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Bad Driving is Associated with Lower Awareness of Driving

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David M. Sanbonmatsu
David L. Strayer

University of Utah
Salt Lake City, Utah

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Disclaimer

STUDY HISTORY

We received grant #525 from MPC to conduct a study on the impact of cell phone use on learning and improvement in driving performance. We hypothesized that the diminished awareness resulting from cell phone use may affect the ability of individuals to improve the safeness of their driving. 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, the monitoring of their driving and travel environment is obstructed. As a consequence, they may be more likely to repeat their mistakes in the future.

We devoted the summer and fall of 2017 to developing a study to test this hypothesis. However, we were unable to design an experiment that could demonstrate diminished learning of the driving environment. Because a second line of research appeared to be more promising, we shut down the originally proposed study.

The second research study we conducted with the MPC 525 funding examined factors affecting the monitoring of driving and driving safety. This is the study presented in this report. Although not all hypotheses of the study were confirmed, the findings are interesting and have been corroborated by a reanalysis of some of our previously collected data. We hope to write the findings for a journal submission next year.

ABSTRACT

Studies of self-regulation suggest that monitoring is essential for task performance and the attainment of goals. Research was conducted to investigate factors affecting the monitoring of driving and driving safety. Participants drove on a simulator course while discussing emotional topics or daily routines. Participants' perceptions of their driving errors, safety, and performance were recorded. Measures were also taken of the importance of driving safety and performance on the simulator. Driving safety as reflected by driving errors was strongly associated with self-awareness of driving. Driving self-awareness and driving safety were greater when the importance of driving safely was high. The discussion of emotional topics had no effect on driving, driving self-awareness, or affect. Findings indicate that lower driving self-awareness is associated with bad driving. Driving education programs should teach developing drivers that monitoring their driving performance and state is central to safely operating a motor vehicle.

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1. INTRODUCTION

A process often central to the pursuit and attainment of goals is monitoring (Baumeister, *Heatherton, & Tice,* 1994). While monitoring an activity, individuals track their thoughts, feelings, behavior, circumstances, and progress toward their goals. When discrepancies are perceived between goals or standards and performance, action may be taken to bring the self into line with those standards (Carver & Scheier, 1998). The self-awareness characterizing monitoring also facilitates self-knowledge. With self-observation, individuals can gain a better understanding of their skills, abilities, and preferences. When monitoring is lacking, individuals may not recognize the shortcomings of their performance and may fail to take immediate corrective action. They may also fail to learn about themselves, which may hamper their ability to make sound task-related decisions in the future (Moore, Behrends, Mazur, & Sanbonmatsu, 2014).

A task in which monitoring is particularly important is driving. Individuals operating a motor vehicle must continually monitor themselves and their performance to ensure that they are not engaging in unsafe practices. For example, drivers need to notice when they are fatigued, distracted, driving in a hazardous manner, and not fully attending to the road. When individuals become cognizant that their behavior or state is out of line they are more likely to take corrective action to increase driving safety.

Research has begun examining the factors affecting performance monitoring. This is important, because factors that draw attention away from the self and diminish monitoring may contribute to self-regulatory failure (e.g., Baumeister, Heatherton, & Tice, 1994). Prior work has shown that the ability to monitor may be impaired by strong cravings and drives (Sayette, Schooler, & Reichle, 2010). Researchers have speculated that self-awareness may be similarly affected by alcohol intoxication and other conditions that limit the ability to process information (Sayette & Griffin, 2011).

A recent MPC funded study that we conducted (Sanbonmatsu, Strayer, Medeiros-Ward, & Watson, 2013) showed that multitasking while driving diminishes the self-awareness of performance that is often essential for self-regulation and self-knowledge and driving safety. Participants in our study drove in a simulator while either talking or not talking on a cell phone. Following previous research, participants who talked on a cell phone made more serious driving errors than participants in the no cell phone condition. Control participants' assessments of their driving safeness and general ability to drive safely while distracted were negatively correlated with the actual number of errors made when they were driving. By contrast, cell phone participants' assessments of the safeness of their driving and confidence in their driving abilities were uncorrelated (or correlated in the opposite direction) with their actual errors. Thus, talking on a cell phone not only diminished the safeness of participants' driving, it diminished their awareness of the safeness of their driving. Moreover, because of this lack of self-awareness, cell phone users tended to maintain misconceptions about their ability to drive safely while multi-tasking.

