

# **EXPLORING THE IMPORTANCE OF PERSONALITY TRAITS, SANCTIONS, AND FEAR APPEALS ON TEEN DRIVER CELL PHONE USAGE AND TEXTING WHILE DRIVING (TWD) LAW COMPLIANCE**

**Final Report**



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**AUGUST 2015**

**US Department of Transportation grant DTRT13-G-UTC34**

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle  Exploring the Importance of Personality Traits, Sanctions, and Fear Appeals on Teen Driver Cell Phone Usage and Texting While Driving (TWD) Law Compliance		5. Report Date August 2014	
		6. Source Organization Code \$103,659	
7. Author(s) McBride, Maranda; Carter, Lemuria		8. Source Organization Report No. STC-2015-S2.NCAT	
9. Performing Organization Name and Address  Southeastern Transportation Center UT Center for Transportation Research 309 Conference Center Building Knoxville TN 37996-4133		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No. DTRT13-G-UTC34	
12. Sponsoring Agency Name and Address  US Department of Transportation Office of the Secretary of Transportation--Research 1200 New Jersey Avenue, SE Washington, DC 20590		13. Type of Report and Period Covered Final Report: September 2014 – August 2015	
		14. Sponsoring Agency Code USDOT/OST-R/STC	
15. Supplementary Notes:			
16. Abstract  Texting while driving (TWD) is a growing problem among teenage drivers. In order to address this issue, it is necessary that we determine which methods are most effective at deterring TWD behaviors for this age group. This objective of this study was to identify key components that affect teenager TWD law compliance by developing and administering a survey in order to identify TWD law compliance profiles of teenagers. In this study, we investigated the role of the "Big Five" personality types along with threats, sanctions, self-efficacy, response efficacy, and response cost which may be associated with teenagers' motivation to comply with texting while driving regulations. The method included a 93-item Likert-scale survey administered online to 524 drivers age 15 through 21. The survey consisted of a set of demographic questions, a Big Five personality assessment, and items adopted from Protection Motivation Theory (PMT) and General Deterrence Theory (GDT). The results of the study indicate that elements of each of the three theories have an impact on TWD behavior. Knowledge of the factors that influence teenagers' TWD behavior can be used to develop customized TWD law compliance training protocols designed to address the motivating characteristics of specific groups of teenagers.			
17. Key Words Texting while driving, Distracted driving, Safety		18. Distribution Statement  Unrestricted; Document is available to the public through the National Technical Information Service; Springfield, VT.	
19. Security Classif. (of this report)  Unclassified	20. Security Classif. (of this page)  Unclassified	21. No. of Pages  49	22. Price  ...



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## EXECUTIVE SUMMARY

Texting while driving (TWD) is a growing problem among teenage drivers. Researchers have found that the number of teenager deaths caused by texting and driving has now exceeded the number of teenager deaths resulting from drunk driving. In order to help improve this statistic, it is necessary that we determine which methods are most effective at deterring TWD behaviors for this age group.

The objective of this study was to identify factors that affect teenager TWD law compliance by developing and administering surveys to identify TWD law compliance profiles of teenagers. Such profiles may be used to create unique TWD law compliance training protocols designed to meet the diverse needs of specific teenager profiles.

In this project, we investigated several factors that may be associated with teenagers' motivation to adopt safety behaviors and to comply with texting while driving regulations. This included dispositional factors such as the "Big Five" personality types (i.e., openness, conscientiousness, extraversion, agreeableness, and neuroticism); situational factors such as threats, sanctions, self-efficacy, response efficacy, and response cost; and social behavior factors such as attitudes, norms, behavioral control, mobile phone involvement, anticipated regret, and perceived advantages/disadvantages of abstaining from TWD. The goal of the study was to identify key components that impact teenagers' perceptions of TWD law compliance and determine how organizations can use knowledge of these perceptions to design more effective methods to deter TWD behaviors.

