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16. Abstract

Previous research, using driving simulation, crash data, and naturalistic methods, has begun to shed light on the dangers of texting while driving. Perhaps because of the dangers, no published work has experimentally investigated the dangers of texting while driving using an actual vehicle. Additionally, previous research does not clearly differentiate the dangers associated with reading and writing text messages. To address these issues, 42 participants drove an instrumented research vehicle on a closed driving course. Participants drove under a control, text reading, and text writing condition. Baseline text reading and writing data were also collected outside of the research vehicle. Results indicated that impairment associated with texting while driving may be greater than previously thought. Principally, when reading or writing texts, drivers exhibited reductions in reaction time that were nearly twice as great as previously thought. Drivers also exhibited nearly identical impairment in the reading and writing conditions, suggesting that both reading and writing text messages may be equally dangerous. These results have immediate implications for improving our understanding of the dangers of texting while driving and may be useful for future public policy discussions.

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An Investigation of the Effects of Reading and Writing Text-Based Messages While Driving

by

Joel Cooper, Ph.D.
Center for Transportation Safety
Assistant Research Scientist
Texas Transportation Institute

Christine Yager, E.I.T.
Center for Transportation Safety
Associate Transportation Researcher
Texas Transportation Institute

and

Susan T. Chrysler, Ph.D.
Center for Transportation Safety
Senior Research Scientist
Texas Transportation Institute

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Texas Transportation Institute
The Texas A&M University System
College Station, Texas 77843-3135

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ABSTRACT

Previous research, using driving simulation, crash data, and naturalistic methods, has begun to shed light on the dangers of texting while driving. Perhaps because of the dangers, no published work has experimentally investigated the dangers of texting while driving using an actual vehicle. Additionally, previous research does not clearly differentiate the dangers associated with reading and writing text messages. To address these issues, 42 participants drove an instrumented research vehicle on a closed driving course. Participants drove under a control, text reading, and text writing condition. Baseline text reading and writing data were also collected outside of the research vehicle. Results indicated that impairment associated with texting while driving may be greater than previously thought. Principally, when reading or writing texts, drivers exhibited reductions in reaction time that were nearly twice as great as previously thought. Drivers also exhibited nearly identical impairment in the reading and writing conditions, suggesting that both reading and writing text messages may be equally dangerous. These results have immediate implications for improving our understanding of the dangers of texting while driving and may be useful for future public policy discussions.

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EXECUTIVE SUMMARY

Government estimates in the United States suggest that around 25% of all fatal crashes are directly related to driver distraction. Research from the Virginia Tech 100-car study suggests that cellular device usage, either for conversation or other visual manual tasks, is the single most common source of distraction. When used to send text messages, cellular phones are thought to increase fatal crash risk by an astounding 6-23 times over baseline. Although the number of annual fatalities caused by text messaging is not known, the potential scope of the problem can be appreciated by the facts that: in 2009, an estimated 5 billion text messages were received per day in the United States, and that 20% of all U.S. drivers have admitted to texting while driving.

To date, only a small handful of experimentally controlled research studies have specifically looked at the dangers of texting while driving, and these have typically been carried out using a driving simulator. The primary objective of this project is to assess the distraction potential of sending and receiving text messages while driving under varying roadway and texting response demands. In order to assess the individual contributions of reading and writing, these activities were blocked in separate experimental conditions. Driving demand was manipulated through changes in roadside objects. Drivers operated an instrumented vehicle on a closed course.

In order to better understand the problem of texting while driving in the real world, while maintaining a high degree of experimental control, this research used an instrumented research vehicle on a closed driving course. Research was conducted at TTI's Riverside campus, which is a 2000-acre complex of research and training facilities situated 10 miles northwest of Texas A&M University's main campus. The site, formerly an Air Force Base, has large expanses of concrete runways and parking aprons that are ideally suited for experimental research and testing in the areas of vehicle performance and handling, visibility, distracted driving, and driver training. Participants drove a closed course, on a portion of a straight, mile-long runway at the TTI Riverside Campus. The course was set up toward the outer edge of the runway and maintained widely paved boundaries for additional safety. This research setting and design allowed participants to drive an actual vehicle with its accompanying dynamics and interact with their personal cell phones, all in a highly controlled research setting that reduced risk exposure to

tolerable levels. This approach leveraged the strengths associated with using an actual vehicle, with research control that is typically only found in the laboratory.

A total of 42 subjects participated in this driving study. Participant ages ranged from 16 to 54, and gender was approximately split. Attempts were also made during recruiting efforts to evenly split participants by the type of mobile device they had, touch screen or QWERTY raised keys, to see if there were any differences in driver performance or texting proficiency.

Results were analyzed using 1- and n-way repeated measures ANalysis Of VAriance (ANOVA). Violations of sphericity in the ANOVA testing were corrected by adjusting the degrees of freedom following the Greenhouse-Geisser procedure. Violations of the homogeneity of variance assumption did not lead to any adjustments or corrections. Though potentially biasing, the importance of variance homogeneity may be marginalized when larger sample sizes are used and when groups of equal sizes are compared; both of which are present in the current set of analyses. For clarity and readability, the unadjusted degrees of freedom will be reported, regardless of whether an adjustment was made in interpreting the F statistic, thus preserving the ability of the reader to identify the exact number of samples that were used to compute each statistic.

Compared to the control condition, reading and writing text messages led to a significant delay in response time, an increase in the number of missed response events, an overall reduction in speed, an increase in the standard deviation of speed on the open roadway sections, an increase in the standard deviation of lane position on the open roadway sections, a reduction in writing and reading rates, and a reduction in the number of glances to the forward roadway. Of the various dependent measures considered in this analysis, only response time to the light task was differentially affected by the writing and reading tasks, with the greatest response time impairment associated with writing a text message. Thus, overall performance on each of the measures herein considered clearly indicated significant impairment from both writing and reading text messages. Results also suggest that any possible difference in driving impairment associated with writing and reading are likely very small.

These findings suggest that previous research may have underestimated reaction time delays associated with texting and driving, that reading and writing text messages are equally difficult, and therefore, equally dangerous, and that when text messages are sent from the vehicle, the efficiency of both the texting and driving tasks are dramatically reduced. However,

many questions remain unanswered. Thus, our recommendation is two-fold. First, that enough is known about reading and writing text messages to suggest that drivers should never text behind the wheel. Second, that additional research is needed to better understand when drivers are likely to engage in these types of tasks in the real world.

INTRODUCTION

Government estimates in the United States suggest that around 25% of all crashes are directly related to driver distraction (1). Research from the Virginia Tech 100-car study suggests that cellular device usage, either for conversation or other visual manual tasks, is the single most common source of distraction (2). When used to send text messages, cellular phones are thought to increase fatal crash risk by an astounding 6-23 times over baseline (3, 4). Although the number of annual fatalities caused by text messaging is not known, the potential scope of the problem can be appreciated by the facts that: in 2009, an estimated 6 billion text messages were sent/received *per day* in the United States (5), and that 20% of all US drivers have admitted to texting while driving (6).

In response to the perceived dangers of sending and reading text messages while driving, 38 out of 50 U.S. states now have at least partial bans on texting, yet many important questions remain unanswered. Similar to conversing via cellular phone, sending and reading text messages is an activity that may allow drivers to selectively initiate the activity during moments of low task demand. However, unlike conversing on a cellular phone, the actual act of sending or reading a text message is one that can be interrupted at any moment, without social consequence (momentarily at least), allowing the driver to pay full attention to the road. An important distinction can be drawn between cell phone conversation and texting; texting is amenable to resumption after selective disengagement while conversation may be more difficult to resume and, once initiated, is usually terminated slowly. However, the question of whether or not drivers actually modulate text messaging engagement, based on task demand, is not well addressed in the literature.

To date, only a small handful of experimentally controlled research studies have specifically looked at the dangers of texting while driving, and these have typically been carried out using a driving simulator. The first published study came out in 2009 by Hosking, Young and Regan (7). They had 20 participants drive a computer simulated roadway that contained a number of emerging threat events, a car following episode, and a lane-change task. Results indicated that drivers were particularly impaired when sending text messages and less so when receiving. In particular, they found that drivers' ability to maintain their lateral position, their ability to detect and respond to traffic signs, the amount of time spent looking at the road, and

their following distance, were all impaired when sending and receiving text messages. However, Hosking, Young, and Regan did not control for task exposure time during the text receiving and sending episodes and thus, it is not clear whether the results they obtained were due to differences in task exposure time, or differences in the distracting nature of the tasks themselves. Additionally, participants did not use their own phones, the effect of which was unknown on the results.

A second study published in 2009 by Drews et al. was also completed using a simulated driving environment (3). Here again, 20 participants drove a simulated roadway while sending and receiving text messages. Unlike earlier work, in this research, participants were able to use their own phones. Additionally, the text messages sent and received in this study were shared between actual friends, thus the actual communication was likely more representative of every-day text messages. The driving tasks consisted of following a periodically braking lead vehicle down a 65 mph two-three lane roadway. Results indicated that when texting, participants expressed greater following variability, greater lateral variability, reduced response time to the lead vehicle, and an increase in collision frequency. Brake response times associated with reading were reported to be higher than those associated with writing. However, because the reading and writing portions of this research were not balanced, the actual amount of driving time associated with reading was likely very low. Indeed, just 1.2 brake response observations per subject were made while reading an incoming text, compared to an average of 14 brake responses while writing. Thus, the actual effects of reading and writing a text message on driving performance cannot be determined from this research.

An additional factor that may play a crucial role in determining the extent of driving interference from texting is whether drivers are actively reading or writing the text message. While there are various theoretical reasons why differentiating the effects of reading and writing on driving could be interesting, from a practical standpoint the answer could have immediate implications for the types of activities that are and are not allowed in vehicles. Currently, there are a number of common secondary driving tasks that are heavily reliant on reading text based information from a screen that may not necessarily require text entry. On the one hand, if text entry is significantly more impairing than reading, then future laws could be selectively written to ban the writing but not reading of text based communications. On the other hand, if the

writing and reading of text based messages is found to be equally impairing to drivers, then simply banning one, but not the other, may not adequately address the problem.

The primary objective of this project is to assess the distraction potential of sending and receiving text messages while driving under varying roadway and texting response demands. In order to assess the individual contributions of reading and writing, these activities were blocked in separate experimental conditions. Driving demand was manipulated through changes in roadside objects. Drivers operated an instrumented vehicle on a closed course.

APPROACH AND METHODOLOGY

Driving simulators are often used to address research questions that are deemed to be too dangerous or impractical to study using other methods, which may account for the fact, to date, no published research has experimentally evaluated the effects of texting on driving using an actual vehicle. While there are several advantages to using driving simulation to address questions about an activity as potentially dangerous as texting while driving, there are also several limitations that make it difficult to confidently generalize the findings of a study using driving simulation to the real world.

In order to better understand the problem of texting while driving in the real world, while maintaining a high degree of experimental control, this research used an instrumented research vehicle on a closed driving course. This allowed participants to drive an actual vehicle with its accompanying dynamics and interact with their personal cell phones, all in a highly controlled research setting that reduced risk exposure to tolerable levels. This approach leveraged the strengths associated with using an actual vehicle with research control that is typically only found in the laboratory.

This research was driven by three primary research questions:

- How well do texting while driving results obtained using an actual vehicle compare to those using a driving simulator?
- Do drivers change the way they interact with non-driving tasks as the driving task becomes more demanding?
- When texting while driving, does driving impairment from reading differ from writing?

