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NC State Research Urges Hanging Up the Phone While Driving

FOR IMMEDIATE RELEASE

Many of us use our cell phones while driving. We try to be careful. We keep our eyes on traffic and try to maintain a safe distance from the car in front of us while we talk on the phone. There's no harm, right?

Two researchers at North Carolina State University have evidence to the contrary.

In a recent scientific study, Dr. David Kaber, associate professor of industrial engineering, and doctoral student Ruiqi Ma examined the effects of cell phone use and in-vehicle automation on driver situation awareness (SA) and driving performance through the use of a PC-based driving simulator. The results of their study recently appeared in the *International Journal of Industrial Ergonomics* (Vol. 35, No. 10).

They found that the use of adaptive cruise control (ACC) – a new technology that automatically adjusts vehicle speed to maintain a user-defined distance from the vehicle directly ahead of it – under normal driving conditions facilitated SA by relieving the drivers' workload, which may have allowed them to pay more attention to the driving environment. The study also showed that cell phone use was detrimental to driver SA with and without ACC.

"The ACC provides good benefits in terms of workload relief, but cell phone use directly counters that," Kaber said. The impact is particularly apparent in the driver's ability to make projections on the developing driving situation, he added.

Eighteen NC State graduate students, ages 21 to 35, participated in the study. All participants drove a virtual car in a three-dimensional simulation of a typical four-lane-highway driving environment under normal conditions. Wearing stereographic goggles to view a

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simulation displayed on a personal computer, participants used a realistic steering wheel, gas pedal and brake pedal to change speed and position as they maneuvered the virtual highway. During the simulations, the participants had to stay behind a lead car and maintain a safe distance from it.

Half of the participants answered cell phone calls as secondary distracter tasks, and all drove with and without adaptive cruise control. Participant driving performance – staying in the lane and keeping a safe distance behind the lead car – was tracked by the computer. The participants' SA was assessed by way of a series of questions randomly posed during simulation freezes.

Kaber and Ma had two goals for this study. The first was to investigate the effects of cell phone use and adaptive cruise control in driving on SA, and perceived driver workload using objective measures. "We wanted to identify if there was a potential benefit of ACC under normal driving circumstances when a person is multitasking," Kaber said. The second goal of the study was to assess the effect of competing driving and communication tasks on driving performance.

Kaber and Ma drew on empirical studies of SA in aviation to devise an operational definition of SA in driving. Kaber explained that there are three components of SA: perception, comprehension and projection of the environment. They translate to "What is it? What does it mean to me? What will this information mean to me in the future?" Kaber said.

Although there have been some studies of SA in driving, Kaber pointed out that "Those studies made inferences on the basis of performance measures, looking at people's overt driving behavior and trying to project what's happening for them cognitively. What Ruiqi [Ma] has done here was to define an objective measure of situation awareness in the context of a driving task in order to directly describe people's cognition or what they know at any given time during the simulation. Ruiqi conducted a cognitive task analysis to identify all the potential goal states of a driver under normal circumstances."

From this cognitive task analysis, Kaber and Ma devised a series of questions that would ascertain the SA of participants during the simulations instead of inferring SA from driving performance measures. "If [the participants] were perceiving, comprehending and projecting, they would be able to answer our questions correctly," Kaber said. "If they were not, they got them wrong."

Although Kaber and Ma saw a trend toward worse headway maintenance (distance between vehicles) and lane deviation when a cell phone was used, more research is needed. "It is important to note that Ruiqi made three phone calls during the driving trial and those [calls] were separated by seven to 10 minutes. To see the impact of cell phone use on driving performance, in future studies we might have the participants talk on the cell phone the whole time," Kaber explained.

"The important thing is cell phone use negatively impacts situational awareness, and situational awareness has been linked to effective decision-making and performance," Kaber added. "People may say 'I'm using my cell phone, and I can brake in time' or 'I can keep my car in the lane' or 'I can maintain my speed,' but the problem is that it is having an impact on their attentional resources. It compromises their overall awareness of the driving environment, and when a critical condition develops, they may not be prepared to deal with it."

In other words, hang up, drivers.

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