The method included the administration of two separate online surveys to young drivers age 15 through 21. The survey consisted of a set of demographic questions, a Big Five personality assessment, and either items adopted from Protection Motivation Theory (PMT) and General Deterrence Theory (GDT) or the Theory of Planned Behavior (TPB). After each survey was validated, regression analyses were performed to identify which factors significantly influence teenagers' intent to text while driving. The results of the surveys indicate that various dispositional, situational, and social behavioral factors have an impact on teenager texting while driving behavior. The results from the first survey indicate conscientiousness, sanction certainty, sanction severity, threat susceptibility, self-efficacy, and response cost significantly influence teenagers' intent to text while driving. The results from the second survey suggest that openness, agreeableness, moral norm, subjective norm, perception of behavioral control, attitude, and anticipated regret have significant impact on teenagers' intention to text while driving.

The results of these two studies provide evidence of individual differences that impact teenager TWD behavior. The data helped identify characteristics of teenage drivers who are more (or less) likely to comply with TWD policies. These differences can be used to develop customized driver training protocols that will be more effective in discouraging teenage TWD behaviors.



## **DESCRIPTION OF PROBLEM**

Researchers at the Cohen Children’s Medical Center in New Hyde Park, NY have found that the number of teenage deaths caused by texting and driving has now exceeded the number of teenager deaths resulting from drunk driving. For instance, it is estimated that more than 3,000 teenagers die and 300,000 are injured in texting and driving accidents while only 2,700 teenagers die and 282,000 suffer injuries related to drunk driving incidents (Ricks, 2013). While many states have enacted laws to crack down on texting and driving, they do not appear to be very effective, especially for teenagers, when it comes to discouraging texting and driving behaviors.

The goal of this project was to identify key components of teenager TWD law compliance behavior by investigating characteristics that are believed to influence teenagers’ decisions to text while driving. Specifically, we explore the role of personality traits, general deterrence theory, protection motivation theory, and an extension of the theory of planned behavior on texting while driving law compliance among teenage drivers. By identifying the influencing characteristics, it may be possible to create teenager profiles that can be used to develop unique TWD law compliance training protocols designed to target teenagers who have certain traits.

## **TRAITS EXPLORED**

The term “personality” is often used to describe a persons’ general disposition. It remains essentially the same over the course of time, which makes it an attractive way to categorize people in an attempt to target specific behaviors that one might desire to modify. Over the years, several personality inventories have been developed and validated through research and considered to be credible means of identifying various personality traits. One of the most common sets of personality traits used in research associated with the use of computer technology is called the Big Five (e.g., Buchanan et al., 2005; Engelberg and Sjöberg, 2004; Karim et al., 2009; Landers and Lounsbury, 2006; Svendsen et al., 2013; Swickert et al., 2002).

The five traits associated with the Big Five are openness, conscientiousness, extraversion, agreeableness, and neuroticism. People who score high on the openness scale typically have active imaginations, are creative, and demonstrate high levels of curiosity. Conscientious people tend to be hard working, well organized, and achievement-oriented. People scoring high on the extraversion scale are sociable, assertive, and collaborative. Highly agreeableness people tend to be good natured, accepting, and respectful other people’s beliefs. People who score high on the neuroticism scale tend to exhibit characteristics such as emotional instability, anxiousness, pessimism, and low self-esteem (John and Srivastava, 1999).



While previous investigations have established links between personality traits and other safety behaviors (e.g., Shropshire et al., 2006) and others have established that the traits of high extroversion, high openness, and low conscientiousness may be closely linked to youth risk-taking behavior (McGhee et al., 2012), there is still a need for more definitive statistical evidence related to teenage TWD behaviors. In this study, we use the Big Five as a mechanism to group individuals in order to investigate their motivation to adopt safety behaviors and comply with TWD regulations.