In order to address these questions, a driving study was conducted at TTI's Riverside Campus, which is a 2000-acre complex of research and training facilities situated 10 miles northwest of Texas A&M University's main campus. The site, formerly an Air Force Base, has large expanses of concrete runways and parking aprons that are ideally suited for experimental research and testing in the areas of vehicle performance and handling, visibility, distracted driving, and driver training. Participants drove a closed course, on a portion of a straight, mile-long runway at the TTI Riverside Campus. The course was set up toward the outer edge of the runway and maintained widely paved boundaries for additional safety.

To address the question of whether drivers change the way they interact with non-driving tasks as the driving task becomes more demanding, researchers had participants drive a course that was evenly divided between an open and unrestricted lane and one that was bordered by lane-restricting construction barrels (see Figure 1). In the barreled roadway section, a total of 17 pairs of barrels, placed 140 feet apart, marked the edges of the lane boundary. In the open section of the roadway, lane boundaries were demarcated by existing pavement markings and/or seams in the concrete paving blocks. Barrels were placed at the outside edges of the 12-foot wide lines. The barreled section was 2,380 feet, and the open section was 2,140 feet.

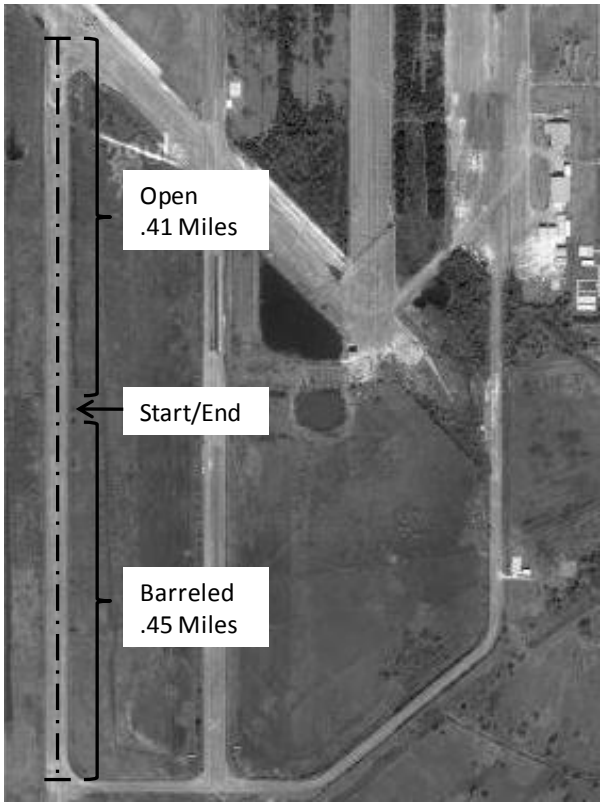


Figure 1. Closed course divided into a work zone and open sections

Each drive began in the middle of the course, at the transition between the barreled and open roadway sections (see Figure 2). Half of the participants began each drive in the work zone, and half began each drive in the open section, the order of which was counterbalanced to reduce any biasing effects on the data. Beginning in the middle, participants drove the full course two times for each of the driving conditions. At the end of the barreled and open sections were pairs of cones, which indicated to participants that they needed to make a U-turn and continue again

down the length of the course. As an example, a participant may have begun in the open section, driven .41 miles to the end of the course, made a U-turn, driven back through the open section (.41 miles), driven through the barreled section (.45 miles), made a U-turn, returned through the barreled section (.45 miles), driven the open section (.41 miles), made a U-turn, returned through the open section (.41 miles), driven the barreled section (.45 miles), made a U-turn, returned through the barreled section (.45 miles), and then stopped, having completed two full laps of the course (3.5 total miles).

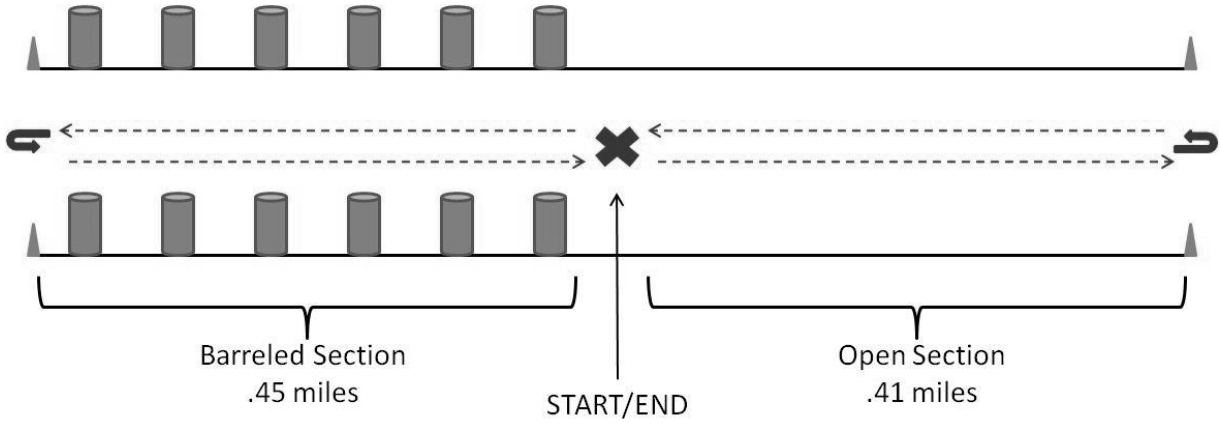


Figure 2. Diagram of course layout

To evaluate the effects of reading and writing texts on driving, three separate driving segments were completed (control, reading, writing), each approximately 10 minutes in length. The order with which participants completed the three segments was counterbalanced across participants.

The three segments consisted of:

- **Control:** No text messages were sent or received; driver focused on maintaining speed of 30 mph, maintaining lane position, and responding to light response task.
- **Writing:** Driver composed a story on their mobile device while driving and trying to maintain speed of 30 mph, maintain lane position, and respond to light response task.
- **Reading:** Driver read a story on their mobile device while driving and trying to maintain speed of 30 mph, maintain lane position, and respond to light response task.

The light response task consisted of a green LED that was attached to the hood of the instrumented vehicle within eye line of the driver (see Figure 3 and Figure 4). The light was programmed to initially turn on after 20 seconds and remain on for 15 seconds unless a response was received from the participant via the joystick button. Thereafter, the light was programmed to turn on at pseudo-random intervals defined by a normal distribution with a mean of 45 seconds and a standard deviation of 5 seconds. Light state was recorded at 60 Hz and stored for later analysis.

Figure 3. Green LED mounted on vehicle hood

Figure 4. Participant responding to light by pressing joystick button

Participants drove TTI's instrumented 2006 Toyota Highlander on the closed course (see Figure 5). The principle data collection system within the instrumented vehicle is the Dewetron DEWE5000 data acquisition integration system. Essentially a large portable computer, the DEWE5000, serves as the data acquisition device for all the peripheral systems in the vehicle.

Figure 5. TTI's instrumented vehicle

A Trimble DSM232 Global Positioning System (GPS) was used to track the speed and position of the subject vehicle. It employed a high gain GPS antenna mounted on the roof of the vehicle, directly over the driver's seat. The receiver was mounted in the rear cargo area near the DEWE5000.

Two forward looking video cameras were used to track lateral lane position of the vehicle (see Figure 6). Steering, brake, and gas potentiometers were used to collect driver inputs to the vehicle. A Crossbow Piezoresistive Accelerometer was used to collect acceleration data for three axes.

Figure 6. A forward facing camera was mounted on each side of the vehicle to track lateral lane position

In addition to the two cameras used to track lane position, there were two more cameras mounted in the interior of the vehicle. One camera was attached to the rear-view mirror and aimed at the driver to track head position and eye glances (see Figure 7). The second interior camera was a fish-eye lens that was attached to the headrest bar of the passenger seat and aimed at the driver to capture the driver's body and hand movements when interacting with their mobile device (see Figure 8). A duplicate LED light was positioned in view of this camera so that it could be seen in the video stream when the light was on or off.

Figure 7. A camera was aimed at the driver to track head position and eye glances

Figure 8. A second camera was aimed at the driver's profile to track hand and body movements

DEMOGRAPHICS

A total of 42 subjects participated in this driving study. Participants were recruited through word of mouth and from a database of past research participants. Each testing session lasted approximately 90 minutes and participants were paid $40 for the study. Participant ages ranged from 16 to 54, and gender was approximately split. Attempts were also made during recruiting efforts to evenly split participants by the type of mobile device they had, touch screen or QWERTY raised keys, to see if there were any differences in driver performance or texting proficiency. Appendix A shows examples of the two types of mobile devices. Table 1 shows a summary of the demographic data.

Table 1. Summary of demographic data for all participants

Demographics Summary	Age
2	< 18 years old
32	18-35 years old
8	> 35 years old
	Cell Phone Type
29	Touch Screen
13	QWERTY Raised Keys
42	**TOTAL**

ORDER OF EVENTS AND INSTRUCTIONS

When participants arrived, they began their driving study appointment by signing consent and video release forms. A visual acuity test was administered to assure that drivers would pass the current visual requirements for a driver's license. Participants also filled out a brief cellular device form that provided experimenters with the participant's mobile number, carrier, and type of phone (see Appendix B).

Recall that there were three segments conducted during the driving experiment: control, writing, and reading. For the writing segment, participants were asked to continuously compose a story of their choice, often a simple fairy tale, while driving. For the reading segment, participants were asked to continuously read a fairy tale story on their mobile device while driving. Fairy tale stories were chosen as the texting task in order to address the question of whether reading and writing text messages differentially affected driving performance. Even though the texting tasks may not be representative of all in-vehicle text based communications, the tasks were designed to assure that drivers were fully engaged in either reading or writing during the texting conditions, and that no task downtime was present.

Experimenters sent two stories to each participant's phone via MMS messages. One story was read in the office for a baseline reading rate, and the other story was read while driving during the reading segment of the experiment. The assignment of which story was read under what condition was counterbalanced across participants. Both stories are provided in Appendix

C. The baseline reading rate conducted in the office consisted of asking the participant to read a story on their phone (whichever was assigned to be read in the office for that subject) and to notify the experimenter when finished reading. When 4 minutes elapsed, the experimenter asked for and recorded the last few words that the participant read to determine how far into the story the participant read in that time frame. If the participant finished the story prior to 4 minutes, the time at which the participant finished reading was recorded instead.

In addition to this baseline reading rate, a baseline texting rate was also administered. This consisted of allotting the participant 4 minutes to compose a story of their choice with the intent of continuously composing for the full duration of time. After 4 minutes elapsed, the experimenter asked the participant to send all of what they were able to compose in that time frame to the experimenter's phone for future analysis.

Participants were then provided with verbal instructions to prepare them for the driving experiment. Appendix D provides the full set of instructions. In summary, researchers explained to the participants that the experiment was broken down into three segments, the order of which varies across subjects. Participants were shown a map, diagram of the course, and two sections of roadway, then the researchers explained how to complete the two laps for each segment. The experimenter then explained how to respond to the light task. Finally, the participants were instructed to try to maintain a speed of 30 mph, stay in their lane, respond to the light task, and compose or read the assigned story if applicable with the segment underway. Once in the instrumented vehicle, participants were given several minutes to practice the light response task prior to driving and several minutes to get used to driving the instrumented vehicle. A TTI experimenter rode in the rear passenger seat to provide instruction and assure safety.

At the starting point of the course, the participant was reminded of the driving tasks to focus on and instructed on which segment to begin: control, writing, or reading. Appendix E contains the counterbalanced list of starting section and order of segments completed by participant number.

