

Cooperative and Highly Automated Driving safety study

Work Package 1: Driving task transition in Automated Vehicles



What were the research questions / objectives of the study?

1. How does experiencing SAE level 3-4 automation affect trustworthiness and acceptability of Automated Vehicles (AV)?
2. How do regular drivers/operators behave in an AV and what are their concerns?
3. How does level 4 automation affect driver's situational awareness and their reaction time?



What we found?

- Greater acceptance after experiencing the AV, including perceiving it as less risky, with largest changes in pre versus post drive responses were for stressfulness (less stress) and comfort performing a non-driving task (more comfortable).
- The most common concerns raised related to the vehicle behaviour (braking, cornering, and speeds which were described as harsh, jerky, slow and unnatural).
- A minimum of 5-6 seconds should be allotted for safe takeover to account for the majority of drivers, even at their slowest. However, this only applies:
 1. if operational requirements prohibit engagement in non-driving tasks, and
 2. takeover request warnings are only provided through audio and visual means (no haptic alerts via seat and/or seatbelt).
- The first five seconds of takeover showed greater driving performance instability with more deviations from the planned trajectory, but on average, the vehicle remained within 1.75m of the trajectory in all conditions, which is within the standard width of an Australian urban lane (3.5m).





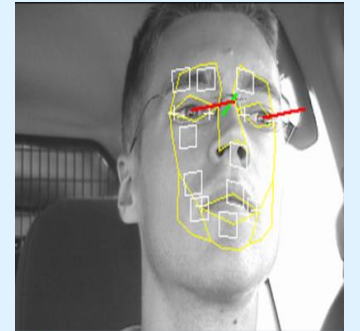
Why is this study important?

- This study is one of the earliest international efforts allowing the general public an experience of automated driving in a level 4 vehicle (behind the wheel) for a prolonged period of time (30 minutes). So far, most (if not all) published studies were conducted in a simulator.
- Australia's draft ADR 90/01 (2021) requires level 3 and above vehicles to execute minimum risk manoeuvre, when an operator has not undertaken driving task within 10 seconds of a takeover request. This study provides insight into the adequacy of 10 seconds as takeover warning time.



How was the study conducted?

- Level 4 automated research prototype vehicle (ZOE2) was used to conduct the study.
- Participants were recruited via social media and local news bulletins, held a valid driver's licence and were randomly assigned to one of the two conditions when they arrived on site: 'High' likelihood of takeovers (n = 37) versus 'Low' likelihood of takeovers (n = 36).
- Participants were driven by ZOE2 while being seated in the driver's seat and were asked to takeover the driving task when a takeover request was displayed / heard.
- Participants were encouraged to engage in non-driving tasks, such as read a book or use their personal mobile equipment, during their 30 minute automated drive on the test tracks.
- Various sensors, including Driver Monitoring System (DMS), collected data of each drive for further analysis.



Picture: DMS

Participants n=73 (21F/52M)
mean age = 46.66
standard deviation = 15.78



What next?

- Although participants were encouraged to engage in non-driving tasks, DMS analysis showed that most participants did not engage in non-driving tasks. Therefore, QUT has extended the tests further through Road Safety Innovation Fund. The extended tests will include engaging participants in cognitive tasks during their automated drive.
- Early results of these extended tests suggests average takeover time has increased by about two seconds. Further analysis confirming results is yet to be conducted.