automated driving assistance

Table 1. HMI designs used in study 2, including different system understandability (trans-fog v.s. trans designs) and different HMI understandability (fog v.s. trans-fog designs).

	fog design	trans-fog design	trans design
ACC activated			
L2 available			
L2 activated (available)			
L2 activated (not available)			

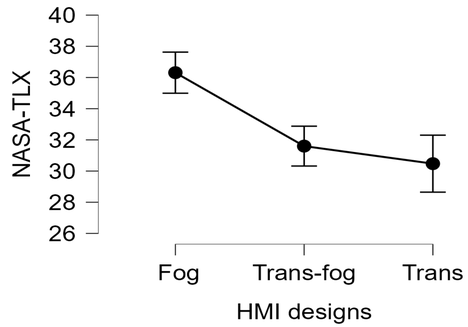


Figure 4. NASA-TLX scores for different HMI designs.

FUTURE WORKS

- Transparency assessment method for dynamic environments (e.g., driving simulator, test track)
- Relationships between functional transparency assessed in online studies and in simulator studies

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