# Policing: An International Journal of Police Strategies & Management

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## Article information:

To cite this document:
Stephen M. James, (2015) "Distracted driving impairs police patrol officer driving performance", Policing: An International Journal of Police Strategies & Management, Vol. 38 Issue: 3, pp.505-516, https://doi.org/10.1108/PIJPSM-03-2015-0030
Permanent link to this document:
https://doi.org/10.1108/PIJPSM-03-2015-0030

# Distracted driving impairs police patrol officer driving performance

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Received 11 March 2015
Revised 27 May 2015
4 June 2015
16 June 2015
Accepted 16 June 2015

## Abstract

**Purpose** – Most US states exempt police officers from restrictive distracted laws, and most agencies require officers to use mobile data computers while driving. The purpose of this paper is to examine the impact of a text-based distraction task on officer driving performance.
**Design/methodology/approach** – Experienced police patrol officers ($n=80$) participated in controlled laboratory experiments during which they drove a high-fidelity driving simulator on four separate occasions; twice immediately following five consecutive 10:40 hour patrol shifts (fatigued condition) and again 72 hours after completing the last shift in a cycle (rested condition). In each condition, officers drove identical, counterbalanced 15-minute courses with and without distraction tasks. The research used a within- and between-subjects design.
**Findings** – A generalized linear mixed-model analysis of driving performance showed that officers' distracted driving performance had significantly greater lane deviation ($F=88.58$, df $=1,308$, $p<0.001$), instances of unintentionally leaving assigned driving lane ($F=64.76$, df $=1,308$, $p<0.001$), and braking latency ($F=200.82$, df $=1,308$, $p<0.001$) than during non-distracted drives. These measures are leading indicators for collision risk.
**Research limitations/implications** – Simulated driving tasks presented were generally less challenging than patrol driving and likely underestimate the impact of distraction on police driving.
**Originality/value** – Police officers appear to drive significantly worse while distracted, and their routine experience with using text-based communication devices while driving does not mitigate the risks associated with doing so. Study results suggest that policing organizations should modify policies, practices, training, and technologies to reduce the impact of distraction on officers' driving. Failing to do so exposes officers and the communities they serve to unnecessary hazards and legal liabilities.

**Keywords** Training, Police, Safety, Distraction, Driving, Technology development
**Paper type** Research paper

## Introduction

Distracted driving is dangerous. There has been considerable research done on the use of communication devices such as cellular telephones while driving (Klauer *et al.*, 2014; Drews *et al.*, 2008; Weiss, 2007; Kass *et al.*, 2007; Strayer *et al.*, 2003; Strayer and Johnston, 2001; Redelmeier and Tibshirani, 1997). To date, every study has found that cell phone usage while driving has a detrimental effect on driver performance. Redelmeier and Tibshirani (1997) concluded that talking on a cellular telephone increased the probability of a collision by between 300 and 650 percent. By engaging in two cognitively challenging activities simultaneously, such as driving and talking on a

The author wishes to thank the Californian Commission on Peace Officer Standards and Training (CA POST) and the Office of Naval Research (ONR) for funding this research and Executives and Officers of the Spokane Police Department for their support and participation. A special thank you must also be extended to Dr Birsen Donmez, University of Toronto, and Dr Linda Ng Boyle, University of Washington, for the use of the distraction task.

Policing: An International Journal of Police Strategies & Management
Vol. 38 No. 3, 2015
pp. 505-516

1363-951X
DOI 10.1108/PIJPSM-03-2015-0030

cell phone, it is possible to directly affect the decision process of one action with the thought process of the other; this is a process known as a "psychological refractory period" resulting in incorrect or late responses (Recarte and Nunes, 2003).

Kass *et al.* (2007) found that cell phone use reduced the driver's situational awareness. Again, this study found that hands-free devices produced the same degradation in performance, leading the authors to conclude that it was the cognitive effort required in engaging in the conversation that has a negative impact regardless of the medium. However, the authors found that experience with dual tasking did mitigate some of the negative effects. A study conducted by Ma and Kaber (2007) examined situational awareness during a simulated driving task that required the participants to divert their attention to a laptop. This study has direct relevance to police performance as their attention is frequently diverted to a mobile data computer (MDC) situated in their patrol cars. The results showed this task had a detrimental effect on driving behavior similar to that associated with the use of a cell phone. The authors did state that conditions in real world driving may vary from their results due to the seriousness of the consequences in a moving vehicle. However, as 80 percent of collisions are related to distracted driving, that is unlikely to be the case (Weiss, 2007).