1.1 Self-Awareness of Driving and Driving Performance

With funding from MPC, we conducted research to further investigate factors affecting the monitoring of driving and driving safety. The most basic aim of our study was to examine the relationship between monitoring and performance. Because monitoring is central to self-regulation and performance, we hypothesized that good driving is associated with greater driving self-awareness than bad driving. The study also examined the impact of emotions on driving self-awareness and driving safety. Numerous studies have shown that complex task performance is adversely affected by arousal and emotionality through diminished attention to the task (e.g., Eysenck, 1982). We hypothesized that high levels of emotionality diminish attention to the self and awareness of driving performance. Finally, the study examined the relationship between task importance and task awareness. We predicted that increases in the perceived importance of driving safely are associated with greater driving self-awareness and better driving.

A simulator study was conducted to test our predictions about driving self-awareness and driving safety. Participants drove on a simulator course while discussing emotional topics or daily routines. The number of driving errors they made was recorded. Participants' perceptions of their errors, and their perceptions of their driving safety and performance were recorded. Measures were also taken of the importance of driving safely, and the motivation and effort to drive safely. The correspondence between driving safety as reflected by driving errors and participants' perceptions of their driving errors and safeness of their driving served as our indices of the self-awareness of driving performance.

2. METHOD

2.1 Participants

Fifty-four female and male undergraduates participated in the University of Utah Institutional Review Board-approved study for extra course credit. They were randomly assigned to either the emotion discussion or control discussion condition.

2.2 Stimuli and Apparatuses

The DriveSafety™ DS-600 simulator was used in this experiment. The DS-600 consists of a Ford Focus cab surrounded by three large screens encompassing a 270-degree view. The simulated vehicle is based on the vehicular dynamics of a compact passenger sedan with automatic transmission.

The driving scenario was designed using DriveSafety HyperDrive Authoring Suite. A city residential road database simulated an approximately eight kilometer section of road with intersections and one- and two-way traffic. Directional arrows embedded in the driving environment provided instructions for navigation. Driving was regulated by speed limit, stop, and yield signs, and traffic lights. The roadways, sign placement (e.g., distance between the crosswalk and the pedestrian crossing sign), and crosswalks conformed to the Manual on Uniform Traffic Control Devices for Streets and Highways (Federal Highway Administration, 2012).

2.3 Procedure

Participants began the study by completing a brief survey of their driving practices and beliefs. Emotion discussion participants were also asked to list five everyday worries or problems while control discussion participants were asked to list five daily routines. They were then familiarized with the driving simulator, using a standardized adaptation sequence designed to reduce the likelihood of motion sickness, after which a 10-minute practice session commenced.

The primary simulator drive of each participant was videotaped by a camera behind the vehicle cab. The participant drivers encountered various potentially hazardous scenarios or situations during the simulation. For example, drivers were required to stop for pedestrians at a crosswalk partially obscured by other vehicles, and slow down and move over because of construction. During the drive, emotion discussion participants were asked to talk about the problems they listed previously while control discussion participants were asked to talk about the daily routines they listed.

Immediately after completing their drive, participants completed a checklist of their errors. The specific driving errors they reported are presented in Table 2.1. Participants indicated the number of times they made each error and were told that a single driving incident could entail multiple errors.