Using the DEWE5000 and PsychoPy data collection software, the following performance measures were collected during the driving experiment for each participant:

- Speed.
- Lateral lane position.
- Steering, brake, accelerator.
- Light response times.
- Reading/texting rates.
- Self-performance ratings and comments.

Following completion of the driving experiment, participants were interviewed about their experience and opinions on the effects of texting while driving. Appendix F shows all raw responses.

FINDINGS

The data collected from the DEWE5000 software and the light response task were converted to text files, preprocessed in Matlab® to capture all relevant components, and imported into SPSS® for statistical analyses. The raw video and log files were also analyzed to calculate length of each segment and section, reading/composing rates, and eye glance status. The following sections detail the results and findings of this experiment.

For each analysis, results are presented visually, in the form of box-plots, and quantitatively, in the form of statistical analysis. Box-plots presented in this report were generated using the convention that the central line in the "box" represents the median data point (see Figure 9). The top of the box represents the 75th percentile, and the bottom represents the 25th percentile. Thus, the relative position of the median score within the 75th and 25th percentiles can give some indication about the skewness of the data for each dependent measure. The "whiskers" represent the data that lay 1.5 times beyond the interquartile range (IQR). This is the range between the 25th and 75th percentiles. If all data below the 25th percentile and above the 75th percentile are within 1.5 times the IQR then the end of the whisker represents the greatest or smallest value. Otherwise, all outliers beyond 1.5 times the IQR, added or subtracted from the 25th and 75th percentiles respectively, are plotted using small black circles.

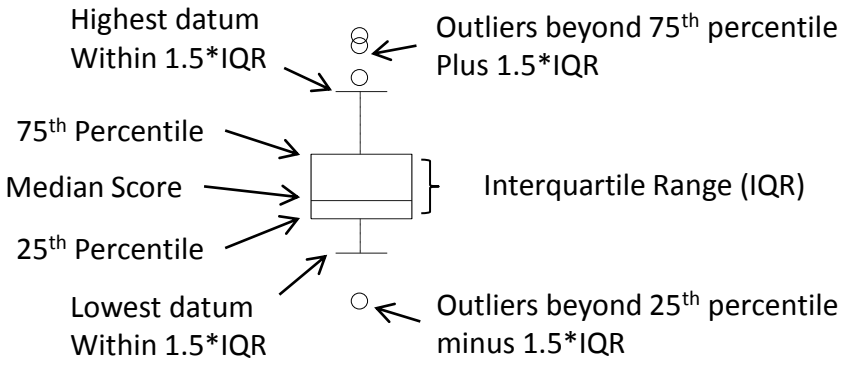


Figure 9. Definition of box plot components

Results were analyzed using 1- and n-way repeated measures ANalysis Of VAriance (ANOVA). Violations of sphericity in the ANOVA testing were corrected by adjusting the degrees of freedom following the Greenhouse-Geisser procedure. Violations of the homogeneity of variance assumption did not lead to any adjustments or corrections. Though potentially

biasing, the importance of variance homogeneity may be marginalized when larger sample sizes are used and when groups of equal sizes are compared; both of which are present in the current set of analyses. For clarity and readability, the unadjusted degrees of freedom will be reported, regardless of whether an adjustment was made in interpreting the F statistic, thus preserving the ability of the reader to identify the exact number of samples that were used to compute each statistic.

Following each overall F-test, pairwise comparisons will be completed between each of the various conditions. In order to mitigate the potential Type-I error rate (false positives), confidence intervals of all pairwise comparisons are adjusted using the Bonferroni procedure for multiple comparisons, and the resulting p values are then reported.

Only the 2-way interactions were considered in this analysis. This was done to put a limit on the number of comparisons made for each analysis and thereby limit the potential for Type-I errors. Additionally, three-way interactions become very difficult to interpret and can easily lead to misunderstandings and overgeneralizations based off spurious associations in the data, thus, they are not considered in this report.

LIGHT RESPONSE TIME

Analysis of the light response data indicated that, compared to performance in the control condition, participants were significantly slower to respond to the onset of the green hood-light when they were writing or reading text messages. When writing a text message, response times to the light detection task were delayed by a factor of 2.45. When reading a text message, response times to the light detection task were delayed by a factor of 1.87. Statistical analysis of these results indicated that light response times in the control, writing, and reading conditions were all significantly different from each other. Thus, unlike many of the other variables presented in this report, performance on this task showed greater impairment in the writing compared to the reading conditions.

Statistical Analysis

Comparison	*df*	*F*	Sig.
Texting	(2,80)	62.9	.000

Pairwise Comparisons for Texting Conditions

	Control	Writing	Reading
Control		.000	.000
Writing	.000		.000
Reading	.000	.000	.000

Descriptive Statistics

Condition	Mean	Std. Error
Control	1.754	.126
Writing	4.302	.252
Reading	3.278	.199

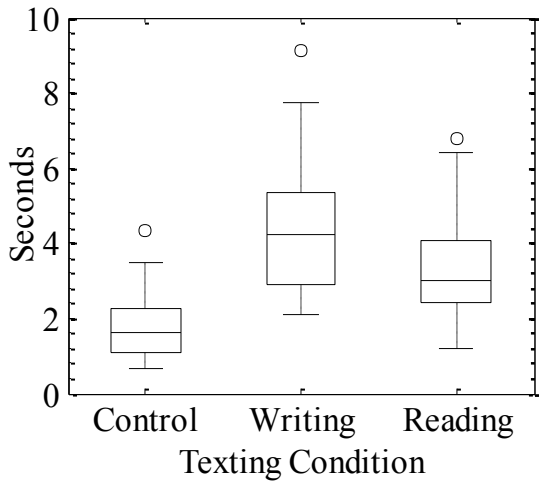


Figure 10. Light response time statistical analysis

MISSED LIGHT RESPONSES

Compared to performance in the control condition, participants were significantly more likely to not respond in the light response tasks when writing or reading a text message. Indeed, in the control condition, just three participants failed to respond to the green light, while in the writing and reading conditions this figure increased to include nearly three-fourths (~30) of the participants. Stated another way, when writing a text message, the number of missed lights increased by a factor of 13.5, and when reading a text message, the number of missed lights increased by a factor of 11.5. And while the number of missed lights in the reading and writing conditions was each different from the baseline condition, the number of missed lights in the reading and writing conditions did not differ from each other.

Statistical Analysis

Comparison	*Df*	*F*	Sig.
Texting	(2,80)	20.6	.000

Pairwise Comparisons for Texting Conditions

	Control	Writing	Reading
Control		.000	.000
Writing	.000		.983
Reading	.000	.983	

Descriptive Statistics

Condition	Mean	Std. Error
Control	.220	.096
Writing	2.98	.473
Reading	2.54	.539

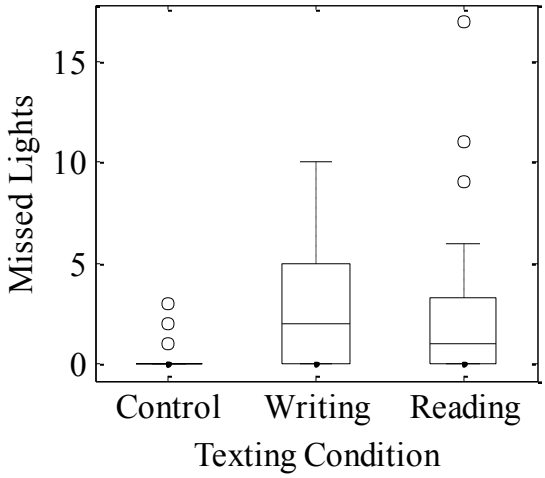
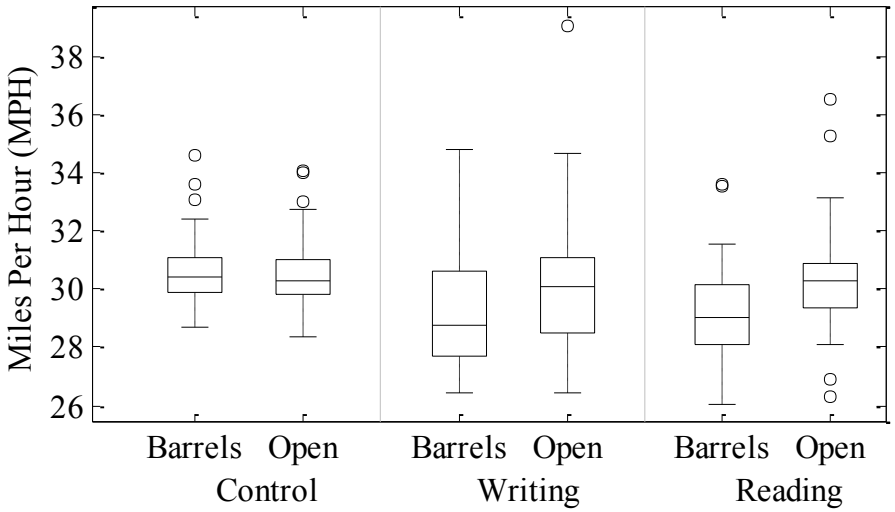


Figure 11. Missed light responses statistical analysis

MEAN SPEED

Although participants were instructed to maintain a 30 mph driving speed, mean (average) driving speed was significantly lower when drivers wrote or read text messages. It was also significantly lower in the driving section with barrels than in the open driving section. The interaction between mean speed and driving section indicated a complex pattern whereby drivers in the control condition recorded similar speeds in both the barreled and open sections, while drivers in the writing and reading conditions tended to lower their speeds overall, but especially in the barreled roadway sections.



Statistical Analysis

Comparison	*df*	*F*	Sig.
Texting	(2,70)	7.36	.001
Section	(1,35)	43.7	.000
Texting * Section	(2,70)	18.1	.000

Pairwise Comparisons for Texting Conditions

	Control	Writing	Reading
Control		.014	.001
Writing	.014		1.00
Reading	.001	1.00	

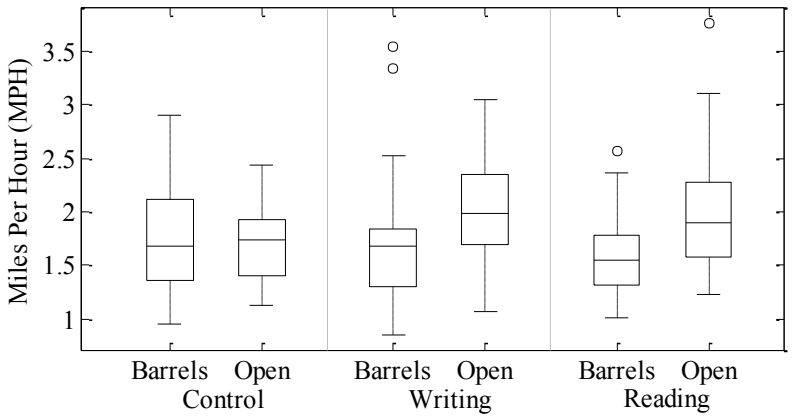
Descriptive Statistics

Condition	Mean	Std. Error
Control	30.7	.211
Writing	29.6	.374
Reading	29.8	.286
Barrels	29.6	.223
Open	30.4	.275

Figure 12. Mean speed statistical analysis

STANDARD DEVIATION OF SPEED

The main effects analysis of the control, writing, and reading conditions did not reach significance. However, the analysis of the driving section and the section by texting (control, writing, reading) interaction, suggests that the actual relationship between the standard deviation of vehicle speed and the text messaging conditions was rather complicated. Similar to mean speed, drivers in the control condition did not vary their speed differently in the barreled and open sections, while drivers in both the writing and reading conditions displayed significantly more speed variation in the open sections than barreled roadway sections. One explanation of this finding is that, in the open section, drivers shifted attention away from the driving task toward the reading and writing tasks, leading to greater speed variability.