The specific driving behaviors found to be negatively affected by this reduced situational awareness due to diverted attention to another task are described as tactical driving behaviors. These include changing lanes, overtaking, negotiating intersections, etc. (Ma and Kaber, 2007). The importance of this degradation in situational awareness is that it affects a driver's perception and comprehension of their surroundings while driving. It limits the driver's ability to project scenarios forward in time and to understand the consequence of their actions or inaction. An element of this is spatial awareness which allows the driver to register and understand where other objects are in relation to him or herself and where they will be in the future (Bolton and Bass, 2009). As law enforcement officers regularly drive distracted, this degradation of situational awareness may be detrimental to their driving performance.

Each state in the USA has responded to the problem of distracted driving differently. Some target novice drivers only while others make the distraction a secondary offense. Pre-2000 only Florida and Arizona had enacted legislation restricting distracted driving; by the end of 2010, 39 states and the District of Colombia had distracted driving laws on their books (Ibrahim *et al.*, 2011). At the time that this paper was written all US states, except Montana, had laws that restrict distracted driving in some way (National Highway Traffic Safety Administration, 2014). A spokesperson for the National Conference of State Legislatures described texting while driving as "negligent" behavior and the laws in Utah reflect that sentiment; drivers that cause a fatal collision due to texting can be sentenced to up to 15 years in prison. This is on a par with the penalty for fatal collisions caused by drunk driving. Yet most states exempt drivers of emergency vehicles from these distracted driving laws. Police officers are human beings who are likely to be subject to the same performance and cognitive limitations as the population at large, yet we require our officers to interact with these devices as part of their normal duties while on shift.

Law enforcement agencies in the USA began adopting motor vehicles without communications in the 1920s. By the 1930s the use of the radio car was a standard law enforcement practice (Vila and Morris, 1999). The radio car enabled larger patrol areas ("beats") to be policed, giving wider service coverage with fewer law enforcement officers (Esbensen, 1987). Law enforcement officers tended to patrol in two-officer patrol vehicles because the increased distance between officers, due to the larger beats, brought a fear that they would not have backup in a timely fashion when needed (Brannon, 1956). Most law enforcement agencies have since transitioned to single-officer patrol cars. In 2010, a survey of 233 California police and Sheriff's departments by the California Commission on Peace Officers Standards and Training (CA POST) reported that 91 percent of agencies responding to the survey utilized single-officer patrol vehicles[1]. Of the 233 agencies, only the LAPD utilizes entirely two-person patrol manning in their vehicles. Single person manning in a patrol vehicle is the norm.

At present it is common to see a two-way radio, a speed camera gun, Low-Jack initiator, duty and private cell phones, and an MDC inside a patrol vehicle. Add to this the requirement for law enforcement officers to scan the road ahead to check for possible traffic violations, scan the sidewalks for suspicious activity, and at times contend with unruly, unwilling passengers in the backseat of the vehicle. Individually and, more importantly, when these distractions are combined, they create an environment that is detrimental to safe driving.

A simple solution to the safety concerns generated by distractions inside a patrol vehicle would be to remove these distractions from the driver (Weiss, 2007). However, equipment such as the radio has been an integral part of the law enforcement operations for 80 years (Vila and Morris, 1999). Over the last 20 years, the MDC has become almost standard issue in law enforcement patrol vehicles (Agrawal *et al.*, 2003). The federal program Community-Oriented Policing Service: Making Officer Redeployment Effective allocated funding to local law enforcement agencies for redistributing law enforcement personnel through the adoption of remote computing (Agrawal *et al.*, 2003). The 2010 CA POST survey found only 30 agencies did not have MDCs mounted in their patrol vehicles. These were the smaller agencies (average number of full-time sworn officers = 28), and they accounted for less than 2 percent of the officers covered by this survey. Since 1995, law enforcement communication infrastructure and operational procedures have been built around these communication technologies. Thus, it is unlikely that these devices will be removed from service.