Deterrence theory suggests that individuals will be discouraged from performing undesirable behavior (e.g., crime, computer abuse, policy violation) if they perceive the punishments (i.e., sanctions) are certain to occur and will be severe in nature (Anderson, 1990; Ehrlich, 1996). When implementing programs or instituting policies intended to deter undesirable behavior, it is assumed that individuals take into consideration the benefits of violating a policy or law and make a rational decision to break the law or engage in the undesirable behavior. Therefore, in the context of this project, driver education programs can be designed to inform teenage drivers about punishments associated with unlawful behavior (such as TWD), but each person will process that information differently. This indicates the need to understand how individuals' perceptions of punishments or sanctions influence their compliance with TWD laws.

In addition to general deterrence theory, fear appeals may also have an impact on TWD compliance. Protection motivation theory (PMT) suggests that when individuals perceive that they are more susceptible to threats and when the threats are more severe, they are more likely to adopt a recommended response to the threat. However, this response is only likely to happen if the individual perceives a sufficient level of self-efficacy as it relates to his ability to perform the recommended response, the actual efficacy of the response itself in terms of its ability to protect the individual from the threat is high, and the costs incurred by the individual performing response are low (Anderson and Agarwal, 2010; Herath and Rao, 2009a, 2009b; Johnston and Warkentin, 2010). Hence, if the threat associated with TWD is severe, such as an accident resulting in death, and teenage drivers believe there is a high probability of experiencing such an accident when TWD, they are less likely to engage in the behavior as long as they believe they are capable of abstaining from TWD. In addition, they must also believe that not TWD will prevent them from having an accident and there is a relatively small cost associated with not TWD (such costs could include missing important messages from family and friends).

The theory of planned behavior (TPB) is grounded in the theory of reasoned action (TRA), which argues that behavioral attitude and subjective norm affect behavioral intention, which in turn affects actual behavior (Fishbein & Ajzen, 1975). Attitude refers to how positively the behavior is evaluated (Ajzen, 1991). It captures an individual's overall





evaluation of performing a behavior. Subjective norm is “the perceived social pressure to perform or not perform the behavior and comply with social standards (Gauld et al., 2014).”

TPB adds a third factor: perceived behavioral control (Ajzen, 1991). Perceived behavioral control is the “perceived ease or difficulty of performing the behavior and can reflect past experience as well as consideration of obstacles (Gauld et al., 2014).” Atchley et al. (2012) posit “the intention to perform a behavior, such as using a cellular device while driving, is influenced directly by perceived norms, as well as attitudes and perceived control over the behavior.”

Our study uses TPB as a guiding framework; however, we include additional predictors to provide a more comprehensive model of texting while driving behavior. First, we extend TPB to include three types of norm – subjective, group, and moral – and two types of attitudes – general TWD attitude (which we have already defined) and TWD concealment attitude. Nemme and White (2010) state, “In the TPB, subjective norm relates to perceived social pressure and approval or disapproval from significant others (Ajzen, 1991) whereas group norm reflects the expectations (explicit or implicit) regarding one’s attitudes and behaviors as a member of a specific reference group within a specific context.” Moral norm refers to “a person’s sense of moral obligation in terms of deciding what is right and wrong based on society’s values to perform a behavior or not” (Gauld et al., 2014). TWD concealment attitude refers to one’s attitude towards texting while driving in such a way that others are unaware of the behavior that is taking place (Gauld et al., 2014).

In addition to extending TPB, we incorporated additional constructs to provide a more comprehensive view of TWD behavior: mobile phone involvement, anticipated regret, perceived advantages and disadvantages of abstention from TWD. Mobile phone involvement “includes additional ways that people interact with their phone when they are not using it to communicate with others (e.g., checking for missed calls, thinking about their phone)” (Gauld et al., 2014). Anticipated regret is “an affective construct that has been shown to significantly influence people’s intentions over and above the standard TPB constructs (Gauld et al., 2014). Extant literature also posits that a prevalent belief that bad things are going to occur as a result of abstention (perceived disadvantages) or that good things are going to transpire as a result of abstention (perceived advantages) impact TWD behavior (Hafetz et al., 2010). Gauld et al. (2014) found that “participants who scored higher on mobile phone involvement, suggesting they have higher levels of behavioral and cognitive association with their phones, were more likely to text in a concealed manner while driving.” Going forward, we refer to the combination of the traditional TPB and these additional items as TPB+.

