MPC-467

April 1, 2014- July 31, 2017

Project Title:
Self-Regulation and Distraction

University:
University of Utah

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Research Needs:
Experimental studies using driving simulators or instrumented vehicles (Caird, et al., 2008; Horrey & Wickens, 2006; Strayer & Johnston, 2001, Strayer, Drews, & Johnston, 2003; Strayer et al., 2013,) have produced strikingly different estimates of driving impairment and crash risk than the correlation-based naturalistic studies of driving (Klauer et al., 2014; Dingus et al., 2006). However, an important limitation of both of these approaches is that the video equipment and instrumentation in the vehicle (or the driving simulator itself) may alter the behavior of the driver – the *Heisenberg Principal,* whereby the act of measurement may alter the behavior in question. Epidemiological studies have circumvented this problem by obtaining the cell phone records of drivers involved in a crash with significant property damage (Redelmeier & Tibshirani, 1997) or a crash with an injury requiring hospitalization (McEvoy et al., 2005) and determining the odds of a crash compared to a control period. The epidemiological studies' estimate of crash risk is comparable with the experimental research. More recently, an observational study of over 56,000 drivers coordinated by the Center for the Prevention of Distracted Driving at the University of Utah verified the detrimental effects of cellular communication on driving outside of the laboratory. This new observational research found that drivers using a cell phone were more than twice as likely to fail to make a legal stop at an intersection (i.e., the odds ratio of failing to stop for cell phone drivers was 2.21).

Although there are several potential reasons for the discrepant results from the different methods, one untested hypothesis is that it stems from a driver's self–regulation of the secondary-task activities based on driving demand. Following Braver, Gray, and Burgess (2007), we differentiate between two forms of self-regulation: *proactive* and *reactive.* An example of the proactive self-regulation is when a driver decides in advance not to use a cell phone when they are operating a motor vehicle. An example of the reactive self-regulation is when a driver moderates their usage in *real-time* based upon driving difficulty or perception of driving errors. Reactive self-regulation may also involve trading off different aspects of driving performance when multitasking. For example, a driver may slow down when they are talking on the cellphone and this change in behavior may be a manifestation of self-regulation.

The conflicting findings necessitate further research on the consequences of cell phone use during actual driving. The "naturalistic" work suggests that cell phone use may not uniformly impair driving and in some instances (e.g., low density traffic) drivers may be able to talk on a cell phone with a lower crash risk. This suggests that it is important to examine when cell phone use impairs driving and if and how drivers self-regulate the use of cell phones.

Research Objectives:
We believe an important next step is to examine the actual traffic and weather conditions under which drivers use cell phones and the impact of cell phone use and other distractions in favorable as opposed to unfavorable driving environments. We speculate that drivers may attempt to reduce the risk of an accident by regulating the use of cell phones. Specifically, many drivers may limit cell phone usage in adverse driving conditions characterized by slick roads, limited visibility, or heavy traffic.

Of course, not all drivers are likely to be sensitive to the risks presented by different road conditions. Our research shows that people tend to be overconfident in their capacity to multi-task (Sanbonmatsu, Strayer, Medeiros-Ward, & Watson, 2013) and their ability to drive safely while distracted (Sanbonmatsu, Strayer, Medeiros-Ward, Behrends, and Watson, 2014). Consequently, many drivers may believe they can safely use a cell phone in virtually any road conditions. A second major aim of the proposed research is to demonstrate that even in the most adverse driving environments, a significant proportion of individuals use a cell phone while operating their vehicles with predictable negative effects on their driving.

Research Methods:
In the proposed observational study, cell phone use and driving behavior will be determined by videotaped observations at three different intersections in the Salt Lake City metropolitan area during October, November, and December of 2014. The fall months in this rocky mountain region are characterized by highly variable weather and driving conditions. One camera will be positioned to record the general physical characteristics of the driver and the driver's activity behind the wheel. Another camera will record the movements of all of the vehicles passing through the intersection. The time of day will be recorded, and information about the temperature and precipitation during each hour will be obtained. Importantly, the video cameras will be positioned so that they are not visible to the drivers (thereby avoiding any distortions of driving behavior because of the experimental protocol).

The videotape records will be analyzed by two paid coders. The number of passengers in the vehicle and the driver's actions will be scored. In particular, the coders will determine whether drivers were talking or texting on a cell phone or engaging in other distracting activities. In addition, the gender and approximate age of the driver will be coded. Driving performance at the intersection will be assessed. Specifically, we will determine whether a legal stop was made, and whether the vehicle was involved in a crash or a near crash requiring an evasive maneuver. We will also determine whether there was a "proximity conflict" defined as "extraordinarily close proximity of the subject vehicle to any other vehicle, pedestrian, cyclist, animal, or fixed object where, due to apparent unawareness on the part of the driver" (Klauer et al., 2006). Finally, as indicated above, we will have various objective measures of the driving conditions such as the time of day and the weather conditions when the vehicle was in the intersection.

Expected Outcomes:
We expect to show that drivers commonly self-regulate their usage of cell phones as a function of the driving conditions. Specifically, we anticipate that cell phone usage will decrease as visibility diminishes, and precipitation and traffic increase. However, we predict that even in the worst road conditions, a substantial proportion of drivers will still use cell phones. Following previous research, we expect that the usage of cell phones will be associated with unsafe driving. Crash rates in our study are unlikely to be predicted by cell phone use because these accidents are generally too infrequent to allow statistical testing for the number of drivers that will be observed. Nevertheless, drivers who are using a cell phone are expected to make more frequent driving errors and be involved in more near crashes and/or proximity conflicts. Finally, we expect to observe an interaction in which the adverse consequences of cell phone use are more pronounced in poor driving conditions.

Relevance to Strategic Goals:
The proposed study examines when drivers use cell phones and the extent to which cell phone use is self-regulated as a function of the driving conditions. The study also examines the consequences of actual cell phone use on driving utilizing an observational approach that is free of the problems characterized by the Heisenberg Principle. 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 research design and data analysis. Paid undergraduates will gain research experience through their assistance with the data collection and coding.

Work Plan:
Months 1-3: Development of video procedures and measures. Drs. Strayer and Sanbonmatsu will design the planned measures and procedures. Dr. Cooper will purchase and prepare the video equipment.
Months 4-6: Data collection The video equipment will be mounted and monitored by a paid undergraduate assistant. A graduate student will oversee the collection of the data.
Months 6-7: Videotape coding: Two undergraduate assistants will code the videotapes.
Months 8-9: Data analysis Dr. Sanbonmatsu and a graduate student will analyze the data.
Months 10-12: 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: $57,670
Matching Funds: $57,670

MPC Funds Requested: $57,670
Source: AAA Foundation for Traffic Safety

Dr. Strayer has current funding from the American Automobile Association Foundation for Traffic Safety that will provide 100% matching funds for the proposed project. The sponsor award number for the matching funds is AAAFTS51108 with University of Utah project code 51002540.

TRB Keywords: distracted driving, self-regulation, driving safety

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