The complex interactions between an officer, his or her driving, and the equipment in the vehicle require further research to evaluate the level of risk to law enforcement officers. Talking on a cell phone produces the same level of impairment as being intoxicated at a blood alcohol level of 0.08 (Drews *et al.*, 2008). The added distractions in a police patrol car may impair an officer's driving even more. This research paper describes the level to which a simplistic distraction task degrades an officer's driving performance during a simulated driving task.

## Data and methods

Kass *et al.* (2007) suggested that experience with dual tasks (driving and a distraction task) mitigated some of the risks of distracted driving. The current study seeks to address the question of whether a text-based distraction has a negative impact on police officer driving performance. The experienced police patrol officers ($n = 80$) who participated in this study were all assigned to the patrol division from a single medium size agency in the Pacific Northwest. All routinely drove a police cruiser while operating an MDC. The mean age of officers in this study was 40 years old (SD = 8.4) with an average length of service of 14.3 years (SD = 7.5). Of the 80 officers, 11.3 percent were female; this is representative of the national average for a medium to large size agency (≈250 sworn officers) (Bureau of Justice Statistics, 2010) and almost identical to the age/sex/experience averages within the agency. The sample of officers in this study accounted for half the patrol division of the agency. Almost a third of the officers who participated (32.5 percent) had had at least one on-duty collision during the three years prior and 6.3 percent were involved in an off-duty collision during the same period (Table I).

This study was conducted under controlled laboratory conditions utilizing a high-fidelity driving simulator (L3 Communications Military Professional Resources Inc. (MPRI) Patrol Sim IV); see Plate 1. The laboratory is controlled for light, sound, and heat. Officers drove the simulator for 15 minutes on four occasions during two separate testing sessions: twice immediately following five consecutive 10:40 hour patrol shifts (fatigued condition) and twice 72 hours after completing the last shift in a cycle (rested condition). In each condition, officers drove identical, counterbalanced, 15-minute courses with and without distraction tasks. Each drive was separated by ten

**Table I.** Officer characteristics

| Officer characteristics | Agency Mean/% | SD | Sample Mean/% | SD |
|---|---|---|---|---|
| Male | 88.7% | | 88.8% | |
| Age | 41.8 | 7.5 | 40.0 | 8.4 |
| Years sworn | 14.8 | 7.5 | 14.3 | 7.5 |
| On-duty accident in past 3 years | | | 32.5% | |
| Off-duty accident in past 3 years | | | 6.3% | |


**Plate 1.** L3 Communications MPRI Patrol Sim IV

minutes. The participant was randomly assigned to have either the fatigued or rested condition first and distracted or non-distracted drive first. The order of drives in the second session was counterbalanced to the first session. The minimum duration between test conditions was 12 days, thus allowing a full uninterrupted duty/rest cycle to take place between testing. This would ensure that the added workload from the first testing condition did not impact the subsequent testing condition. The mean number of days between conditions was 32.4 (SD = 24.5).

*The drive*

The officer was asked to follow a lead vehicle, keeping no farther than 100-feet away, during a rural freeway scenario. The lead vehicle traveled at 55 mph and braked at random intervals. The lead vehicle would continue to brake until the officer applied the brakes of his/her own vehicle, a simulated Ford Crown Victoria. Once the officer applied more than 1 percent of the available braking pressure, the lead vehicle would accelerate to 55 mph. The officer was instructed to remain in the right-hand lane of the freeway behind the lead vehicle. There were no other vehicles in the scenario. Each scenario lasted 15 minutes.