In summary, this study sought to empirically establish the role that personality characteristics (Big Five), sanctions (GDT), threats (PMT), fear appeals (PMT), attitudes (TPB+), norms (TPB+), and perceptions (TPB+) play in the execution of safe driving

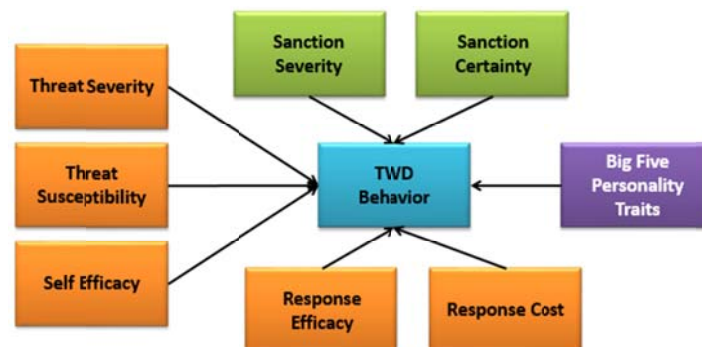
behaviors such as electing not to engage in TWD. The study was broken up into two parts. The first part (Study 1) took into consideration the Big Five, GDT, and PMT factors. The second part (Study 2) combined the Big Five and TPB+ factors.

## STUDY 1: PMT/GDT AND BIG FIVE SURVEY

### Pilot Study

#### Approach and Methodology

The first step in developing the survey used for Study 1 was to review the relevant literature. The purpose of this review was to identify characteristics that could be used to categorize teenage drivers in the context of TWD law compliance. Based on the literature review, we developed research model to link the characteristics identified with the dependent variable – “TWD behavior” (Figure 1). Using this model, a survey was developed to investigate the influence of the factors associated with the Big Five, GDT, and PMT on TWD behaviors.



**Figure 1: Research model linking the Big Five, GDT, and PMT with TWD behavior**

Items from previously validated instruments were appropriately adapted to fit the context of the present study. The Big Five items were adapted from a survey developed by Benet-Martinez and John (1998). While the original survey consisted of 44 items, the survey for our study consisted of only 28 items. Based on previous confirmatory factor analyses, the reverse scaled items were dropped from the survey because they did not load properly; therefore, these items were not included in the survey for the current study. The items included five questions each to measure Conscientiousness, Extraversion, Agreeableness, and Neuroticism, and eight questions to assess Openness. Each item was rated on a scale from 1 to 5 where 1 represented ‘strongly disagree’ and 5 represented ‘strongly agree’. Appendix A provides the list of survey items associated with each of the five personality factors. These items were presented randomly as a group after demographic items were answered.



The survey consisted of 14 GDT items – six for sanction severity and eight for sanction certainty. There were 29 PMT items in the survey: four for threat severity, six for threat susceptibility, five for self-efficacy, seven for Response Efficacy, and seven for response cost. These items were adapted from nine previously validated survey instruments (Anderson and Ararwal, 2010; Bulgurcu et al., 2010; Herath and Rao, 2009; Johnston and Warkentin, 2010; Lee and Larsen, 2009; Peace et al., 2003; Pechmann et al. 2003; Siponen and Vance, 2010; Venkatesh et al., 2003). Appendix B provides a list of the items used to measure each of the GDT and PMT factors assessed in this survey. As with the Big Five items, each GDT and PMT item was rated on a scale of 1 to 5 where 1 represented ‘strongly disagree’ and 5 represented ‘strongly agree’.