Participants next reported their affective states during the simulator drive on the PANAS (positive and negative affect schedule, Watson, Clark, & Tellegen, 1988). They finished by completing a brief survey about their driving motivations and performance. They answered "How important was it for you to drive safely and carefully on the simulator?" on a four-point scale anchored by *not at all important* and *highly important*, "To what extent were you motivated to perform safely and carefully on the simulator?" on a four-point scale anchored by *not at all motivated* and *highly motivated*, and "How much effort did you put into driving safely and carefully on the simulator course?" on a five-point scale anchored by *minimum effort* and *maximum effort*. Finally, they rated "the safeness of your driving during this experiment using the simulator" on a seven-point scale anchored by "-3" = *not at all safe* and "+3" = *highly safe* and "your overall driving performance on the stimulator" on a seven-point scale anchored by "-3" = *very bad* and "+3" = *very good.*

Table 2.1 Driving Errors Self-reported by Participants and Coded from the Videotapes

1.	Failing to stop at a crosswalk for one or more pedestrians
2.	Swerving off the road (at least two wheels off the road)
3.	Swerving into the wrong lane (at least two wheels into the opposite lane)
4.	Failing to move over for a bicyclist, pedestrian, or emergency vehicle
5.	Traveling in the wrong direction on a one-way road
6.	Failing to stop at an intersection for a red light or stop sign
7.	Failing to take appropriate action to avoid a hazard
8.	Moving into a lane (traveling in the same direction) occupied by another vehicle (leading to a near collision or collision)
9.	Hitting a vehicle, pedestrian, bicyclist, or object
10.	Failing to signal a turn
11.	Speeding 10 or more miles per hour over the posted speed limit
12.	Making an illegal turn

3. RESULTS

3.1 Indices and Means

Participants took an average of 756 seconds (13.0 minutes) to complete the main simulator drive (s. d. = 70.4). The videotaped driving of each participant was coded for errors using the same checklist that participants completed. Following Sanbonmatsu et al. (2016), coding focused on the total number of serious driving errors made by and reported by participants. These were all the errors except speeding 10 miles over the posted limit and failing to signal a turn. Participants made an average of 4.18 serious errors (*s.d.* = 3.63) during their drive and reported making an average of 4.70 serious errors (*s.d.* = 3.45). They tended to report that they were motivated to drive well, $M = 3.37$ (*s.d.,* = .68), it was important for them to drive safely and carefully, $M = 3.31$ (*s.d.,* = .72), and that they made an effort to drive safely and carefully, $M = 3.85$ (*s.d.,* = .79). On average, they rated their driving on the simulator as somewhat safe, $M = 1.02$ (*s.d.,* = 1.32), and their driving performance as somewhat good, $M = .74$ (*s.d.,* = 1.48).

Three indices of driving self-awareness were used in the analyses. The first index was the extent to which participants' memory of their driving errors corresponded to their actual driving errors. The self-awareness of errors was operationalized as the absolute value of the total number of serious driving errors recalled minus the total actual serious driving errors. The second index was the degree to which participants' driving errors corresponded to their judgment of the safeness of their driving on the simulator. The z score of each participant's total serious driving errors and the z score of each participant's judgment of the safeness of their driving were calculated. The self-awareness of driving safety was operationalized as the absolute value of the z score of each participant's driving errors minus the z score of their judgment of the safeness of their driving. The final measure was the correspondence between participants' driving errors and their judgment of the goodness of their driving performance. The self-awareness of driving performance was operationalized as the absolute value of the z score of each participant's driving errors minus the z score of their judgment of their driving performance.

3.2 Emotion and Driving

The initial analyses focused on the impact of the emotion manipulation on driving errors and driving self-awareness. Unexpectedly, participants tended to make fewer driving errors when they discussed their problems as opposed to their routines, $M = 3.23$ (*s.d.,* = 2.29) vs. $M = 5.07$ (*s.d.* = 4.40), $t(52) = 1.91$, $p = .062$, $d = .55$. Moreover, there were no differences in driving self-awareness as reflected by memory for driving errors and reported driving safeness and performance. An examination of the responses on the PANAs indicated that emotion manipulation was not successful in increasing negative affect. For example, the levels of distress reported by participants did not differ in the emotion discussion and routine discussion conditions, $M = 1.69$ (*s.d.,* = 1.09) vs. $M = 1.50$ (*s.d.* = .79), $t < 1$. Consequently, the experimental manipulation of emotion was ignored in the subsequent analyses.