*The distraction*

In one of the two drives the officer was asked to interact with a word search task on a 9" × 12" touch screen, in portrait orientation, built into the dash of the simulator. The touch screen appeared to the right of the driver, 2" below the windscreen. After 30 seconds of driving, the officer received an onscreen message to "Start the MDC Task." The officer interacted with the word search task at his/her own pace. The task required them to identify one of three words: "discover," "project," or "mission" and their location in the line of text. "discover" had to be the first word in a line of three, "project" the second word, and "mission" the third. Three lines would appear at a time and each iteration of the task had ten lines of text; officers could scroll up and down to locate the correct line of text. Once the line of text with the correct word in the correct position was identified, the officer pressed a "select" button. If the answer was correct, the officer could select a new set of words; if the selection was incorrect, he/she could try again. There was one correct line in each iteration. Officers could select a "hint" button if they forgot the words or their place in the line of text. Each letter was 3/8" in height (225 percent bigger than 12-point font) and each button was 1" × 2". The text and button sizes were considerably larger than are typically found on an MDC. This distraction task is a modification of the in-vehicle information systems IVIS task (Donmez *et al.*, 2007) (see Plate 2).

*The data*

Data were sampled at 72 Hz; 72 rows of data on vehicle state (speed, direction, throttle pressure, brake pressure, etc.) and scenario variables (lane position, distance to other vehicles, etc.) were collected every second.

*Lane deviation*. Lane deviation, the amount the officer's own vehicle moved laterally, was measured on seven one-mile straight road sections. A participant who maintained a perfectly straight course would have a lane deviation value of 0. The greater the value for lane deviation, the less attention the participant dedicated to their driving performance.

*Lane departures*. The driving lane within the simulation was 4 m wide. The simulated Ford Crown Victoria in the simulation is marginally less than 2 m wide (1.96 m).

**Plate 2.**
Distraction task



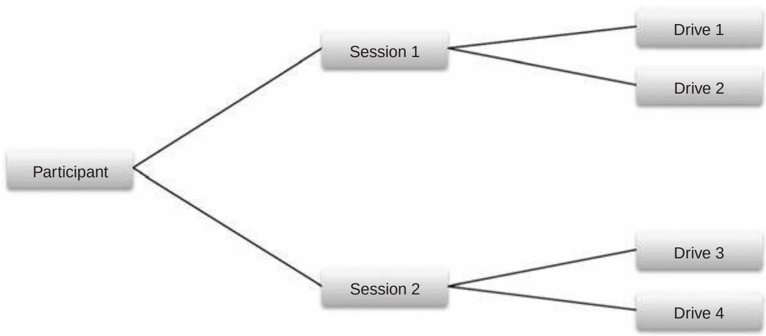
Participants were instructed to remain in the center of their driving lane. The vehicle would have to travel laterally more than 1 m to leave its driving lane. Although lane departures can be viewed as a gross measure of lane deviation, it has more significance and so it was measured separately. Varying position within a driving lane is an indicator of inattention; however, when this variation takes the vehicle outside its driving lane, it considerably adds to the risk of collision.

*Breaking latency*. During the 15-minute scenario, the officer's braking latency was measured 36 times. Braking latency is the time measured in milliseconds between stimuli; in this case, the lead vehicle applying its brakes, and the participant applying his or her own brakes. The greater the latency, the greater the chance there will be insufficient time and distance to slow sufficiently to avoid a collision.

*Distance from lead vehicle and collisions*. Officers were asked to maintain a constant distance from, and stay within 100 feet of, the lead vehicle. Participants chose their own distance, between 0 and 100 feet, to maintain behind the lead vehicle. Distance between the participant's simulated vehicle and the lead vehicle in the scenario was measured in feet. Finally, number of collisions with the lead vehicle was measured (Figure 1).

### *The analysis*

IBM SPSS 22.0.0.0 was used for statistical analysis. As the protocol required multiple observations per participant, the data potentially violated the assumption of independence. To allow for this, a generalized linear mixed-model with a hierarchal structure was used.




**Notes:** Participants attended the laboratory on two separate occasions with a minimum of 12 days between sessions. During each session participants completed two drives; one distracted and one non-distracted

**Figure 1.** Data structure

*The results*

Five driving performance measures were considered in this analysis: lane deviation, lane departures, braking latency, following distance, and collisions. Even with strong individual differences requiring a general linear mixed effects model, the negative effects of distraction on driving performance can been observed at the aggregate level (see Table II).