Statistical Analysis

Comparison	*df*	*F*	Sig.
Texting	(2,70)	1.58	.212
Section	(1,35)	31.2	.000
Texting * Section	(2,70)	12.7	.000

Pairwise Comparisons for Texting Conditions

	Control	Writing	Reading
Control		.368	.888
Writing	.368		1.00
Reading	.888	1.00	

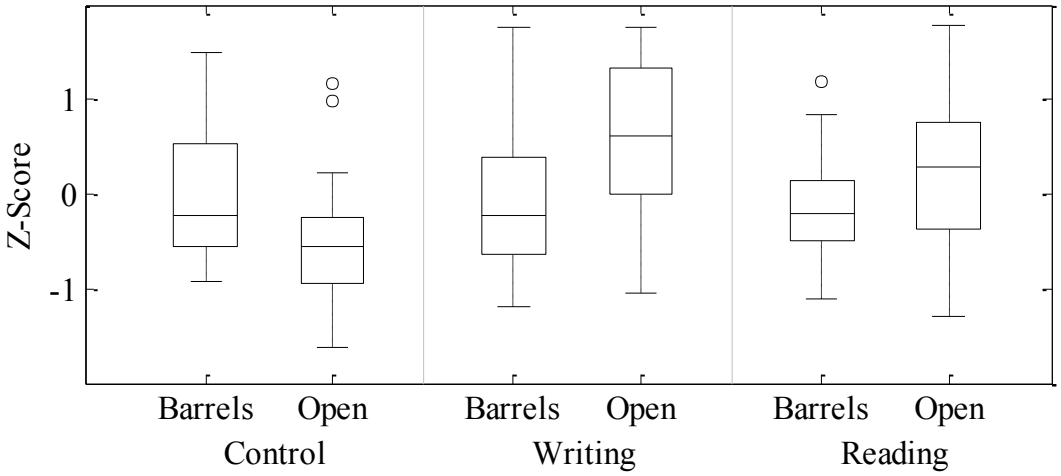
Descriptive Statistics

Condition	Mean	Std. Error
Control	1.71	.066
Writing	1.85	.084
Reading	1.78	.070
Barrels	1.65	.065
Open	1.91	.062

Figure 13. Standard deviation of speed statistical analysis

STANDARD DEVIATION OF LANE POSITION

Drivers' ability to maintain a consistent lane position, as measured by the standard deviation of lane position, was significantly affected by the text messaging condition. However, this effect was primarily observed in the interaction between the barreled and opened sections as the main effect of the two roadway sections was not significant (p =.051). The interaction suggested that drivers in the control condition showed a somewhat reduced standard deviation of lane position, and drivers in the writing and reading conditions showed increased standard deviation of lane position in the open roadway sections.



Statistical Analysis

Comparison	*df*	*F*	Sig.
Texting	(2,70)	11.8	.000
Section	(1,35)	4.09	.051
Texting * Section	(2,70)	15.0	.000

Pairwise Comparisons for Texting Conditions

	Control	Writing	Reading
Control		.000	.002
Writing	.000		.879
Reading	.002	.879	

Descriptive Statistics

Condition	Mean	Std. Error
Control	-.40	.066
Writing	.30	.084
Reading	.09	.070
Barrels	-.13	.071
Open	.13	.072

Figure 14. Standard deviation of lane position statistical analysis

TEXT MESSAGING CHARACTERS PER MINUTE

While in the office, participants produced an average of 102 characters per minute. This was reduced to just 59.3 characters per minute in the barreled sections of the roadway and 63.6 characters per minute in the open sections of roadway. Texting rates were significantly different in office, barrels, and open roadway conditions.

Statistical Analysis

Comparison	*df*	*F*	Sig.
Texting	(2,74)	10.5	.000

Pairwise Comparisons for Texting Conditions

	Office	Barrels	Open
Office		.000	.000
Barrels	.000		.003
Open	.000	.003	

Descriptive Statistics

Condition	Mean	Std. Error
Office	102	4.11
Barrels	59.3	2.91
Open	63.6	3.04

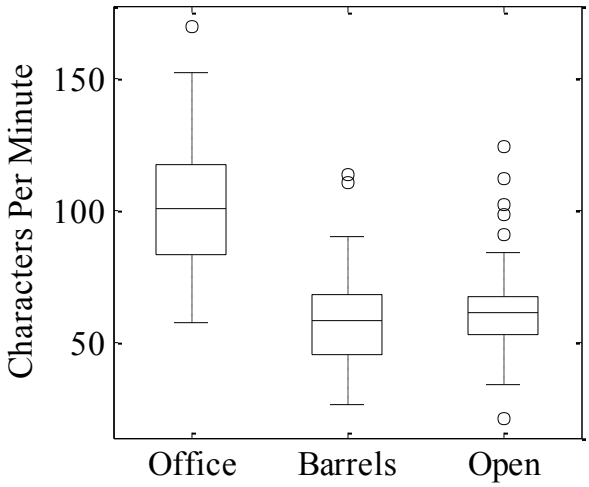


Figure 15. Text messaging characters per minute statistical analysis

READING RATE PER MINUTE

While in the office, participants read an average of 1192 characters per minute. This was reduced to just 634 characters per minute in the barreled sections of the roadway and 709 characters per minute in the open sections of roadway. Pairwise comparisons indicated that each of these three conditions were significantly different from the others.

Statistical Analysis

Comparison	*df*	*F*	Sig.
Texting	(2,78)	163.3	.000

Pairwise Comparisons for Texting Conditions

	Office	Barrels	Open
Office		.000	.000
Barrels	.000		.000
Open	.000	.000	

Descriptive Statistics

Condition	Mean	Std. Error
Office	1191	57.3
Barrels	633.6	34.7
Open	708.6	35.1

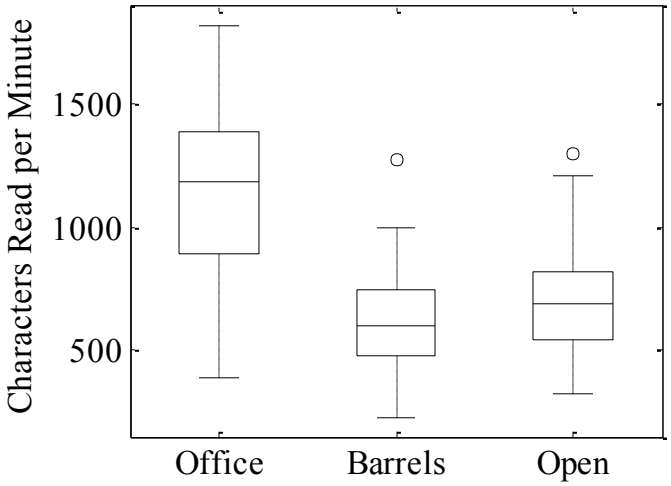


Figure 16. Reading rate per minute statistical analysis

SUBJECTIVE PERFORMANCE RATING

After each driving segment was completed, participants were asked to rate their driving performance on a scale of 1-100, with 1 being the worst driving possible, and 100 being the best driving possible. Results from these subjective performance ratings were largely in line with objective task performance ratings. In general, participants felt that they drove the worst when they were writing text messages; this was true for 31 out of 40 participants. Seven out of 41 participants thought their driving performance was lowest during the reading task, and four participants thought the reading and writing tasks resulted in equivalent driving performance. Overall, participants felt their driving performance while writing text messages was 39% below maximal level, driving while reading was rated 29% below maximal level, and driving in the control condition was rated just 10% below maximal level.

Statistical Analysis

Comparison	*df*	*F*	Sig.
Texting	(2,80)	86.1	.000

Pairwise Comparisons for Texting Conditions

	Control	Writing	Reading
Control		.000	.000
Writing	.000		.000
Reading	.000	.000	

Descriptive Statistics

Condition	Mean	Std. Error
Control	90.1	.089
Writing	60.8	2.49
Reading	70.7	2.63

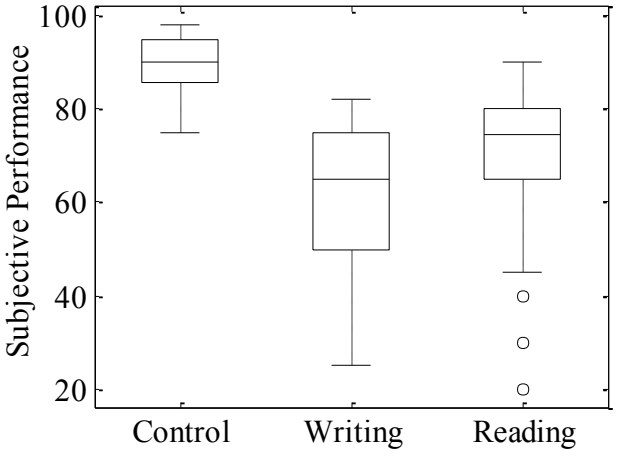


Figure 17. Subjective performance rating statistical analysis

SUMMARY AND CONCLUSIONS

This purpose of this research was to address three primary research questions that were identified in the introduction of this manuscript. They were:

1. How well do texting while driving results obtained using an actual vehicle compare to those using a driving simulator?
2. Do drivers change the way they interact with non-driving tasks as the driving task becomes more demanding?
3. When texting while driving, does driving impairment from reading differ from writing?

In response to question 1, we found that, in general, the results of this research compare very favorably to previous results obtained using driving simulation. Similar to previous research, in this research, drivers exhibited significant impairments to lateral and longitudinal control when either reading or writing text messages. Additionally, we found very large differences in response time to the light response task when drivers were reading or writing text messages.

One exciting and initially unexpected finding from this research was our ability to analyze the GPS data to extract a measure of lane position variability. Prior to this project, research using the instrumented vehicle at TTI has had to rely on a number of time-consuming and error-prone techniques to evaluate lane position variability. By confining the current study to a single straight section of runway, we were able to easily identify and analyze driving data associated with the distinct sections of roadway used in this study. Added to the other performance data, the overall set of variables collected in this research provide additional knowledge to our understanding of this common form of driver distraction.

In response to question 2, we found that when reading or writing text messages in the barreled roadway sections, on average, drivers reduced their speed, reduced their speed variability, reduced their lane position variability, wrote and read fewer characters per minute, and made more glances to the forward roadway. By contrast, drivers in the control condition did not change any characteristics of vehicle speed in the barreled roadway sections, except that their

standard deviation of lane position was somewhat increased. This pattern of results suggests that when drivers entered the barreled roadway section, the mental resources to both keep from hitting the barrels, and to maintain all other tasks at peak performance, was simply not available, forcing drivers that were reading and writing text messages to make tradeoffs in task performance to accommodate the changing task/roadway demands. It is noteworthy that while task performance improved in the barreled sections, it was still far below performance in the control conditions. Thus, while it appears that drivers directed more attention to the roadway in the barreled sections, the shift was still insufficient to counteract all impairments associated with the texting and driving tasks.

Based on these results it is reasonable to wonder if drivers intentionally modified their behavior in the barreled roadway section to accommodate for the increased roadway demands. Unfortunately, it is not possible from this research to determine the answer. However, there were some suggestions in the open-ended exit questionnaire that drivers were at least aware of the increased difficulty associated with driving in the barreled roadway section. It is difficult, however, to imagine that drivers would see much overt benefit in reducing their speed by just 1 mile or so per hour in the barreled sections. In the end, whether conscious or not, the observed speed reductions in the barreled section would have increased the amount of time that participants had to make heading corrections by a small degree, having the overall effect of keeping the overall amount of attention needed to safely guide the vehicle between the barrels, manageable.

