EFFECTS OF AUDITORY WORKING MEMORY TASKS WHILE SWITCHING BETWEEN AUTONOMOUS AND MANUAL DRIVING
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As the increasing number of autonomous vehicles join manual cars on the road, a thorough evaluation of the potentially negative effects driving autonomously may have on cognition is vital. When driving and simultaneously engaging in a secondary task, a driver's limited attentional resources are quickly diminished, resulting in little attention available to maintain an accurate situational awareness of the dynamically changing driving surroundings. While distracted driving negatively affects performance in general (Fitousi & Wenger, 2011), some individuals have a higher working memory (WM) capacity, and are thus better able to perform more than one task at once.

We evaluated how the interaction between individual WM capacity and current level of workload affects brake reaction time, specifically while driving in a simulated autonomous car and being engaged in a cognitively-demanding secondary task. Participants engaged in a verbal operation span task while driving manually and autonomously, and were instructed to brake to a series of auditory cues to determine reaction time.

Results indicated the longer an individual spent in autonomous mode, the longer it took to react to a braking event ($B=0.016, SE=0.007, t(39)=2.216, p=0.033, r=-0.007$). For all participants, more items currently held in WM at the time of the braking event predicted a longer RT ($B=0.36, SE=0.16, t(39)=2.26, p=0.030$). This effect also depended on WM capacity such that the higher an individual’s capacity, the less of an increase in RT due to the number of items being currently held in WM ($B=-0.06, SE=0.03, t(39)=2.16, p=0.035$).

Thus, by using autonomous mode, a driver is at risk for taking a longer reaction time to environmental stimuli requiring immediate reaction. Overall, our research shows it is paramount to a driver’s safety to fully evaluate the potential disadvantages of using autonomous features.