*Lane deviation*. Average lane deviation for non-distracted driving was 0.26 (SD = 0.09) compared to 0.39 (SD = 0.18) for distracted driving. A generalized linear mixed-model analysis of driving performance showed that officers' distracted driving performance had significantly greater lane deviation ($f = 88.58$, df = 1, 308, $p < 0.001$) (see Figure 2)[2].

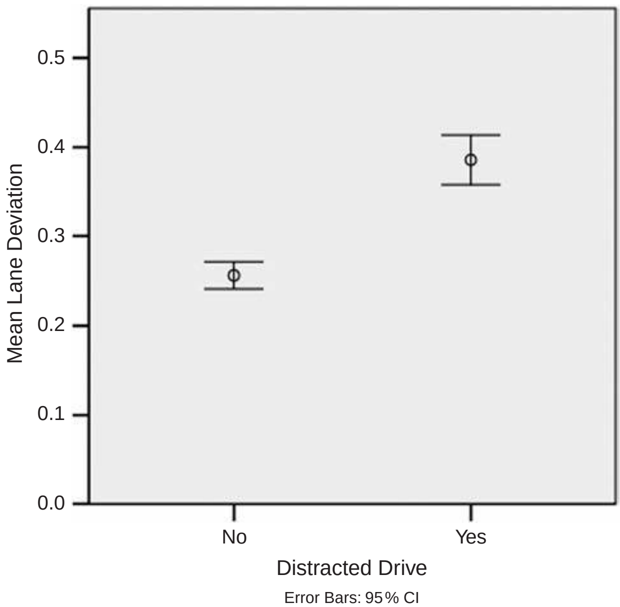
*Lane departures*. Average number of lane departures for non-detracted driving was 3.21 (SD = 6.19) compared to 9.35 (SD = 8.85) for distracted driving. Instances of officers unintentionally leaving their assigned driving lane was also significantly correlated with distracted driving ($f = 64.76$, df = 1, 308, $p < 0.001$) (see Figure 3).

*Breaking latency*. Average mean braking latency[3] for non-detracted driving was 1.47 seconds (SD = 0.43) compared to 2.45 seconds (SD = 0.74) for distracted driving. Braking latency was greater during distracted drives ($f = 200.82$, df = 1, 308, $p < 0.001$) than during non-distracted drives (see Figure 4). These measures are leading indicators for collision risk.

| Performance measures | Non-distracted ($n = 141$) Mean | SD | Distracted ($n = 144$) Mean | SD |
|---|---|---|---|---|
| Lane deviation | 0.26 | 0.09 | 0.39 | 0.18 |
| Number of lane departures | 3.21 | 6.19 | 9.35 | 8.85 |
| Mean braking latency (sec) | 1.47 | 0.43 | 2.45 | 0.74 |
| Mean following distance (m) | 43.43 | 12.86 | 51.96 | 15.75 |
| Number of collisions | 0.01 | 0.08 | 0.13 | 0.36 |

**Notes:** Results of non-distracted vs distracted driving performance. Strong individual differences where observed in baseline driving performance, reflected in the standard deviations below, requiring a general linear mixed effects model

**Table II.** Driving performance




**Notes:** Lateral movement from true course (zero) is measured plus (lateral movement right) and minus (lateral movement left) in meters. See footnote 2 for further explanation on lane deviation calculations

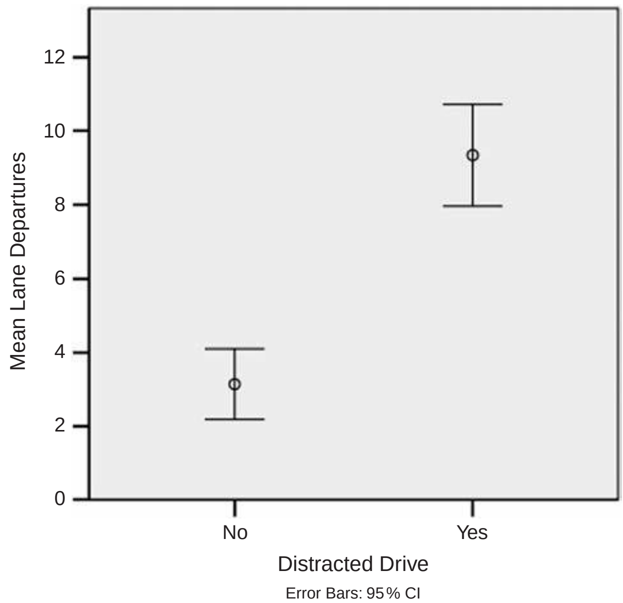
**Figure 2.**
Mean lane deviation for distracted and non-distracted driving

