

How automated vehicles can impede driver performance, and what to do about it

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As cars keep getting smarter, automation is taking many tricky tasks—from parallel parking to backing up—out of drivers' hands.

Now, a University of Toronto Engineering study is underscoring the importance of [drivers](#) keeping their eyes on the road—even when they are in an [automated vehicle](#) (AV).

Using an AV driving simulator and eye-tracking equipment, Professor Birsan Donmez and her team studied two types of in-[vehicle](#) displays and their effects on the driving behaviors of 48 participants.

The findings, published recently in the journal *Accident Analysis & Prevention*, revealed that drivers can become over-reliant on AV technology. This was especially true with a type of in-vehicle display the team coined as takeover request and automation capability (TORAC).

A "takeover request" asks the driver to take vehicle control when automation is not able to handle a situation; "automation capability" indicates how

close to that limit the automation is.

"Drivers find themselves in situations where, although they are not actively driving, they are still part of the driving task—they must be monitoring the vehicle and step in if the vehicle fails," says Donmez.

"And these vehicles fail, it's just guaranteed. The technology on the market right now is not mature enough to the point where we can just let the car drive and we go to sleep. We are not at that stage yet."

Tesla's AV system, for example, warns drivers every 30 seconds or less when their hands aren't detected on the wheel. This prompt can support driver engagement to some extent, but when the automation fails, driver attention and anticipation are the key factors that determine whether or not you get into a [traffic accident](#).

"Even though cars are advertised right now as [self-driving](#), they are still just Level 2, or partially automated," adds Dengbo He, postdoctoral fellow and lead author. "The driver should not rely on these types of vehicle automation."

In one of the team's driving scenarios, the participants were given a non-driving, self-paced task—meant to mimic common distractions such as reading text messages—while takeover prompts and [automation](#) capability information were turned on.

"Their monitoring of the road went way down compared to the condition where these features were turned off," says Donmez. "Automated vehicles and takeover requests can give people a false sense of security, especially if they work most of the time. People are going to end up looking away and doing something non-driving related."

The researchers also tested a second in-vehicle display system that added information on

surrounding traffic to the data provided by the TORAC system, called STTORAC. These displays showed more promise in ensuring driving safety.

STTORAC provides drivers with ongoing information about their surrounding driving environment, including highlighting potential traffic conflicts on the road. This type of display led to the shortest reaction time in scenarios where drivers had to take over control of the vehicle, showing a significant improvement from both the TORAC and the no-display conditions.

"When you're not driving and aren't engaged, it's easy to lose focus. Adding information on surrounding traffic kept drivers better engaged in monitoring and anticipating traffic conflicts," says He, adding that the key takeaway for designers of next-generation AVs is to ensure systems are designed to keep drivers attentive. "Drivers should not be distracted, at least at this stage."

Donmez's team will next look at the effects of non-driving behaviors on drowsiness while operating an AV. "If someone isn't engaged in a non-driving task and is just monitoring the road, they can be more likely to fall into states of drowsiness, which is even more dangerous than being distracted."

More information: Dengbo He et al, In-vehicle displays to support driver anticipation of traffic conflicts in automated vehicles, *Accident Analysis & Prevention* (2020). DOI: [10.1016/j.aap.2020.105842](https://doi.org/10.1016/j.aap.2020.105842)

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