In response to question 3, unlike previous research, the design of this study allowed us to cleanly disambiguate driving impairment associated with reading and writing text messages. Our results indicate that both activities lead to nearly indistinguishable driving impairments. Indeed, in our analyses, only response time differentiated between reading and writing, indicated by slightly increased response time delay during writing than reading.

Compared to the control condition, reading and writing text messages led to a significant delay in response time, an increase in the number of missed response events, an overall reduction in speed, an increase in the standard deviation of speed on the open roadway sections, an increase in the standard deviation of lane position on the open roadway sections, a reduction in writing and reading rates, and a reduction in the number of glances to the forward roadway. Of the various dependent measures considered in this analysis, only response time to the light task

was differentially affected by the writing and reading tasks, with the greatest response time impairment associated with writing a text message. Thus, overall performance on each of the measures herein considered clearly indicated significant impairment from both writing and reading text messages. Results also suggest that any possible difference in driving impairment associated with writing and reading is likely very small.

FURTHER DISCUSSION

The fact that the standard deviation of lane position increased when drivers in the control condition entered the barreled roadway section is very interesting. This finding may, in some respects, be similar to the finding in other research that lane position maintenance shows apparent improvements under cognitive load that is unrelated to the driving task. Here it appears that the heightened need to maintain a central lane position in the barreled section may have been responsible for the increase in lateral lane movements. Whereas, in the open roadway sections, with no threat of collision and no need to direct overt attention to lane maintenance, the standard deviation of lane position may have been more reflective of an automatic and attention-free process.

The light response task used in this research shares many features with peripheral detection tasks commonly used in other research (9, 10). However, there are some distinctions to the task that are worth discussing. Primarily, the light detection task used in this research was designed to measure our drivers' ability to maintain a higher level goal in the face of writing and reading distractions. Unlike response tasks used in other research, our task was designed NOT to attract attention when the light illuminated. This made it impossible for drivers to sit passively and wait until they noticed the light onset (a feature common in other research). On the contrary, drivers were forced to periodically look at the light (located on the vehicle hood) to determine whether or not it was illuminated. This made the detection of the light contingent upon periodic scanning to its location, with a failure to do so leading to delayed or missed responses. In many respects, the nature of this task is similar to the proactive scanning of the driving environment in order to seek out potential driving threats. Thus, the overall characteristics of this task may allow it to probe different aspects of attention and memory than is measured by a more *reactive* response task (such as braking in response to a lead vehicle). One example of this would be the periodic scanning of the driving environment for emergency vehicles or latent driving threats.

Like all research, the specific design features of this experiment should be carefully considered when assessing the real-world generalizability of our findings. In order to address the question of whether reading and writing text messages differentially affected driving performance, we had to use texting tasks that may not be representative of all in-vehicle text based communications. Principally, the tasks that we used were designed to assure that drivers were fully engaged in either reading or writing during the texting conditions, and that no task downtime was present to adulterate the findings. Thus, while not representative of most text based communications, the manipulations in this research allow us to make very clear statements about impairments associated with reading and writing text messages in a vehicle.

In order to assure the safety of our participants and researchers, the complexity of the driving task was intentionally minimized. This resulted in a couple of important design constraints that are relevant for the generalizability of these results. Principally, the driving course did not contain any turns, hills, traffic, or potential conflicts, other than the construction barrels for a portion of the course. Additionally, participants were told to maintain a 30 mph speed. The likely effect of these constraints was to lower the actual driving demand well below that which would be experienced under real-world circumstances. With that said, it is frightening to think of how much more poorly our participants may have performed if the driving conditions were more consistent with everyday, routine driving.

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APPENDIX A: TYPES OF MOBILE DEVICES

To participate in this study, your cell phone must have a full keyboard. They may be touch screen or raised keyboard.

For example:

Raised QWERTY keys:

or

or

Touch Screen:

or

APPENDIX B: CELLULAR INFORMATION FORM

Subject # _____

Cellular Phone Information

10-Digit Cell Phone Number: _____

Wireless Provider (AT&T, Verizon, etc.): _____

Type of Keypad (raised/touch): _____

----------FOR EXPERIMENTER USE ONLY----------

Time it took to read fluency:

Answers to Questions:

1. What was this “companion”?
2. What did it eat?
3. Where was it found?

Place in story reading after 4 minutes:

Baseline texting, send after 4 minutes:

APPENDIX C: STORIES SENT TO PARTICIPANTS

The Cottager And His Cat
Source: http://www.rickwalton.com/folktale/crimsn15.htm

Once upon a time there lived an old man and his wife in a dirty, tumble-down cottage, not very far from the splendid palace where the king and queen dwelt.

In spite of the wretched state of the hut, which many people declared was too bad even for a pig to live in, the old man was very rich, for he was a great miser, and lucky besides, and would often go without food all day sooner than change one of his beloved gold pieces.

But after a while he found that he had starved himself once too often.

He fell ill, and had no strength to get well again, and in a few days he died, leaving his wife and one son behind him.

The night following his death, the son dreamed that an unknown man appeared to him and said:

'Listen to me; your father is dead and your mother will soon die, and all their riches will belong to you.

Half of his wealth is ill-gotten, and this you must give back to the poor from whom he squeezed it.

The other half you must throw into the sea.

Watch, however, as the money sinks into the water, and if anything should swim, catch it and keep it, even if it is nothing more than a bit of paper.'

Then the man vanished, and the youth awoke.

The remembrance of his dream troubled him greatly.

He did not want to part with the riches that his father had left him, for he had known all his life what it was to be cold and hungry, and now he had hoped for a little comfort and pleasure.

Still, he was honest and good-hearted, and if his father had come wrongfully by his wealth he felt he could never enjoy it, and at last he made up his mind to do as he had been bidden.

He found out who were the people who were poorest in the village, and spent half of his money in helping them, and the other half he put in his pocket.

From a rock that jutted right out into the sea he flung it in.

In a moment it was out of sight, and no man could have told the spot where it had sunk, except for a tiny scrap of paper floating on the water.

He stretched down carefully and managed to reach it, and on opening it found six shillings wrapped inside.

This was now all the money he had in the world.

The young man stood and looked at it thoughtfully.

'Well, I can't do much with this,' he said to himself;

but, after all, six shillings were better than nothing, and he wrapped them up again and slipped them into his coat.

He worked in his garden for the next few weeks, and he and his mother contrived to live on the fruit and vegetables he got out of it, and then she too died suddenly.

The poor fellow felt very sad when he had laid her in her grave, and with a heavy heart he wandered into the forest, not knowing where he was going.

By-and-by he began to get hungry, and seeing a small hut in front of him, he knocked at the door and asked if they could give him some milk.

The old woman who opened it begged him to come in, adding kindly, that if he wanted a night's lodging he might have it without its costing him anything.

Two women and three men were at supper when he entered, and silently made room for him to sit down by them.

When he had eaten he began to look about him, and was surprised to see an animal sitting by the fire different from anything he had ever noticed before.

It was grey in colour, and not very big; but its eyes were large and very bright, and it seemed to be singing in an odd way, quite unlike any animal in the forest.

'What is the name of that strange little creature?' asked he.

And they answered, 'We call it a cat.'

'I should like to buy it--if it is not too dear,' said the young man; 'it would be company for me.'

And they told him that he might have it for six shillings, if he cared to give so much.

The young man took out his precious bit of paper, handed them the six shillings, and the next morning bade them farewell, with the cat lying snugly in his cloak.

For the whole day they wandered through meadows and forests, till in the evening they reached a house.

The young fellow knocked at the door and asked the old man who opened it if he could rest there that night, adding that he had no money to pay for it.

'Then I must give it to you,' answered the man, and led him into a room where two women and two men were sitting at supper.

One of the women was the old man's wife, the other his daughter.

He placed the cat on the mantel shelf, and they all crowded round to examine this strange beast, and the cat rubbed itself against them, and held out its paw, and sang to them;

and the women were delighted, and gave it everything that a cat could eat, and a great deal more besides.

After hearing the youth's story, and how he had nothing in the world left him except his cat, the old man advised him to go to the palace, which was only a few miles distant, and take counsel of the king, who was kind to everyone, and would certainly be his friend.

The young man thanked him, and said he would gladly take his advice; and early next morning he set out for the royal palace.

He sent a message to the king to beg for an audience, and received a reply that he was to go into the great hall, where he would find his Majesty.

The king was at dinner with his court when the young man entered, and he signed to him to come near.

The youth bowed low, and then gazed in surprise at the crowd of little black creatures who were running about the floor, and even on the table itself.

Indeed, they were so bold that they snatched pieces of food from the King's own plate, and if he drove them away, tried to bite his hands, so that he could not eat his food, and his courtiers fared no better.

'What sort of animals are these?' asked the youth of one of the ladies sitting near him.

'They are called rats,' answered the king, who had overheard the question, 'and for years we have tried some way of putting an end to them, but it is impossible.

They come into our very beds.'

At this moment something was seen flying through the air.

The cat was on the table, and with two or three shakes a number of rats were lying dead round him.

Then a great scuffling of feet was heard, and in a few minutes the hall was clear.

For some minutes the King and his courtiers only looked at each other in astonishment.

'What kind of animal is that which can work magic of this sort?' asked he.

And the young man told him that it was called a cat, and that he had bought it for six shillings.

And the King answered: 'Because of the luck you have brought me, in freeing my palace from the plague which has tormented me for many years, I will give you the choice of two things.

Either you shall be my Prime Minister, or else you shall marry my daughter and reign after me. Say, which shall it be?'

'The princess and the kingdom,' said the young man.

And so it was. And they lived happily ever after.

----------END OF FIRST STORY/START OF SECOND STORY----------

Title: The Emperor's New Clothes
Source: http://ivyjoy.com/fables/emperor.html

Many years ago, there was an Emperor, who was so excessively fond of new clothes, that he spent all his money in dress.

He did not trouble himself in the least about his soldiers; nor did he care to go either to the theater or the chase, except for the opportunities then afforded him for displaying his new clothes.

He had a different suit for each hour of the day; and as of any other king or emperor, one is accustomed to say, "he is sitting in council," it was always said of him, "The Emperor is sitting in his wardrobe."

Time passed merrily in the large town which was his capital; strangers arrived every day at the court.

One day, two rogues, calling themselves weavers, made their appearance.

They gave out that they knew how to weave stuffs of the most beautiful colors and elaborate patterns, the clothes manufactured from which should have the wonderful property of remaining invisible to everyone who was unfit for the office he held, or who was extraordinarily simple in character.

"These must, indeed, be splendid clothes!" thought the Emperor.

"Had I such a suit, I might at once find out what men in my realms are unfit for their office, and also be able to distinguish the wise from the foolish!

This stuff must be woven for me immediately."

And he caused large sums of money to be given to both the weavers in order that they might begin their work directly.

So the two pretended weavers set up two looms, and affected to work very busily, though in reality they did nothing at all.

They asked for the most delicate silk and the purest gold thread; put both into their own knapsacks; and then continued their pretended work at the empty looms until late at night.

"I should like to know how the weavers are getting on with my cloth," said the Emperor to himself, after some little time had elapsed;

he was, however, rather embarrassed, when he remembered that a simpleton, or one unfit for his office, would be unable to see the manufacture.

To be sure, he thought he had nothing to risk in his own person; but yet, he would prefer sending somebody else, to bring him intelligence about the weavers, and their work, before he troubled himself in the affair.

