

Press Release

Findings from the DEKRA Road Safety Report 2024

Great Need for Research into Human Takeover from Automated Driving

- ▶ Varying performance in DEKRA study with Dresden University of Technology
- ▶ Secondary task makes it more difficult to detect any system-related errors
- ▶ Trust in automation plays an important role

Highly automated driving at level 3 relies on a high degree of networking between the information systems involved. Intelligent solutions for automated hazard avoidance in real time are intended to bring a digital form of “swarm intelligence” to the road in the future, which will help to mitigate safety deficits. But what happens if the information chain is prone to error and no valid data is transmitted due to insufficient system reliability? The effects of prompts to take the wheel when inaccurate information is displayed are the subject of a study conducted by DEKRA and the Chair of Engineering Psychology at the Technical University of Dresden as part of a collaborative project at the DEKRA Lausitzring.

Vehicle models from various manufacturers that can drive in the highly automated level 3 mode are already on the roads of this world. Level 3 means that drivers no longer have to permanently monitor the vehicle in certain situations. Rather, the system prompts them to take the wheel, when necessary, within a warning period. “Reliable technology is a crucial prerequisite for acceptance of and trust in automation”, says DEKRA traffic psychologist Dr. Thomas Wagner, referring to the DEKRA Road Safety Report 2024, entitled “Traffic Environments for People”. The 17th edition of the report addresses, among many other topics, the challenges associated with prompts to take control from highly automated driving.

The study of test subjects examines the effects of non-intended takeover requests on the heart rate and eye movements of the person behind the wheel. The subjectively experienced extent of trust in automation was also measured. To this end, DEKRA and the Chair of Engineering Psychology at the Technical University of Dresden were able to recruit a total of 49 people for a 40-minute test drive at the DEKRA Lausitzring from a previous online survey on, among other things, socio-demographic factors.

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The 19 female and 30 male participants – aged between 18 and 56 years – had held their driving license for an average of nine years and had no previous experience with highly automated vehicles. The participants were led to believe that the test vehicle, which was already equipped with a large number of environment sensors at the factory and had been retrofitted with additional sensors, was driving highly automated. However, the vehicle was controlled, and critical takeover scenarios were initiated manually by a trained DEKRA safety driver in the passenger seat using a joystick. The test vehicle was equipped with a half-height partition between the front seats to prevent the test subject from noticing this control.

Less driving comfort due to attention being diverted from the secondary task

After several uneventful laps, the test subjects either experienced a “false alarm” with no apparent cause or a comprehensible request to take control, indicated by the “sensor malfunction” warning on the cockpit display. After a few more minutes of trouble-free driving, a “silent error” was simulated – the vehicle drifted slowly into the oncoming lane without any prior system warning on the cockpit display. During the drive, the test subjects occupied themselves with a secondary activity of their own choice – such as working on e-mails or reading a book – as is permitted in a highly automated vehicle in level 3 mode.

Analysis of the eye movement data using eye-tracking glasses did not reveal any major differences between the effects of an unfounded and a comprehensible takeover request. “For both conditions, the mean values of the percentage of the time dedicated to observing traffic increased by about ten percent compared to a flawless journey in automated driving mode², explains Thomas Wagner.

The “false alarm” triggered increased monitoring of the driving situation – combined with a shift away from the secondary task. This could be seen in a higher percentage of the time looking at the areas inside the vehicle relevant for vehicle control and on the traffic environment. More specifically, there was an increase from 35 to around 44 percent of the total time of the ten-minute period analyzed. The “silent error” led to a further increase in monitoring of the driving task to 54 percent. “Experiencing a takeover request thus reduces driving comfort, because the tendency to engage in a secondary activity decreases, and the driver devotes more attention to the traditional task of monitoring the traffic area in front of the vehicle”, says the DEKRA expert.

The results obtained from the self-reported changes in trust in automation were less clear. No significant decrease in the trust values in the group with an unfounded takeover prompt compared to the group with a comprehensible warning could be shown. Overall, however, a decrease in trust in the reliability of the system was observed. The heart rate variability of the test subjects only marginally differed

between the two takeover conditions. The second critical situation, i.e. the unnoticed drifting of the vehicle into the oncoming lane, had no major impact on heart rate variability. This was also because this dangerous change in vehicle control was usually recognized, due to the non-driving secondary task, very late or not at all. According to the “out of sight, out of mind” principle, most of the subjects did not identify the gradual departure from the lane as dangerous or experience it as a stressor.

Accordingly, the takeover performance in case of a “silent error” was poor. None of the subjects was able to take control of the vehicle in time and safely. Just six subjects took over the vehicle a little late, but still successfully. At that point, the vehicle was already partly in the oncoming lane, but a complete lane departure was just avoided. 40 subjects either took over too late or did not react at all. By contrast, takeover performance when the instruction was clearly communicated was significantly better. On average, the subjects were ready to take over and had their hands on the steering wheel after 5.1 seconds. In the opinion of the DEKRA traffic psychologists, the latency period of over five seconds until the takeover can be seen as an indication of the development of situational awareness. If the driver is not always and constantly “in the loop”, they need much more time to mentally process a traffic situation. In addition, four people did not even attempt to take manual control of the vehicle.

“The bottom line is that these results should give us pause for thought in every respect and make it clear that there are still many hurdles to overcome on the road to highly and fully automated driving, and not just in terms of vehicle technology”, says Thomas Wagner. Further in-depth research is needed, particularly in light of current legislation in Germany, for example, which requires takeover under traffic-endangering circumstances or in the event of faulty system conditions. The aim should be to learn more about factors leading to poor takeover or no takeover at all. In addition, the number of real-world trips under experimental conditions must be increased.

Further background information on this topic and many others can be found in the DEKRA Road Safety Report 2024. It is available at www.dekra-roadsafety.com.

About DEKRA

DEKRA was originally founded in 1925 to ensure road safety through vehicle inspection. With a much wider scope today, DEKRA is the world's largest independent non-listed expert organization in the testing, inspection, and certification sector. As a global provider of comprehensive services and solutions, we help our customers improve their safety, security, and sustainability outcomes. In 2023, DEKRA generated revenue of EUR 4.1 billion. The company currently employs around 49,000 people who offer qualified and independent expert services in approximately 60 countries on five continents. With a platinum rating from EcoVadis, DEKRA is now in the top one percent of sustainable businesses ranked.