*Distance from lead vehicle and collisions*. Average mean following distance[4] for non-distracted driving was 43.43 feet (SD = 12.86) compared to 51.96 feet (SD = 15.75) for distracted driving. While officers interacted with the distraction task, they drove significantly farther behind the lead vehicle ($f = 22.55$, df = 1, 308, $p < 0.001$), yet collided with the lead vehicle more frequently ($f = 9.96$, df = 1, 308, $p = 0.002$) (see Figure 5). Of the 23 collisions from 22 officers, only one occurred during a non-distracted drive (see Figure 6).

## Discussion

The simulated driving tasks presented, both distracted and non-distracted, were generally less challenging than real world patrol driving and likely underestimate the impact of distraction on police driving. As with any experimental research using simulated tasks, it must be acknowledged that the tasks participants were presented with may not elicit the same response as they would in the real world; participants understand that there are no real consequences for poor performance and therefore, it is possible that the results of this study may overestimate the impact of distraction on police driving.

This study is an important step in understanding the effect of distraction on law enforcement driving performance. It builds on the current distracted driving literature in three important ways. First, the study used current law enforcement officers assigned to their agency's patrol division. This addresses the question of experience mitigating some of the negative impact of distraction on driving performance. As the results of this study show, law enforcement officers appear to drive significantly worse while distracted. This




**Notes:** Lane departures are a count of each time all or part of the simulated vehicle crossed the painted white line bounding the allocated driving lane. Later movement greater than 1m from the requested lane position was required for a lane departure

**Figure 3.**
Mean lane departures for distracted and non-distracted driving



routine experience with using text-based communication devices while driving does not appear to mitigate the risks associated with doing so. Second, the text-based word-search distraction task is an appropriate proxy for the text-based MDC distraction task officers are faced with during their normal duty driving. The text is more visible and the buttons for interaction are larger than what is found on a typical MDC screen. The placement of the touch screen is more in-line with the direction of gaze required to see the road in front of the officer than the typical placement of the MDC, which is lower and further to the right. Third, the protocol required the officer to drive for 15 minutes and then get out of the "vehicle" to perform another task. The short duration of each drive is more congruent with patrol driving. The short duration of drive also helps to mitigate time-on-task effects that contribute to fatigue and diminish vigilance.

Our results suggest law enforcement officers' driving performance is degraded by distraction, and that continuing to allow officers to drive distracted may place officers, their passengers, and other road users at greater risk. Law enforcement officers are typically exempt from distracted driving restrictions imposed on the general public, but the mounting research on this topic favors non-distracted driving being whenever possible. This change in usual and accepted practice mean that if policing organizations which do not modify policies, practices, training, and technologies to reduce the impact of distraction on officers' driving, may expose themselves and their officers to legal liabilities and charges of deliberate indifference. Failing to address the issue of distracted driving for law enforcement officers unnecessarily exposes officers and the communities they serve to greater risk of accidents and injuries.