In addition to the Big Five, GDT, and PMT factors, we also included screening questions used to determine whether each respondent fit the criteria for our study (Appendix C). Demographic information such as the respondents’ gender, race/ethnicity, and grade in school was also collected. Data associated with texting behavior was also obtained through the survey. This information included how often the respondents text on their cell phone in general, send a text message while driving, and read a text message while driving. Additionally, the survey included items that asked about respondents’ past TWD incidents such as whether or not they had ever drifted into another lane, been distracted to the point of recklessness, driven more than 10 miles over the speed limit, received a ticket, ran a stop sign, hit something, or injured someone due to TWD. Lastly, respondents were asked how often they use a seat belt, how often they use dictation software to text while driving, and to identify the cell phone use driving restrictions in the state in which they primarily drive.

When the survey was administered, the respondent first provided their informed consent to participate in the study. They were then presented three separate blocks of questions. The first block was the list of demographic questions presented in the same order across all respondents. The second block was the Big Five personality assessment in which the items associated with all of the personality traits were mixed together but presented in the same order across all respondents. The third block of the survey consisted of the presentation of the PMT and GDT items. In this block, the PMT and GDT items were mixed together and randomly presented to each respondent.

To test our research model, an online survey was administered to drivers in the United States age 15 through 21 years who met the following conditions: 1) have a driver’s license or learner’s permit, 2) own or drive a vehicle, and 3) own a cell phone. A multiple linear regression was used to statistically test the model.



### **Sample Population**

The survey was administered online and completed by 105 teenage and young adult drivers. All of the respondents had either a driver's license or learner's permit, owned a cell phone, and drove regularly. Eighty percent of the respondents were 15 through 19 years of age. The other 20% were 20 or 21 years old. Additionally, 76% of the respondents were Caucasian, 70% were female, and 75% drove 3-10 hours per week.

The following is a list of additional information obtained from the respondents regarding their TWD behavior.

- 59% have read a text message while driving.
- 53% have sent a text message while driving.
- 22% have been distracted enough by their TWD that they thought they were driving recklessly.
- 18% have drifted into another lane due to TWD.
- 16% have driven more than 10 MPH over the speed limit while texting.
- 8% have run a stop sign because they were TWD.
- 2% have hit something because they were TWD.
- 0% have ever received a ticket for TWD.
- 1% have injured someone else because they were TWD.

### **Data Analysis**

Once developed, the survey was validated systematically following guidelines found in Gerbing and Anderson (1988). Preliminary analyses included reliability analyses and confirmatory factor analysis. Items for each of the twelve independent variables (5 Big Five factors, 2 GDT factors, and 5 PMT factors) were tested for reliability using Cronbach's alpha (Cronbach 1970). Based on this analysis, all of the items associated with each factor were kept in since Cronbach's alpha for each item was greater than 0.70. Table 1 illustrates the statistics associated with the reliability analysis.

A principal component analysis with Promax rotation was used to assess the convergent and discriminant validity of the PMT items. As displayed in Table 2, most items loaded on the proper factor; however, Self-Efficacy (SE) and Response Cost (RC) items loaded together. Similar occurrences have been noted in other studies (e.g., Carter and Bélanger, 2005; Moore and Benbasat, 1991). When this occurs, it can be due to the two factors having a causal relationship to one another even though they are conceptually different (Moore and Benbasat, 1991). Finally, the following cross-loaded items were dropped from further analysis: Self-Efficacy 4, Self-Efficacy5, Response Cost 2, Response Cost 6, Response Cost 7, Response Efficacy 1, Response Efficacy 3, Threat Severity 4,



Threat Susceptibility 1, Threat Susceptibility 3, and Threat Susceptibility 6. (Note: Sanction Certainty 1 was not analyzed because the item was worded incorrectly).