All the people throughout the city had heard of the wonderful property the cloth was to possess; and all were anxious to learn how wise, or how ignorant, their neighbors might prove to be.

"I will send my faithful old minister to the weavers," said the Emperor at last, after some deliberation, "he will be best able to see how the cloth looks; for he is a man of sense, and no one can be more suitable for his office than be is."

So the faithful old minister went into the hall, where the knaves were working with all their might, at their empty looms.

"What can be the meaning of this?" thought the old man, opening his eyes very wide.

"I cannot discover the least bit of thread on the looms."

However, he did not express his thoughts aloud.

The impostors requested him very courteously to be so good as to come nearer their looms; and then asked him whether the design pleased him, and whether the colors were not very beautiful; at the same time pointing to the empty frames.

The poor old minister looked and looked, he could not discover anything on the looms, for a very good reason, because there was nothing there.

"What!" thought he again.

"Is it possible that I am a simpleton? I have never thought so myself; and no one must know it now if I am so.

Can it be, that I am unfit for my office? No, that must not be said either.

I will never confess that I could not see the stuff."

"Well, Sir Minister!" said one of the knaves, still pretending to work.

"You do not say whether the stuff pleases you."

"Oh, it is excellent!" replied the old minister, looking at the loom through his spectacles.

"This pattern, and the colors, yes, I will tell the Emperor without delay, how very beautiful I think them."

"We shall be much obliged to you," said the impostors, and then they named the different colors and described the pattern of the pretended stuff.

The old minister listened attentively to their words, in order that he might repeat them to the Emperor;

and then the knaves asked for more silk and gold, saying that it was necessary to complete what they had begun.

However, they put all that was given them into their knapsacks; and continued to work with as much apparent diligence as before at their empty looms.

The Emperor now sent another officer of his court to see how the men were getting on, and to ascertain whether the cloth would soon be ready.

It was just the same with this gentleman as with the minister; he surveyed the looms on all sides, but could see nothing at all but the empty frames.

"Does not the stuff appear as beautiful to you, as it did to my lord the minister?" asked the impostors of the Emperor's second ambassador;

at the same time making the same gestures as before, and talking of the design and colors which were not there.

"I certainly am not stupid!" thought the messenger.

"It must be, that I am not fit for my good, profitable office! That is very odd; however, no one shall know anything about it."

And accordingly he praised the stuff he could not see, and declared that he was delighted with both colors and patterns.

"Indeed, please your Imperial Majesty," said he to his sovereign when he returned, "the cloth which the weavers are preparing is extraordinarily magnificent."

The whole city was talking of the splendid cloth which the Emperor had ordered to be woven at his own expense.

And now the Emperor himself wished to see the costly manufacture, while it was still in the loom.

Accompanied by a select number of officers of the court, among whom were the two honest men who had already admired the cloth, he went to the crafty impostors, who, as soon as they were aware of the Emperor's approach, went on working more diligently than ever;

although they still did not pass a single thread through the looms.

"Is not the work absolutely magnificent?" said the two officers of the crown, already mentioned.

"If your Majesty will only be pleased to look at it! What a splendid design! What glorious colors!" and at the same time they pointed to the empty frames;

for they imagined that everyone else could see this exquisite piece of workmanship.

"How is this?" said the Emperor to himself. "I can see nothing! This is indeed a terrible affair!

Am I a simpleton, or am I unfit to be an Emperor? That would be the worst thing that could happen--Oh!

The cloth is charming," said he, aloud.

"It has my complete approbation."

And he smiled most graciously, and looked closely at the empty looms; for on no account would he say that he could not see what two of the officers of his court had praised so much.

All his retinue now strained their eyes, hoping to discover something on the looms, but they could see no more than the others; nevertheless, they all exclaimed,

"Oh, how beautiful!" and advised his majesty to have some new clothes made from this splendid material, for the approaching procession.

"Magnificent! Charming! Excellent!" resounded on all sides; and everyone was uncommonly gay.

The Emperor shared in the general satisfaction; and presented the impostors with the riband of an order of knighthood, to be worn in their button-holes, and the title of "Gentlemen Weavers."

The rogues sat up the whole of the night before the day on which the procession was to take place, and had sixteen lights burning, so that everyone might see how anxious they were to finish the Emperor's new suit.

They pretended to roll the cloth off the looms; cut the air with their scissors; and sewed with needles without any thread in them.

"See!" cried they, at last.

"The Emperor's new clothes are ready!"

And now the Emperor, with all the grandees of his court, came to the weavers; and the rogues raised their arms, as if in the act of holding something up, saying,

"Here are your Majesty's trousers! Here is the scarf! Here is the mantle!

The whole suit is as light as a cobweb; one might fancy one has nothing at all on, when dressed in it; that, however, is the great virtue of this delicate cloth."

"Yes indeed!" said all the courtiers, although not one of them could see anything of this exquisite manufacture.

"If your Imperial Majesty will be graciously pleased to take off your clothes, we will fit on the new suit, in front of the looking glass."

The Emperor was accordingly undressed, and the rogues pretended to array him in his new suit; the Emperor turning round, from side to side, before the looking glass.

"How splendid his Majesty looks in his new clothes, and how well they fit!" everyone cried out.

"What a design! What colors! These are indeed royal robes!"

"The canopy which is to be borne over your Majesty, in the procession, is waiting," announced the chief master of the ceremonies.

"I am quite ready," answered the Emperor.

"Do my new clothes fit well?" asked he, turning himself round again before the looking glass, in order that he might appear to be examining his handsome suit.

The lords of the bedchamber, who were to carry his Majesty's train felt about on the ground, as if they were lifting up the ends of the mantle;

and pretended to be carrying something; for they would by no means betray anything like simplicity, or unfitness for their office.

So now the Emperor walked under his high canopy in the midst of the procession, through the streets of his capital;

and all the people standing by, and those at the windows, cried out,

"Oh! How beautiful are our Emperor's new clothes!

What a magnificent train there is to the mantle; and how gracefully the scarf hangs!"

in short, no one would allow that he could not see these much-admired clothes; because, in doing so, he would have declared himself either a simpleton or unfit for his office.

Certainly, none of the Emperor's various suits, had ever made so great an impression, as these invisible ones.

"But the Emperor has nothing at all on!" said a little child.

"Listen to the voice of innocence!" exclaimed his father; and what the child had said was whispered from one to another.

"But he has nothing at all on!" at last cried out all the people.

The Emperor was vexed, for he knew that the people were right; but he thought the procession must go on now!

And the lords of the bedchamber took greater pains than ever, to appear holding up a train, although, in reality, there was no train to hold.

The End.

APPENDIX D: VERBAL INSTRUCTIONS TO PARTICIPANTS

Verbal Instructions at Intake

Thank you for your willingness to participate! This study is about the distraction potential of texting while driving. Today you will be asked to drive our instrumented vehicle on a closed course. A researcher will be riding with you at all times, giving you directions or additional instructions.

- The experiment itself is broken down into **three segments**, each approximately 7 minutes long.
- [***Show course map***.] This is a map of the course you will drive today. You are here in this building. First you will drive out to the start point of the course, which will allow you several minutes to get used to driving the vehicle. There are two sections on the course: a work zone section and an open section. The start point is located in the middle.
- [***Show diagram of course***.] Once you are at the start point of the course, the researcher in the vehicle will tell you which section you will start on, so hypothetically if you are asked to start on the work zone section, you will begin at START, drive south, pass through the pair of cones and make a u-turn, pass back through the pair of cones and drive north, drive all the way to the far end, pass through the pair of cones at that end and u-turn, then drive south back to the start point – and that is ONE LAP. **You will drive two laps**, so REPEAT ONE MORE TIME. This completes one segment – you will repeat this procedure for all three segments of the experiment.
- [***Show picture of construction barrels and cones to go through***.] At each end of the course, you will see a **pair of cones** that you should always drive through **before and after making a u-turn**. For the work zone section of the course, you will see construction barrels on each side of the lane you are driving in.
- **While you are making a u-turn** at either end of the course, **you can halt all texting activity** to concentrate on u-turning safely.

Now I want to talk to you about what each of the three segments will be like. You may complete each segment in a different order than how I will explain it to you. **The researcher in the vehicle will tell you which segment you are supposed to complete.**

- **No texting**: You will not be asked to send or receive any text messages
- **Primarily <u>writing</u> text messages**: For this segment, you will tell us a fairy tale story via text messages. Choose a fairy tale story that you are familiar with so that it is easy for you to tell it (to avoid long pauses of you trying to remember what happens next). You will be asked to continuously type the story in a text message and **send it each time you pass the start point** [***show diagram again***] so you will **only send a total of <u>4 text messages</u>**. The researcher in the vehicle will help remind you of this.
- **Primarily <u>reading</u> text messages**: For this segment, you will read a fairy tale story that is **sent to you through an <u>MMS message</u>** (a picture message). The story is quite lengthy, so it is unlikely you will finish reading it during the experiment. You will be asked to **read aloud the last few words you read each time you pass the start point** [***show diagram again***].

Today you will be receiving/sending approximately 10 text (SMS) or picture (MMS) messages total. $10 worth of the $40 compensation is to help offset any fees you might incur. Other than the $40 total compensation, TTI is not responsible for any fees you incur.

[***Show picture of LED light and response joystick***.] Also while driving each segment, you will be asked to respond quickly to a **green LED light** that is taped on the hood of the vehicle. **As soon as you observe that the light is on, respond as quickly as possible by flicking the response joystick**.

After completing a segment, you will be asked a couple of **follow-up questions** and you will have a chance to provide your thoughts/feedback on your experience during that segment.

In general, **your top priority is to drive safely, try to stay in your lane, and obey the speed limit of 30 mph**. We want you and your passenger to come back safely! **Please do not be concerned about finishing the fairy tale stories** – you likely will not have enough time to complete them in the time it takes you to drive the two laps on the course.

Do you have any questions? Do you need to use the restroom or get a drink of water?

APPENDIX E: LIST OF COUNTERBALANCED SEGMENTS

Starting Section	WZ = Work Zone (barreled) O = Open
Segment Letter	A = Control B = Writing (Composing) C = Reading

Subject #	Starting Section	1st Segment	2nd Segment	3rd Segment
1	WZ	A	B	C
2	O	A	C	B
3	O	B	A	C
4	O	B	C	A
5	WZ	C	A	B
6	O	C	B	A
7	O	A	B	C
8	WZ	A	C	B
9	WZ	B	A	C
10	WZ	B	C	A
11	O	C	A	B
12	WZ	C	B	A
13	WZ	A	B	C
14	O	A	C	B
15	WZ	B	A	C
16	O	B	C	A
17	WZ	C	A	B
18	O	C	B	A
19	O	A	B	C
20	WZ	A	C	B
21	O	B	A	C
22	WZ	B	C	A
23	O	C	A	B
24	WZ	C	B	A
25	WZ	A	B	C
26	O	A	C	B
27	WZ	B	A	C
28	O	B	C	A
29	WZ	C	A	B
30	O	C	B	A
31	O	A	B	C
32	WZ	A	C	B
33	O	B	A	C
34	WZ	B	C	A
35	O	C	A	B
36	WZ	C	B	A
37	WZ	A	B	C
38	O	A	C	B
39	WZ	B	A	C
40	O	B	C	A
41	WZ	C	A	B
42	O	C	B	A

APPENDIX F: POST EXPERIMENT INTERVIEW RESPONSES

How did texting during the experiment today compare to texting in your everyday life?

