Influence of Cell Phone Conversation on a Simulated Driving Task

Switzer, J., & J.L. Hendrick, SUNY Cortland, Cortland, NY

Abstract

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Switzer, J., & J. L. Hendrick, State University of New York at Cortland.

There is an increasing concern of the influence of cell phone use and car accidents and how much their use results in increased reaction time (RT). New York State allows drivers to use hands free (HF) cell phones while driving, but not hand held (HH). Are RTs in these conditions different? The purpose of this study was to examine RT in simulated driving conditions of college-aged participants to see if having a conversation on a cell phone affects one's ability to respond quickly. Data from male (n=9) and female (n=9) college student volunteers were collected. After practice, each participant completed twenty trials (in which they reacted to a red light by moving their right foot off one pedal and onto another pedal as quickly as possible) in each of three conditions: control (no cell phone), conversing on HF and HH cell phones. During the cell phone conditions, participants were engaged in a conversation with a student who was located in a different room. Mean RT, movement times (MT) and total response time (TRT) were recorded and compared in separate repeated measures ANOVA. Significant condition main effects were found for RT, MT and for TRT (p < .001) LSD comparisons across conditions found that both cell phone conditions resulted in significantly slower RT, MT, and TRT than the control (p < .05). Although MT was not significantly different between the two cell phone conditions (p > .05), RT and TRT were both significantly slower in the HH than in the HF condition (p < .05). Talking on a cell phone, no matter if it is HF or HH, has a detrimental effect on one's ability to respond quickly with the most detrimental effects found while using a HH cell phone.

Purpose

The purpose of this study was to examine reaction times of college-aged participants conversing on a cell phone. The study was designed to examine whether hands-free and/or hand-held cell phone usage results in different reaction times compared to not using a cell phone at all. In addition, are reaction times while using a hands-free cell phone different than while using a hands-held phone?

Introduction

The use of cell phones while driving has become a significant issue in New York state. Of those 130 million people using cell phones in the state, 54% have some sort of cell phone in their car, and 73% use it when they are driving (McCartt, Braver, & Geary, 2003). The New York cell phone law, implemented in 2001, states that:

> **… no person shall operate a motor vehicle upon a public highway while using a mobile telephone to engage in a call while such vehicle is in motion. …this section shall not apply to … the use of a hands-free mobile telephone (New York State Vehicle & Traffic Law Article 33, §1225-c 2a – 3c).**

As noted by the National safety Council, "driving while you dial a phone or balancing it to your ear can be distracting and potentially dangerous" (Safety, Health & Environmental Resources, www.nsc.org/library/facts/carphone.htm). Initial reports found that since that law has been in effect there has been a change from 2.3% to 1.1% of people using cells in their cars (McCartt, Braver, & Geary, 2003). However, many drivers continue to talk on hand held phones. New York is not the only state that feels cell phones are a problem; there are 17 states in the United States that has some sort of legislation on the use of cell phones while driving (Texas Department of Public Safety Public Information office). This could imply that people are aware of the dangers of using a cell phone while driving.

Moore and Moore (2001) reported that people between the ages of 25-54 years caused up to 81% of fatal crashes while using a cell phone, 72% were males and 28% were females. Using cell phones has also been shown to affect reaction time. Warshawasky-Livine and Shinar (2002) found that reaction time increased significantly from 0.32 to 0.42 sec. during a driving situation. Haigney (2001) noted that up to 65% of cell phone conversations involve some verbal negotiation and that using hands-free cell phones still requires the individual to dial out and accept in coming calls physically. In both situations reaction time would be increased which could result in or increase the probability of an accident. In simulated driving situations, reaction times increased with more complex conversations (McKnight & McKnight,1993) and decreased accuracy of responses (Lui, 2003). Older drivers (over the age of 50) were found to be distracted even more (McKnight & McKnight,1993). Lesch & Hancock (2003) found reaction time increases of 1/10 second with young drives and increases of 1/3 second with older drivers. Many others have found increased reaction times with cell phones (Hancock, Lesch & Simmons, 2003; Lamble, Kauranen, Laasko & Summala, 1999; Matthews, Legg & Charlton, 2003; Summala, Lamble & Hyvarinen, 2002).

While there are many possible distractions for drivers, using cell phones was found to increase RT more than just adjusting the car radio (Consiglio, Driscoll, Witte & Berg, 2003). Drivers' capacity to process all the relevant information is also reduced (Cooper & Zheng, 2002). Laberge-Nadeau, Maag, Bellavance, Lapierre, Desjardins, Messier and Saidi (2003) found the increase of risk of injury was increased by 38% for cell-phone users. According to the Governor's Traffic Safety Committee (2003), collisions are four times higher when using a cell phone and there are no safety advantages to using a hands-free cell phone.

There is strong evidence showing decreased information processing capabilities of drivers who use cell phones, but there is limited evidence to support that using the hands-free phones, which are allowable in many states like NY, have reduced risk. With the number of people who drive regularly for their jobs, using cell phones becomes a necessity. Few opt to use the hands-free phones (11.8% men and 5.4% women according to a survey of Canadian drivers by Laberge-Nadeau et al. (2003). If more evidence was provided as to the benefits of using these devices, users may be persuaded to use them.

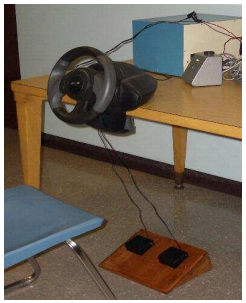

Figure 1. Simulated Driving Apparatus with Lafayette RT/MT Box (Model # 63017)

Figure 2. Verizon Wireless LG model phone with prinivil model head set.