**Table 1: Reliability Analysis (Pilot Study)**

<b>Variable</b>	<b># Of Items</b>	<b>Cronbach's Alpha</b>
Openness (OPEN)	8	0.820
Conscientiousness (CONS)	5	0.721
Extraversion (EXTRA)	5	0.829
Agreeableness (AGR)	5	0.781
Neuroticism (NEUR)	5	0.779
Sanction Severity (SEV)	6	0.797
Sanction Certainty (CERT)	8	0.879
Threat Severity (TSEV)	4	0.762
Threat Susceptibility (TSUS)	6	0.867
Self-Efficacy (SE)	5	0.860
Response Efficacy (RE)	7	0.874
Response Cost (RC)	7	0.836

Principal component analysis with Promax rotation was also used to assess the convergent and discriminant validity of the GDT and Big Five items. As seen in Table 3, most items loaded on the proper factor. The following cross-loaded items were dropped from further analysis: Sanction Severity 3, Sanction Severity 4, Conscientiousness 4, and Agreeableness 3.

The research model (Figure 1) was tested using multiple linear regression analysis. The model includes twelve independent variables (Openness, Consciousness, Extraversion, Agreeableness, Neuroticism, Sanction Severity, Sanction Certainty, Threat Susceptibility, Threat Severity, Self-Efficacy, Response Efficacy, and Response Cost) and one dependent variable (Have read a text message while driving). The basic characteristics of these variables are presented in Table 4.

**Table 2: Factor analysis – Protection Motivation Theory (Pilot Study)**

Survey Item	TSEV	TSUS	SE & RC	RE
Threat Severity 1	0.815			
Threat Severity 2	0.631			
Threat Severity 3	0.646			
Threat Susceptibility 2		0.754		
Threat Susceptibility 4		0.809		
Threat Susceptibility 5		0.842		
Self-Efficacy 1			0.841	
Self-Efficacy 2			0.793	
Self-Efficacy 3			0.708	
Response Cost 1			-0.725	
Response Cost 3			-0.622	
Response Cost 4			-0.813	
Response Cost 5			-0.844	
Response Efficacy 2				0.656
Response Efficacy 4				0.743
Response Efficacy 5				0.767
Response Efficacy 6				0.835
Response Efficacy 7				0.844

**Table 3: Factor analysis – General Deterrence Theory and Big Five (Pilot Study)**

Survey Item	SEV & CERT	OPEN	CONS	EXTRA	AGR	NEUR
Sanction Severity 1	0.725					
Sanction Severity 2	0.864					
Sanction Severity 5	0.664					
Sanction Severity 6	0.643					
Sanction Certainty 2	0.665					
Sanction Certainty 3	0.725					
Sanction Certainty 4	0.744					
Sanction Certainty 5	0.624					
Sanction Certainty 6	0.540					
Sanction Certainty 7	0.801					
Sanction Certainty 8	0.744					
Sanction Certainty 9	0.784					
Openness 1		0.441				
Openness 2		0.418				
Openness 3		0.705				
Openness 4		0.612				
Openness 5		0.828				
Openness 6		0.713				
Openness 7		0.638				
Openness 8		0.748				
Conscientiousness 1			0.635			
Conscientiousness 2			0.611			
Conscientiousness 3			0.605			
Conscientiousness 5			0.802			
Extraversion 1				0.781		
Extraversion 2				0.803		
Extraversion 3				0.798		
Extraversion 4				0.502		
Extraversion 5				0.610		
Agreeableness 1					0.800	
Agreeableness 2					0.628	
Agreeableness 4					0.719	
Agreeableness 5					0.647	
Neuroticism 1						0.746
Neuroticism 2						0.652
Neuroticism 3						0.670
Neuroticism 4						0.729
Neuroticism 5						0.723