I didn't care about spelling or punctuation or correct words, just tried to get it typed

Much harder while driving than it would be to sit a write it; took a lot longer to do it while driving; a lot poorer content - misspellings

Definitely not as easy when you're driving

Harder because I was having to concentrate on different things; having to create something that I wasn't that interested in, whereas a conversation with friends I'm interested in

It was harder because I had to use my e-mail and so it was a different format, it was more difficult. Focusing on the little green light also required more concentration, probably would have texted slower in real life, trying to write continuously.

I was a little more comfortable because I wasn't worried about other cars or unforeseen environmental factors (stoplights, etc.); at one point I found myself very engrossed in the text and thought that I need to pay attention to the road because I was driving.

It was very difficult to maintain speed while reading or composing a text

It was slower and less accurate.

It was ridiculously more difficult, I rarely text message while I drive.

I don't text while I drive anymore; it was easier to stray in my head when the barrels weren't there because there was nothing there to keep you in place (lane markers or other vehicles)

Try not to text while driving; sometimes I read texts while driving, but I try not to send texts while driving; these messages were longer than messages in real life

I really try hard not to text when I drive, I do at stop lights but not when I move

I think when you are texting in everyday life it is a little easier because it doesn't take quite as much concentration to generate the thoughts and the texts are not so long

I try not to text and drive, but I do occasionally do it; normally when I do it, it's very quick, yes and no, as opposed to a whole story, so here I was having to think a lot and wasn't able to focus as much on driving; I did feel more out of control while texting for such a long period of time instead of a short text here and there

In everyday life the texts are shorter, briefer. Short texts, short replies. In this experiment there were multiple factors and details to the texts.

I don't text and drive now. Generally I do it only when I'm stopped or at a red light or something.

In the lobby, it was the same. I don't usually text in the car unless I'm at a stoplight or something. I think if that was my car and I was really on the road, it would be about the same.

A little more stressful because I know that I'm being tested, and I have to respond to the light.

I was focusing more on it, which really took most of my attention. Normally, it's a side thing.

It was a lot harder, just sit around and text and can think about what you're doing; texting and driving is counterintuitive

The barrels made it feel a lot more nervewracking, because if you hit the lines at all you're running into something; it was out of the ordinary because the material of the text was different (normally saying hello, how's it going), harder to read

Much easier; no traffic, knew I wouldn't hurt anyone if I wobbled off; slower than I normally drive and text; I live out in the country so all I have is 45+mph

More complicated, because I was also driving. I felt like I was multitasking as opposed to just texting. There were a lot more typos.

More difficult because it wasn't natural, trying to think of a story and text, longer

I usually text with two hands as opposed to just one hand.

More difficult, hard to focus, typing the correct word was difficult. Had to remind myself to look up, because you get in the mindset of texting and ignoring the driving.

Almost never text while driving, so that was uncomfortable. I felt like I was breaking the rules, it felt like not wearing my seatbelt. I have personal rules about texting.

I would say it's kinda comparable because I am looking for a light, but I don't have traffic, traffic and traffic lights, but this time I was focusing on the LED. Normally don't text in the car, only at stop lights.

Mine aren't normally so long.

I do text and drive quite a bit, but in the experiment today I felt safer b/c I knew there weren't other cars – felt more secure, knew I wouldn't rear end someone or run a red light

A lot harder, some of the texts were grammatically incorrect
Pretty similar – I wasn't as worried out here though – knew there was nothing to run into, going in a straight line, no outside forces on you
It was more difficult. Required a lot more focus.
I don't usually text that long, and I don't usually text while I'm driving. If I'm reading something, I'll read it quickly.
Much harder.
It was hard, pressure. I definitely noticed that it's hard to text with one hand, that was kind of different.
Difficult, you have to keep an eye on the road and the barrels and the text
A lot slower; mostly because I was just using my thumb and it was hard to make sure I spelled words right
Content is very different; I was trying to remember more of something and trying to put it into sentences; more detail-usually just "Hey, we'll be there in 5 minutes" usually not sending a story while driving.
Harder because there was a lot of distractions (driving) (normally don't text and drive)
A little bit more challenging; I like to use Google voice in everyday life; also normally I write short sentences as opposed to long stories; also used to car a little bit more – false sense of confidence
If I do compose a text, I do it much slower because I really don't want to (if someone else is in the car I do it slower because I don't want to kill other people); so I felt more deliberate in focusing on texting the entire time and not taking as many breaks to pay attention

What strategies did you use or factors did you consider while deciding when to text during today's study?
Tried to text the whole time
Tried to do it when we were just going straight; more difficult in between the barrels – was worried about hitting those
Knew I had to look up every once in a while; looked to make sure I was driving straight and to check my speed and then I felt safe enough to look down
After looking to see that it was clear, going correct speed, and was in my lane; I was texting more than I would if I were on the highway; knew there was no threat or wouldn't run off road and get hurt
I felt more comfortable texting when I was not with the barrels around me, I would look up probably every few seconds, and right after the green light, I would go back to texting because I knew it wouldn't come back on for a few more seconds. Trying to text more on the straightaway without the barrels.
I tried to complete the story, so I felt like I should continue texting; but I didn't want to hit a cone or miss the light; definitely looked around a lot b/c it made me nervous needing to compose something so lengthy
Blatant disregard for my safety was one. Experimenter instructions. Would have waited until I had stopped to text during everyday life.
The cones, my speed, the little light.
When I had a clear straight view, when I saw the road wasn't a turning situation, not the U-turns.
I tried to text most of the time; if I thought my speed might be off or if I hadn't looked in a while, that's when I'd look up, but I tried to do it most of the time
Focused on writing and reading, and when I became concerned about the other things, I'd pay attention – so there was no strategy
Tried to look at the screen, make my eyes kept going in a loop, screen, light, road, speedometer, kept my eyes going; reading seemed easier (wasn't concentrating as much) than typing
I just texted the whole time so I could get the story out. The only time I didn't was for the U-turn because I needed my hands
I think that reading takes a little bit more concentration. Texting you can pick up and put down a little easier. When its reading you want to find out the end of somebody else's though. But when you are texting you already know what you want to say. Not going to be texting and driving or reading in the future unless it's absolutely necessary. I'm more distracted when texting than I ever thought.
I would do it when I doing it on a straightaway, but I would read for a few seconds and then look up to check that I wasn't swerving
I only was texting during the straightaways not during the U-turns. There is not much steering control or visual alertness needed in the straightaways. I was more hyper-sensitive during the construction cones.
The competitive part in me made me want to write and read. I knew there wasn't a danger of the unexpected happening. The control of the experiment gave me more freedom to engage in the activity.
If I was turning the corner and needed to have both hands on the wheel. I made it the lowest priority, making sure I did everything before paying attention to the phone.

Take a look at the speed, the light, and then the road, and type. Try to look at the road and the typing at the same time.
I tried to keep my phone in both cases by the sensor light so I could just slightly glance over.
Just tried to hold the phone a little higher so I could see it and road at the same time; looking up and down; lucky because I could feel where most of letters are; sure I misspelled several words
I would glance at my phone when I was reading, long enough to see the whole paragraph so I could process it; when I'd glance up, I would look at light and I could see if I was in my lane through peripheral; felt speed well, didn't have to look at speedometer; sometimes would check grammar when looking at phone
As long as I was maintaining my lane and close to the right speed, I felt like it was ok to go ahead and look at the phone
Held phone up, closer to line of sight. Had shifty eyes between road and phone. Halfway through moved hand down to be closer to the toggle for LED.
Trying to make sure I stayed within the lines, LED light, make those my priority not the accuracy of the text
I was uncomfortable texting between the barrels. More comfortable texting in the open space. Trying to keep an eye out for the light after every few words.
I didn't text when I was slowing down or speeding up. I tried to cruise at an even speed so I didn't have to watch the speedometer. I was trying to think about how long I looked down before I looked up.
I think when the open course w/o the barrels, I was much more comfortable writing the texts, and strategy wise, I think I was trying to look in between the LED and down to use the peripheral vision to get the light in my line of sight.
If I was starting to slow down, I would slow down my texting, or if I had to grab the joystick, I might put my phone to the side for a second. It was hard to text and steer.
Check the speed limit, where I am in the lane, then look at the phone.
I hold my phone up a little bit so I can keep an eye on the road while texting, glance from one to the other real quick – keep eyes focused on phone more than the road
Look down after looking at the light, speed, and ahead of me
Just peripheral vision; if I felt like I was in the lane I didn't worry about because there was no traffic in the other lane
If I knew that I had checked my speed and LED and lane placement, then I felt it was time to go ahead and do some texting.
Held phone up so I could see the road and the cones and the green light. Decided to use one hand so I could keep one hand on the steering wheel. Probably in my own car I would have texted with both hands and steered with my knees, but I couldn't reach the wheel.
I think kind of just the muscle memory in my fingers. I didn't know that I knew where all the letters were. When I was turning I didn't. I tried to text the entire time, but if I noticed that my speed was higher, I would stop texting.
When I was more on a straight heading, when I was slowing down, coming to a stop I guess
When it's a straight shot
Started with hand on steering wheel so I could see light and lane in peripheral; arm got tired so I moved it to the armrest, but I still glanced at road in peripheral and glanced at light occasionally to check
Tried to look at three different places: out on road, light, and keyboard; helps having raised keyboard because it was a lot easier to type than if you had a touch screen; I've used my friends iphone and it was a lot more difficult; this way I was using both hands to type while looking out at road
With writing I tried to look up every sentence or two; with reading I looked up every paragraph
Moved my phone closer to road so I could see both (he held it high on top of steering wheel)
I don't feel comfortable texting or reading if I'm making any kinds of turns; if I'm coming from a stop to cruising speed I won't do it then; I wait until I'm cruising

In your opinion, is the difficulty of texting affected by the type of keypad (touch screen versus raised keypads)? Why or why not?
Raised keys make it easier to text, my sister in law doesn't have to look at her phone, she can do it all while driving
Yes, when I had the raised key pad, I used to not even have to look at it; now I have to look at it – touch screen is definitely more difficult
Touch screen you actually have to look at it, whereas raised you have a muscle reaction you can remember where everything is
You can feel the 9-key and can feel where each key is; on this (touch screen) I kept making mistakes and had to back up

