HUMAN-MACHINE-
INTERACTION

Ko-HAF
KOOPERATIVES
HOCHAUTOMATISIERTES FAHREN

Automated Driving and Driver Drowsiness

METHOD

Wizard-of-Oz (right-hand-drive vehicle)

- A right-hand-drive vehicle was used to simulate an automated drive in real driving environment.
- Participants were at no time able to intervene in the real driving process.
- This setting was chosen, because it can not be assumed that every participant will take-over control safely when experiencing higher drowsiness levels in real driving environment.

1

WHICH OPTIONS OF A DRIVER-STATE-RELATED OR OF A SYSTEM-BASED STRATEGY WOULD BE MOST ACCEPTED – OUT OF A USER´S PERSPECTIVE?[1]

To date it is unknown how the system should react in the case of elevated drowsiness.
To evaluate this, participants subjectively assessed various options of a driver-state related and of a system-based strategy.

Results

- A specific offer of non-driving-related tasks might be an accepted driver-state related option.
- A minimum risk maneuver should be avoided (users‘ perspective).

Further research

- A holistic view is needed for developing safe and accepted systems (evaluation of different perspectives).
- The idea of a preparation strategy as a combination of the driver-state related and the system-based strategy should be evaluated.

2

HOW TO GET THE DRIVER DROWSY AND HOW DOES DROWSINESS INFLUENCE VARIOUS TAKE-OVER ASPECTS?[2]

Results

- To investigate the influence of drowsiness, the cumulative percentage allows for an a priori estimation of the time needed to reach a certain drowsiness level (DL). According to Tab.1 a period of about 60 minutes is an appropriate time frame for a test drive.
- Large individual differences were observed by large standard deviations when participants had initially reached DL4 or DL6. Hence, a manipulation of automation duration is less suitable to investigate drowsiness effects.
- There was no significant influence of the drowsiness level on take-over-time aspects. However, in contrast to the participants of the non-drowsy condition some participants experiencing higher levels of drowsiness showed surprise when a RtI (Request to Intervene) happened.

Tab.1: Cumulative percentage until participants reached DL4 or DL6 for the first time as a function of time (N=30)

time (minutes)	DL_4 (cumulative percentage)	DL_6 (cumulative percentage)
0	0.00 %	0.00 %
5	3.33 %	0.00 %
10	10.00 %	0.00 %
15	20.00 %	0.00 %
20	23.33 %	3.33 %
25	30.00 %	10.00 %
30	46.67 %	16.67 %
45	60.00 %	40.00 %
60	73.33 %	56.67 %
75	76.67 %	60.00 %
>75	76.67 %	63.33 %
never reached:	23.33 %	36.67 %

DROWSINESS LEVEL 4:
eyelid closures (1-2s); eyes rolling sideways; rarer blinks; no proper focused eyes; decreased facial tone; lack of apparent activity; large isolated or punctuating movements.

DROWSINESS LEVEL 6:
eyelid closures (4s or more); falling asleep; longer periods of lack of activity; movements when transition in and out of dozing.

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