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SCHOOL OF COMPUTER SCIENCE

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Impact of Alert Design and Hazard Direction on Driver Behaviour and Understanding in a Simulated Autonomous Vehicle

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Abstract:

Autonomous vehicles may vary between no automation, requiring full manual driver control, and full automation where no driver input is necessary. This may even happen within the same vehicle in different situations, where the vehicle may be able to drive fully autonomously in some situations but require manual control in others. Autonomous driving is at its most dangerous when human intervention is required after long periods of fully autonomous driving. This danger arises as a result of the fact that humans are not well suited to monitoring an autonomous system operating correctly for long periods of time.
This means that when it comes time for the driver to retake control from automation, their mind may have wandered, or they may have become distracted. In either case, they are out-of-the-loop and will have to regain understanding of the situation as they retake control. This thesis research explores the importance of examining both the situation (hazard scenario) in which drivers retake control and the design of the alert requesting driver attention or intervention. Two alert designs (varying in how they presented information to the participant) were tested, one providing only auditory feedback and one providing audio-visual feedback featuring a heads-up-display (HUD). Our results indicated that the audio-visual alert allowed the driver to grip the steering wheel more quickly and improved situation awareness scores relative to the audio-only alert. These differences were largest when the driver had to turn their head directly to the right or left to see the hazard, highlighting the importance of testing takeover in a wide variety of situations. We concluded that while further research is necessary, the design of the user interface to an autonomous system and the nature of the situation in which the driver is asked to retake control, both contribute to how much time is required to take control safely. These conclusions are important to consider when researchers are testing future autonomous vehicle user interface designs as they imply that it is critical to test in a variety of situations that include not just different kinds of hazards, but ones which come from different directions as well.