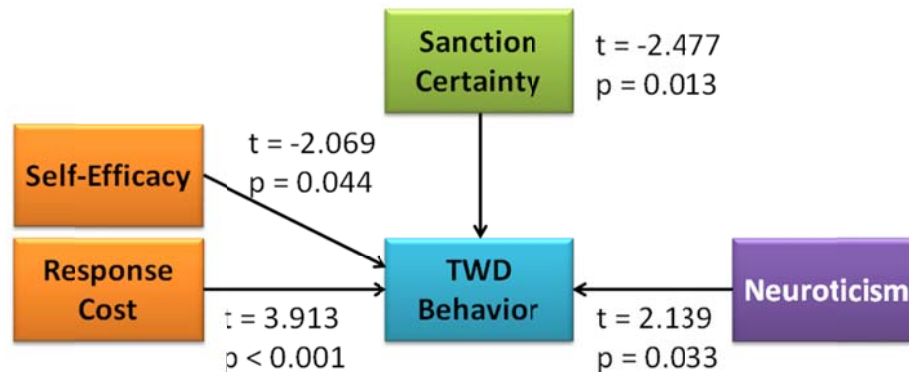
**Table 4: Final regression variables (Pilot Study)**

Factor	N	Minimum	Maximum	Mean	Std. Deviation
Openness	105	1.88	5.00	4.0287	0.62354
Conscientiousness	105	2.50	5.00	4.0976	0.63690
Extraversion	105	1.00	5.00	3.5410	0.94133
Agreeableness	105	1.50	5.00	3.9111	0.80780
Neuroticism	105	1.40	5.00	3.5452	0.85456
Sanction Severity	105	1.50	5.00	3.8357	0.88089
Sanction Certainty	105	1.25	5.00	3.5685	0.89820
Threat Severity	105	2.00	5.00	4.2048	0.67750
Threat Susceptibility	105	2.00	5.00	4.1460	0.77752
Self-Efficacy	105	1.67	5.00	4.2095	0.81683
Response-Efficacy	105	2.00	5.00	4.2462	0.69848
Response Cost	105	1.33	6.00	3.3230	1.03947
Read Text While Driving	105	1.00	5.00	2.0100	0.99510

**Findings**

Based on the regression analysis, the model explains forty-one percent of the variance in TWD behavior based on an adjusted  $R^2$  of 0.412. Since the overall model was significant ( $F=6.447, p < 0.0001$ ), we tested the significance of each variable.

Four factors were shown to have a significant effect on teenage drivers’ history of reading a text message while driving (see Figure 2 and Table 5): Self-Efficacy (PMT), Response Cost (PMT), Sanction Certainty (GDT), and Neuroticism (Big Five). The results imply that individuals who score higher on either the Self-Efficacy or Sanction Certainty scales are less likely to have read or sent a text message. On the other hand, those who scored higher on the Response Cost or Neuroticism scales were more likely to have read or sent a text message.



**Figure 2: Significant results with path coefficients (Pilot study)**



**Table 5: Results of Regression Analysis (Pilot Study)**

<b>Factor</b>	<b>Beta</b>	<b>t</b>	<b>Sig.</b>	<b>Supported</b>
Openness	-0.055	-0.631	0.530	NO
Conscientiousness	0.112	1.293	0.199	NO
Extraversion	-0.167	-1.841	0.069	NO
Agreeableness	0.054	0.594	0.554	NO
<b>Neuroticism</b>	<b>0.174</b>	<b>2.139</b>	<b>0.035</b>	<b>YES*</b>
Sanction Severity	0.042	0.309	0.758	NO
<b>Sanction Certainty</b>	<b>-0.397</b>	<b>-2.477</b>	<b>0.015</b>	<b>YES*</b>
Threat Severity	0.105	0.900	0.370	NO
Threat Susceptibility	0.040	0.313	0.755	NO
<b>Self-Efficacy</b>	<b>-0.250</b>	<b>-2.069</b>	<b>0.041</b>	<b>YES*</b>
Response Efficacy	0.112	0.906	0.367	NO
<b>Response Cost</b>	<b>0.384</b>	<b>3.913</b>	<b>0.000</b>	<b>YES***</b>

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001

The results of the pilot study were presented at the University Transportation Center Conference in March, the Humanitarian Technology Conference in May, and the Applied Human Factors and Ergonomics Conference in August. To confirm the results of the pilot study, we made slight modifications to the survey and collected additional data from a larger pool of people.