3.3 Driving Errors and Driving Self-awareness

Correlational analyses were performed to examine the relationship between driving performance and driving self-awareness (see Table 3.1). The results indicate that driving performance and safety as reflected by total driving errors was significantly associated with awareness of errors, safety awareness, and performance awareness. As driving performance and safety increased, the monitoring of driving performance and safety increased.

An examination of the role of task importance indicated that as the importance of driving safely increased, the number of driving errors decreased while the awareness of errors and awareness of performance increased. Similarly, as the effort to drive safely increased, the number of driving errors decreased, and the awareness of errors and performance awareness increased. While the motivation to drive safely was significantly associated with fewer driving errors, it was not associated with greater driving self-awareness. Generally, it appears that driving safety and the monitoring of driving safety were elevated by increases in the importance of driving safely and the effort given to driving safely.

Table 3.1 Correlations Between Driving Errors, Driving Awareness, and Task Importance (p values in parentheses)

	Total errors	**Awareness of errors**	**Awareness of safety**	**Awareness of performance**
Awareness of errors	.39 (.004)	1	.49 < (.001)	.49 < (.001)
Awareness of safety	.57 < (.001)	.49 < (.001)	1	.89 < (.001)
Awareness of performance	.59 < (.001)	.49 < (.001)	.89 < (.001)	1
Importance	-.28 (.039)	-.30 (.03)	-.19 (.17)	-.26 (.06)
Motivation	-.39 (.003)	-.16 (.26)	-.14 (.33)	-.16 (.26)
Effort	-.43 (.001)	-.51 < (.001)	-.18 (.18)	-.25 (.06)

Notes: $N = 54$

4. DISCUSSION

The findings suggest that performance and performance awareness go hand in hand. Participants who drove well in our study tended to be much more aware of their driving performance and safety than participants who drove poorly. The findings also revealed that the self-awareness of driving and the safeness of driving increases as the importance of driving safety increases. Somewhat surprisingly, the discussion of emotional topics did not lead to worse driving and lower self-awareness of driving than the discussion of daily routines. Responding on the PANAS suggests that the experimental manipulation was not effective in inducing differences in negative emotion.

According to theories of self-regulation (e.g., Carver & Scheier, 1998), monitoring is essential for task performance and the attainment of goals. When self-awareness is high, individuals are more apt to recognize when their behavior is discrepant with their goals and more likely to take corrective steps to improve their performance. Increases in the importance of a task may heighten self-awareness because people are more concerned about how they are performing and because people are cognizant of the importance of monitoring to performing well.

Our study provided correlational rather than causal evidence of the linkages between self-awareness, performance, and task importance. However, our previous work (Sanbonmatsu et al., 2016) provided experimental evidence that factors that adversely affect performance also diminish performance awareness. Again, participants in the study drove on simulator while talking or not talking on a cell phone. Cell phone usage diminished driving safety and awareness of driving safety. Interestingly, a reanalysis of this data showed that, in line with the findings of the present study, there was a strong positive correlation between driving safety and awareness of driving safety across both cell phone and no cell phone conditions. Thus, our previous work also found that bad driving is associated with lower awareness of driving performance.

Alternative processes may have contributed to the observed relationship between performance and performance awareness. For example, when individuals are struggling at a task and unable to improve their performance, they may not want to be fully cognizant of their flailing and may subsequently diminish monitoring. In contrast, persons who are performing well may increase their monitoring so they can be even more aware of the excellence of their behavior.

Factors that facilitate better performance may not affect self-awareness directly, but indirectly by increasing favorableness of the effect associated with watching the self-perform. Although this is not how self-regulation and goal pursuit generally works, it is possible that this type of affect regulation operates in some conditions.

Our findings indicate that lower driving self-awareness is associated with bad driving. In addition to paying attention to the road, drivers need to pay attention to themselves and the safeness of their driving. Driving education programs should teach developing drivers to monitor their activities, alertness, wakefulness, and emotions, and how well or poorly they are driving. Good drivers monitor their personal state and driving performance, and take action to address unsafe cognition, affect, and behavior.

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