Methods and Procedures

Participants
- ✧Female (n = 9) and male (n=9) college students
- ✧Mean age was 20.6 for females and 22.6 years old for males
- ✧Cell phone use ranged from 1-35 hours a week

Instrumentation
- ✧Reaction time/Movement time apparatus with foot pedals and steering wheel (Figure 1)
- ✧Verizon Wireless Cell phone with headset (Figure 2)

Conditions
- ✧Control – no cell phone conversation
- ✧Hand-held (HH) – conversation on hand-held cell phone
- ✧Hands-free (HF) - conversation on hands-free cell phone

Removal of outliers
- ✧All RT trials less than 100 ms were redone
- ✧After data collection, *M* and *SD* for each participant were calculated.
- ✧All trials with RT > 2 *SD* were removed.

Pilot Study – to examine practice effect
- ✧3 subjects
- ✧4 days of testing, control, HH and HF
- ✧Found
  - Significant improvement from day 1 to day 2, then leveled off
- ✧Therefore, only one practice day was needed

Procedures
- ✧Each participant signed an informed consent form on the first day of testing
- ✧Visual reaction time in go (green light) no-go (red light) conditions. When subject saw the green light they were instructed to step off the right pedal and step onto the left pedal as quickly as possible.
- ✧RT, MT and response errors were recorded
- ✧2 days of testing
  - 1st day
    - 2 blocks of control condition
    - each block – 20 trials (6 trials at each of 2, 3, & 4 s foreperiod with 2 catch trials).
  - 2nd day
    - Warm-up was given in control condition, followed by (order was randomly varied):
    - 1 block hands-free*
    - 1 block hand-held*
    - *conversations were held with person in other room

Design and Statistical Analysis
- ✧SPSS for Windows, version 11
- ✧ANOVA, separate one-way within-subjects ANOVA for each variable (RT, MT, Response time) to compare 3 conditions (control, HH, HF)
  - -alpha level set at .05
  - -post hoc analysis- least significant difference (LSD)

Findings

The study's findings were:

1. There was a significant condition effect for RT ($F(2,34)$ =62.013, p<.0005) Mean RT for HH and HF cell phone conditions were significantly slower than the control condition and from each other (M = .545, M =.581, and M = .439s, respectively)
2. There was a significant condition effect for MT ($F(2,34)$= 49.227, p < .0005). Mean MT for HH and HF cell phone conditions were significantly slower than the control condition (M = .767, M =.800, and M = .661s, respectively).
3. There was a significant condition effect for total response time (TRT) ($F(2,34)$= 63.958, p < .0005). TRT for both the cell phone conditions (HH and HF) were significantly slower than the control condition and from each other(M = 1.312, M = 1.380, and M = 1.100s, respectively).

Results

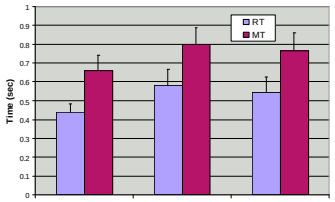

Figure 3. Reaction Time and Movement Time Means and Standard Deviations for Each Condition

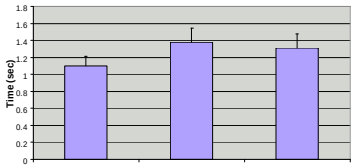

Figure 4. Total Response Time Means and Standard Deviations for each Condition

Discussion

This study examined the influence of cell phones on a person's ability to respond. RTs increased by 28% when conversing on cell phones as compared to not using cell phones. This result supports others in the literature who found reaction times and/or response times to increase while using cell phones (Consiglio et al., 2002; Hancock et al., 2003; Lamble et al., 1999; Lesch & Hancock, 2003; Lui, 2003; Matthews et al., 2003; McKnight & McKnight,1993; Summala et al., 2002; Warshawsky-Livine & Shinar, 2003). Movement times also increased. These results provide additional evidence that cell phones did have an adverse effect on the user's attention, performance, and ability to process information quickly.

For both RT and TRT, times were significantly greater in the hand-held versus the hands-free condition (movement times were unaffected). Perhaps the participants were unfamiliar with wearing and using the head set and this distraction added a further distraction to the condition. It should be noted however, that McKnight and McKnight (1993) found no relation between prior experience with cell phones and their distraction effect. Redelmeir and Tibshairani (1997) did indicate that hands-free cell phones have no safety advantages.

A key finding was that using the hands-free device (which is legal to use while driving in NY) did not result in faster TRT as compared to the hand-held mobile phone. While participants were merely carrying on a conversation during the task, Haigney and Westerman (2001) noted that using a hands-free cell phone still requires the individual to dial out and accept incoming calls physically, making the point that there are no advantages to using hands-free cell phones while driving. Having conversations on cell phones is different than conversing with passengers in the car. As noted by McKnight and McKnight (1993), passengers are aware of the driving conditions and can adjust the intensity and amount of conversation according. Cell phone callers do not. Cell phones are a problem while driving, and thus affect one's perceptual and motor skills (Violanti, 1998). As Violanti reported, "…cellular phones by themselves do not cause collisions; a person behind the steering wheel of a vehicle is always required (p. 524).

It is worth mentioning that the participants in the study were college-aged students. As people age, the ability to process information quickly decreases, thus magnifying these results. As found by McKnight and McKnight (1993), the distracting effect of using cell phones is two- to three-times greater with drivers over the age of 50.

Conclusions

Conversing on cell phones, whether hand held or hands-free has a detrimental effect on one's ability to respond. Using hands-free cell phones, which are allowable in many states, did not reduce the distracting effects; on the contrary, they resulted in slower responses than the hand held phone.

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