Project Title:
Does Cell Phone Use Impair Learning and Improvement in Driving Performance?

Principal Investigator:
David Sanbonmatsu, Professor,
University of Utah
Department of Psychology,
(801) 581-8505,
sanbonmatsu@psych.utah.edu

Co-Investigator:
David Strayer, Professor,
University of Utah
Department of Psychology,
(801) 581-5037,
david.strayer@utah.edu

Research Needs
A process that is central to the pursuit and attainment of goals is monitoring (Baumeister, Heatherton, & Tice, 1994). In the monitoring of a task, individuals observe themselves, the task conditions, and their progress toward their goals. In the context of driving, individuals monitor the road conditions, and their thoughts, feelings, and performance in the operation of a vehicle. Research at the Center for the Prevention of Distracted Driving at the University of Utah has demonstrated that cell phone use not only diminishes the safeness of driving (e.g., Strayer & Drews, 2007; Strayer, Drews, & Johnston, 2003), it diminishes drivers’ awareness of the safeness of their driving. In a study funded by the Mountain Plains Consortium, talking on a cell phone diminished participants’ cognizance of their driving errors and performance (Sanbonmatsu, Strayer, Biondi, Behrends, & Moore, 2015). Participants’ estimations of their errors and self-assessments of their driving safety were highly correlated with their actual driving errors when they were not distracted but largely uncorrelated when they talked on a cell phone. The findings suggest that motorists may be overconfident about their ability to drive safely while distracted (Sanbonmatsu, Strayer, Medeiros-Ward, Behrends, & Watson, 2015) and persist in using cell phones because they are unaware of the adverse effects of multi-tasking on their driving.

The diminished situational awareness resulting from cell phone use may affect the ability of individuals to self-regulate their driving (Carver and Scheier, 1998) and improve the safeness of their performance. Motorists normally learn the challenging and hazardous features of the roads they frequent and the errors they make in driving. However, when drivers engage in cellular communication, their monitoring of their driving and the travel environment is obstructed. As a consequence, they may be more likely to repeat their mistakes in the future.

Research Objectives
The proposed research seeks to further understanding of the impact of cell phone use on driving safety. Our study tests the hypothesis that cell phone use impairs motorists’ ability to learn from their mistakes and improve the safeness of their driving. Because cell phone use diminishes monitoring, distracted
motorists may be less likely to learn how to effectively navigate the challenging facets of the roads they frequent. The proposed study also explores individual differences in driving self-awareness and improvement in performance. Whose ability to monitor and learn from their driving is most likely to be impaired by cell phone use? We hypothesize that individuals who have limited working memory capacity or executive control (e.g., Engle, 2002) are generally less aware of their driving performance and the road conditions, particularly when they are engaged in a distracting activity such as cellular communication. We also examine whether overconfident drivers are less apt to monitor their performance and less likely to improve the safeness of their driving.

Research Methods
One hundred male and female participants begin by completing questionnaires assessing their perceptions of their general driving skills and ability to drive safely while using cell phones. They also report the frequency of their cell phone use while driving. Participants subsequently drive on a high-fidelity driving simulator featuring three high-resolution displays providing a 180-degree field of view. The simulator incorporates proprietary vehicle dynamics, traffic scenario, and road surface software to provide realistic scenes and traffic conditions. The 8 minute simulator course contains 10 challenging driving situations that contribute to driver error. Participants will loop around the course three times while talking or not talking on a hands-free cell phone. As they are driving, monitoring will be measured by unexpectedly stopping the simulator program and asking participants questions about the driving environment (e.g., What was the current speed limit on the road?) and their driving behavior (e.g., How many cars have you passed on the course?). Participants will also be asked to indicate on a checklist any errors they made on the simulator. This probing will occur twice during the first loop through the course. Upon completion of the driving task, participants will perform an automated version of the operation span (OSPAN) task (Unsworth et al., 2005) which measures working memory capacity and executive functioning.

Expected Outcomes
The simulator performance will be videotaped and analyzed by coders for errors (e.g., collisions, running a red light) in each of the 10 sections of the course. The coders will be unaware of whether a driver was talking on a cell phone. Based on prior research (e.g., Strayer & Drews, 2007), we predict that driving performance will be worse in the cell phone condition than in the no cell phone control condition. All drivers are expected to make fewer errors during their second and third loops through the course. However, cell phone users are expected to improve less because of diminished monitoring and self-awareness of their driving errors.

The level of general monitoring will be operationalized as the total number of questions answered correctly about the driving environment and driving behavior. Monitoring of errors will be operationalized as the correlation between perceived and actual driving errors. Monitoring is expected to be lower in the cell phone condition than in the control condition. We anticipate that participants’ learning and improvement will be dependent on their ability to monitor their driving. Hence, general monitoring and monitoring of errors are expected to be positively correlated with the amount of improvement in performance. Moreover, the level of monitoring is expected to mediate the effects of cell phone use on improvement over the final two loops through the course.

Relevance to Strategic Goals
Studies suggest that millions of drivers in the United States talk or text on cell phones while they drive. This is a major public safety issue because of the number of accidents and fatalities that are attributable to distracted driving and the substantial body of empirical evidence showing the impairments from
talking on a cell phone (e.g., McEvoy et al., 2005; Redelmeier & Tibshirani, 1997). The proposed study will further knowledge of the consequences and costs of multi-tasking in the operation of a motor vehicle. The study will show that cellular communication diminishes the ability of motorists to improve the safeness of their driving. Thus, consistent with the goals of the MPC, the research examines important factors and processes affecting transportation safety. The findings of the research will aid in the development of educational programs and communications to promote safe driving. The information should also be valuable to governmental agencies such as the National Highway Transportation Safety Administration in their policy recommendations.

**Educational Benefits**
A graduate student will receive support and training in experimentation and data analysis. A small cadre of volunteer undergraduates will gain research experience through their assistance with the data collection. One undergraduate student will be paid to assist on the study and gain research experience during the summer. Students serving as participants will learn about behavioral research and distracted driving.

**Work Plan**
*Months 1-4: Development of procedures and measures*  Drs. Strayer and Sanbonmatsu will design the planned measures and procedures, and obtain Institutional Review Board approval for the study. A graduate student will program the driving simulator.

*Months 5-10: Data collection*  The experiment will be administered by a team of undergraduate assistants supervised by a graduate student from one of the investigator’s laboratories. Dr. Sanbonmatsu will train the team and oversee the collection of the data.

*Months 11-12: Data analysis*  Dr. Sanbonmatsu and the graduate student will analyze the data.

*Months 13-15: Report generation*  An initial report will be written for MPC in accordance with guidelines. The investigators will write up the findings for publication in a top tier, peer reviewed journal and submit the findings for presentation at a national conference.

**Project Cost**
Total Project Costs:  $113,354
MPC Funds Requested:  $56,677
Matching Funds:  $56,677

**References**