Yes. I used to have a raised one, and I used to be able to text without even looking because I knew where the numbers and buttons were. But with the touch, you have to keep looking. Easier to use the one with raised numbers as opposed to the touch screen.
I don't know because I haven't had a raised keypad in a long time.
I have never used the touch, but I would think that it would. I would think the touch screen would be harder because you can't feel, almost like Braille, you couldn't feel the number of letters you cross before you get to the right one.
Yes. Because with the touch screen, you're not as accurate. With the keypad, I'm more accurate, and I can watch the road and feel what I'm texting rather than just watching what I'm typing to make sure I'm accurate.
I have never used a touch screen. I believe probably a keypad would be easier because you're actually feeling it, while the touch screen, you might accidentally touch the wrong one. You'd be trying to correct yourself, which would be an issue, and you'd be more likely to make mistakes.
When I had raised keys it was easier, I didn't have to look at it, but with a touch screen you can't do that
I don't know, all I've ever done is a touch screen
Used to have a blackberry; I like the touch screen, but with raised you don't have to look at it b/c you can feel so I think raised would be easier, and I felt that way when I first got my iPhone
Yes and no. I think it depends on your familiarity with whatever you are using.
Yes, when I had a raised key pad, I could feel where the letters or numbers were, made it easier than touch screen that you have to look at to type a number
Yes. If there is a physical keyboard it is a lot easier to text because of the muscle memory of physical touch memory and you can feel that. With a flat screen you don't have awareness or understanding of where you are on the keyboard.
No. I have used both.
I haven't used a raised keypad, so I don't know what it's like.
Yes, because you can text on the keypad without having to look at it, but with the touch screen you have to spend a considerable amount of time looking at the phone and the message. It's a lot easier to make mistakes on a touch screen, so you have to pay attention to mistakes, delete words, fix it.
I'd say yes, it affects it because you're not as sure where the keys are, so you have to focus more on what you're pushing. For the "swipe" app specifically: Each key has a specific sliding motion, so you can know which letter you're pushing, so there's a lot more certainty without looking. Slide to different quadrants based upon letter you want. 32 different characters).
At least I can feel the buttons; touch screen you can't feel the buttons
No, I think experience with phone is what matters; used to have 9-key and could text just as well, just a matter of knowing your phone
I haven't seen that much difference; I've had both
Yes. I think raised is easier because you can feel it a lot better, and it doesn't require as much sight. Specific swipe texting: easier when you have undivided attention toward it, but when you're multitasking, it's more difficult because it tries to predict the words, and so you're having to do a lot more correcting.
Yes, I think raised keys are easier; touch screen is easy to mess up
Yes. Touch pad on old phone is better because you can just feel and drive, as opposed to the one that I have to look at the numbers.
I have never had a raised keypad, so I have a hard time saying. I don't think it would so much because you get used to it.
I've never used the touch, so I can't really answer that. Everyone has a bias that their way is the better way.
Potentially the raised is a little bit better. I've attempted to use the touch phones, and it takes me longer and I have to think about it more. I think if I got used to it, it would be the same. Neither are good.
Never used a touch screen, and I think I would be more likely to use that as much.
Yes. My old phone had buttons and I didn't have to look at it near as much as with the touch pad. I used to be able to text without having to look at the phone at all.
I don't think it makes a difference; I like my touch screen and am used to it
Absolutely, because you have to use both hands for the raised keys
Yes, it's a lot harder with the touch screen because you can't feel any of the buttons; you hear the click but don't know what key you pressed because you have no point of reference
I think the touch is more difficult because of the lack of raised keys.
Yes. Raised keypad is easier because you can feel the buttons, so when I had a raised keypad I didn't even take my eyes off the road to text, because you get used to where the letters are. I also think the QWERTY keyboard is harder.

I've never used a touch screen before, so that would be very difficult for me. This just seems like a habit. I'm used to that.
I got used to the T-9 and it became easy. The full keyboard is a lot. I have never texted on a touch screen
No, I think it's the same because the touch phones can turn sideways and go to the full keyboard
Yes, because I think with a flip phone, it was really hard to text b/c it was just the numbers; I haven't used the full raised keyboard (only had a touch screen); on iphone it's really easy to text with two hands, not with just thumb
Yes because with touch pad there's no difference between each key – can't tell what button you're hitting; same order as regular keyboard; kind of know what key I'm hitting even if I'm not looking at it
I find touch screens harder to use; probably because I have big thumbs
Yes it's more challenging with a touch screen because you don't have a feel for it whereas raised keys you have a better idea of where keys are at
Yes, the reason I got a raised keyboard is because I feel like I have less control over the input with a touch screen phone (don't like the autofill stuff); especially if I'm driving I feel like I have to spend so much more time correcting things that touch screen keyboards try to type for you, whereas with a raised keyboard I can shoot off more accurate texts

In your own words, how well do you think you did today?
Pretty bad, but I didn't crash into anything
Wasn't terrible; but I definitely noticed it was very difficult to do while paying attention to everything on the road; definitely not a safe thing to do; a lot of people only think of themselves when texting, but they should think about others on the road
Decent
Pretty good; didn't knock any barrels over and no one died
Not too great. I'm bad at multitasking in general, I can't even walk and text that well! The little green light, when I was having to text, there was such a huge difference between those involving texting and reading and those that did not.
I think I did moderately on the sections where I had to read/write texts; did very well on sections where I didn't have to read/write a text
I would say average.
I'd say I did moderately well, not excellent, but moderate.
About a 70 / 100.
Pretty well, not great
I did ok, I don't think I did well texting a driving, did ok reading and driving, did well just driving
Pretty good, a C maybe overall
Okay. I think I did better when I was not texting or reading. But I don't think I did very well when I was texting or reading.
Did ok, just the driving part was fine, but when I started writing texts I felt like I was all over the place
I think I did pretty well.
Not too good. I think I proved the point that a law is needed.
There was nothing out there, no reasons to look in the mirror, no other cars, there were a few speed blips where I was a little faster, but I think I saw them and corrected it. I think I stayed in the lane, pretty much, maybe veered off once. I wasn't really able to look at the road a whole lot while I was trying to text. I think I did an overall good job.
Moderately well. It was difficult but in the testing scenario it wasn't impossible. I normally wouldn't text a message or read one that long.
Not as well as I would have hoped.
I didn't hit anything, but I've determined that should never try to text and drive simultaneously; it was nice to come out because it proved to me that I can't do that in the real world; I think I could read them –can read a lot in a glance, but you can't type a lot in the same time span
Pretty well
Maybe a little above average
Fairly well. I didn't break any of the rules, but I noticed I was more tense when added activities were added to driving.
(made a face), did better than 50%, no idea really, didn't hit any barrels – I guess that's good
Not as well as I usually do if I were to text while I drive. I try not to text, but I only text if I actually have to. About 60%.
I didn't hit any cones, I think the highest speed I got was 37, I think I did OK.

Not very well because I wasn't very comfortable. I think I was more comfortable writing the story than reading.
I don't think I did very well, and I found myself concentrating too much on the phone over the driving.
I didn't hit any barrels, I kept it around 30,35, but it was definitely hard to pay attention to the light.
I feel like I did okay, felt like I did the worst when I was actually texting not reading; good not great
Overall I feel like I did okay, I was focused on many things – bit difficult for me to perform well; 80 on a scale of 1 to 100
Pretty good, not excellent, but good
Not as well as I expected. I found the reading to be much more distracting than I anticipated.
I think I did bad. If I look at a text or type a text, it's not as long. I didn't really notice the green light when texting or reading. I didn't hit a cone. I think I kept more in the speed limit when texting or reading than when I wasn't.
I feel like I got maybe a 70, maybe passed. I didn't hit anything, but it was hard!
I think I did fair. I was confident with my driving, I know I sped a couple of times.
50%
Pretty well, didn't hit any cones or anything like that; spelling and content of text message was not very good; didn't do a good job of getting the light on the texting segment (only got it half the time)
I think I did ok – didn't hit any cones or go crazy out of the lines, but I was driving slower, wasn't paying as much attention to the road, almost hit a barrel; wasn't at 100% focusing on the road
80%
Relatively well but not excellent
Pretty well; I was definitely distracted, but I didn't hit any cones and thought I maintained speed overall pretty well; so I would say good

What, if anything, did you learn today as a result of this experiment?
I learned that reading texts is harder than texting
Have to concentrate more; I wasn't really paying attention to what I was typing, so while reading I missed all the green lights
Don't text and drive; I think it's ok at stoplights if you have to, but it's usually ok for you to wait, and if it's really an emergency you can just call and talk to them
I definitely don't text as much as I did today while driving
That I shouldn't text and drive; it's hard
Not to use my e-mail while driving. Reading was just as difficult as the texting was, I thought it would be easier.
You have to keep checking your part in the story. I can't say that I could receive texts while driving and that would be better, it's all equally dangerous.
Texting takes a lot of attention, especially composing a text
Cell phones should remain off while in the car.
That I should not be texting anything that requires a lot of thought or concentration over a period of time … I shouldn't text.
It's actually more difficult to read and drive as opposed to typing and driving.
It really does affect you whether you think it does or not
I learned that long text messages are definitely more difficult than shorter messages
There's too many factors to be concentrating on, and texting definitely does distract, too many distractions; today we didn't even have radio, or conversations
How much I swerve when texting, even at a low speed (30 or 70 mph), still swerving
Personally, I learned that it is a lot harder to text and drive than it is just to read.
That reading causes me to be distracted more than I ever thought it did.
Nothing
Texting is not good! It impairs your senses.
The dangers of both reading and texting while driving.
Personally, they should outlaw texting while driving, which is going to be virtually impossible to enforce; need to throw people in jail for long time when there are wrecks
That I can forget or be unaware of my speed while texting
Probably I did better than I expected, so that's not good; not noticing the green light bothered me
Nothing new, I'll do it anyway
That even on a simple course with simple instructions and at a low speed, reading while driving and texting while driving caused me to be more distracted.

That it's difficult to concentrate on all the things you have to concentrate on to text and drive and that I probably take that for granted.
My attention factor was not where it should be while texting. Obvious that your mind isn't on what it should be.
I learned that reading and texting while driving probably should be avoided, but they're all related to the urgency of the message.
Solidifies my belief that texting is not good. Performance-wise, I'm sure this shows in the record.
I learned that I have a hard time maintaining a proper speed limit anyway, and texting and driving makes it worse.
I guess that it was just hard and there were no other cars or factors playing in to the driving.
I did learn that I speed more when I text; I don't feel like I'm in as much control when I'm texting – the part where I was texting just flew by (felt like a minute) so I'm probably not too aware of what's going on
Don't text and drive – extremely distracting; not worth it even if it's urgent – if it's urgent you can pull over to send a text or call the person; I'm not against talking on the phone and driving, but I'm completely against texting and driving
That I really am influenced by the content of the message; once I got into the story I was paying way more attention to that than the light; if it had been boring I wouldn't have cared
That reading is more distracting than simply texting.
How little I noticed the green light made me notice how much if you're looking down, you're not paying attention to everything in your environment.
I hate texting and driving.
I think, even with familiar road, the same road, over and over, you still have to stay alert. When I was in the cone section I became more emotionally self-conscious. I think my reading slowed down in the cone section.
Don't text and drive
Made me feel like my brain could only focus on two things at once: staying in lane or texting; light and texting, etc.
Limited things while texting
How difficult it is to drive and text at the same time; it was like alcohol goggles – you don't realize how bad it is until you take them off and drive normally again
Texting while driving is bad; it's more impairing than driving intoxicated (I told him that)
I'm glad I have Google Voice; and don't try to write a story while driving
Comparing both reading and writing messages, there is a real difference between that and not doing either; I was able to notice a big difference in lack of focus

Do you have any other comments or feedback?
The car has good alignment; and I knew there was no oncoming traffic
I really enjoyed it
No
Good learning experience
It was very difficult to maintain speed while reading or composing a text
The QWERTY keypad, you've been around computers long enough that you know where the keys are. It's easier to just glance while you're typing, but reading requires more focus. It also didn't help that the task was reading a novel; 2-3 sentences would be easier, because you could see the whole message, put it away, and process the text. The longer message made the task less life-like.
I think in real life you have all sorts of other distractions. The speed was hard to control in this study. On the highway I would have used my cruise control.
I prefer calling to texting because my phone is not very user-friendly in the car; the touch screen is difficult to use.
Hidden experimental techniques would be interesting, so you don't know whether you're under a testing situation.
It got easy to judge when the light was coming on; seemed fairly timed
Definitely going to make me think twice before texting again.
Biological measurements might also be helpful, including blood pressure or other physiological indicators.
I think it's a good study because I don't like people texting and driving.
Just that it would have been a lot harder if there were other things to pay attention to.
If kids are in the car, ask them to text for me instead.
I think the LED was hard to see. I feel like if it was red, you might be able to see it better.
White text on black background is easier to read (he read on Christine's phone); there's less glare