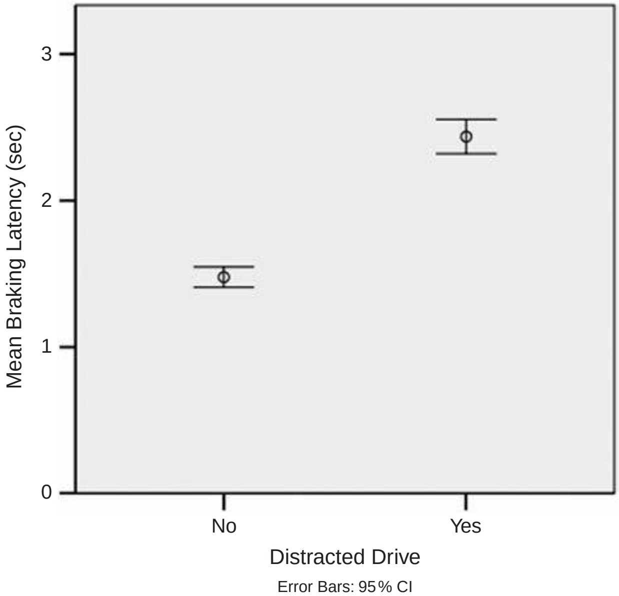



**Figure 4.**
Mean braking latency, in seconds, for distracted and non-distracted driving

**Notes:** Mean braking was calculated from 36 individual braking instances. Participants were asked to react to the lead vehicle applying its brakes

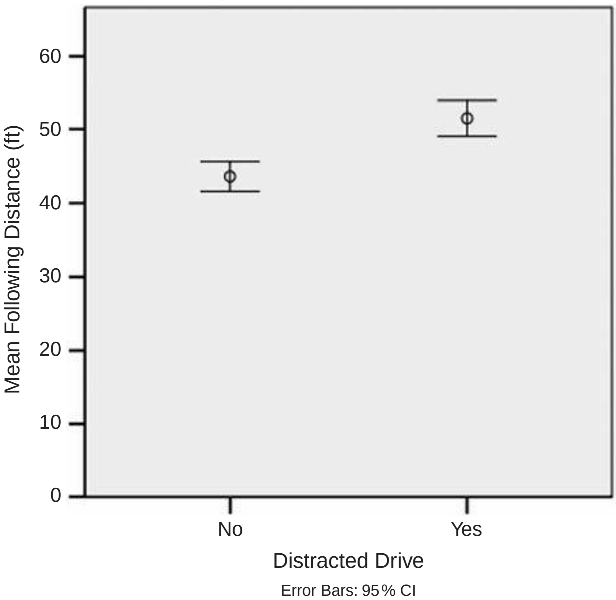



**Figure 5.**
Mean following distance, in feet, between the participant's vehicle and the lead vehicle for distracted and non-distracted driving

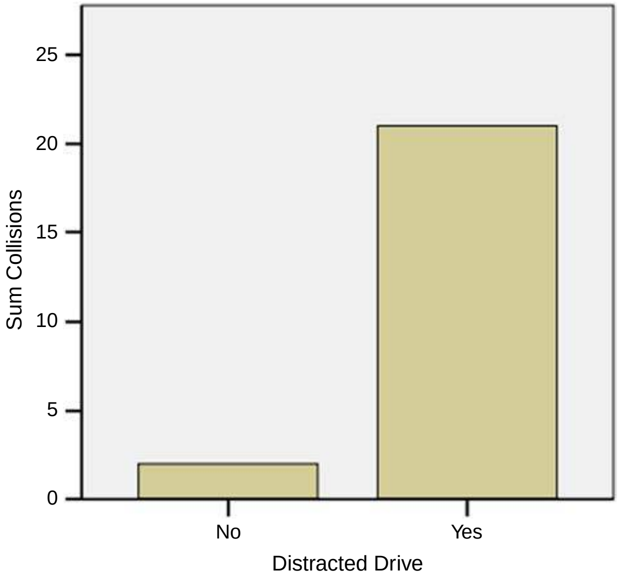



**Figure 6.** Number of collisions for distracted and non-distracted driving

## Notes

1. The author of this paper received access to the original survey data from CA POST.
2. Lane deviation (l) is calculated as $l = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \overline{X}\right)^2}$ where $n$ is the number of observations per drive and $\sum_{(i=1)}^{n}\left(x_i - \overline{X}\right)^2$ is the sum of the variation from mean lane position squared.
   In total, 72 observations per second were collected.
3. Average mean braking latency refers to the average of all mean braking latency measures; where mean braking latency is derived from a single drive measured 36 times over 15 minutes.
4. Average mean following distance refers to the average of all mean following distances measured; where mean following distance was derived from a single drive measured at 72 Hz for 15 minutes.

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