### **Full Data Collection**

#### **Approach and Methodology**

Based on the results of the pilot study and feedback received from our presentation at the University Transportation Center Conference, minor changes were made to the survey. For instance, we changed the gender ratio so that we had an equal number of male and female participants. In addition, we added the following questions to the demographic section of the survey:

- How long have you been driving?
- In which state do you drive the most?
- How often do you read a text message while stopped (e.g., at a stop light or stop sign)?
- How often do you send a text message while stopped (e.g., at a stop light or stop sign)?
- How often do you drive while sleepy?



Additionally, after we ran the pilot study we discovered that we neglected to include questions for our intended dependent variable (intent to TWD); therefore, we included the following three questions to obtain the information we desired:

- I intend to text while driving in the next week.
- It is likely that I will text while driving in the next week.
- I am willing to text while driving in the next week.

### **Sample Population**

The survey was administered online and completed by 524 teenage and young adult drivers. All of the respondents had either a driver's license or learner's permit, owned a cell phone, and drove regularly. Ninety-one percent of the respondents were age 15 through 19 years old. The remaining 9% were 20 or 21 years old. Additionally, 69% of the respondents were Caucasian, 50% were female, and 81% drove at least 3 hours per week. The following is additional information obtained from the respondents.

- 58% have read a text message while driving.
- 46% have sent a text message while driving.
- 82% have read a text while stopped.
- 80% have sent a text while stopped.
- 76% have driven while sleepy.
- 10% have been distracted enough by their TWD that they thought they were driving recklessly.
- 15% have drifted into another lane due to TWD.
- 16% have driven more than 10 MPH over the speed limit while texting.
- 5% have run a stop sign because they were TWD.
- 3% have hit something because they were TWD.
- 2% have received a ticket for TWD.
- 1% have injured someone else because they were TWD.

### **Data Analysis**

Once developed, the survey was validated systematically following the same guidelines used for the pilot study. Items for each of the twelve independent variables (5 Big Five factors, 2 GDT factors, and 5 PMT factors) were tested for reliability. Based on this analysis, all of the items associated with each factor were kept in since Cronbach's alpha for each item was greater than 0.70. Table 6 illustrates the statistics associated with the reliability analysis.

**Table 6: Reliability Analysis (Full Data)**

<b>Variable</b>	<b># Of Items</b>	<b>Cronbach's Alpha</b>
Openness	8	0.810
Conscientiousness	5	0.754
Extraversion	5	0.800
Agreeableness	5	0.717
Neuroticism	5	0.739
Sanction Severity	6	0.753
Sanction Certainty	8	0.847
Threat Severity	4	0.755
Threat Susceptibility	6	0.855
Self-Efficacy	3	0.744
Response efficacy	7	0.824
Response Cost	7	0.744
Intent	3	0.915

A principal component analysis with Promax rotation was used to assess the convergent and discriminant validity of the PMT items. As displayed in Table 7, most items loaded on the proper factor. The following items were dropped from further analysis due to cross loading: Self-Efficacy 2; Response Efficacy 3, 5, and 7; and Threat Susceptibility 1.

Principal component analysis with Promax rotation was also used to assess the convergent and discriminant validity of the General Deterrence Theory and Big Five items as well. As seen in Table 8, most items loaded on the proper factor; however, Sanction Severity and Sanction Certainty items loaded together.

In this study, it is not unreasonable for Sanction Severity and Sanction Certainty to load together since the two are closely linked to one another. For teenagers evaluating TWD, this may have occurred because the severity of the punishment may only be considered important if the likelihood of punishment is high. Sanction Severity 3 was dropped from further analysis due to cross loading. (Note: Sanction Certainty 1 was not analyzed because it was worded incorrectly).

**Table 7: Factor Analysis – Protection Motivation Theory (Full Data)**

Survey Item	TSEV	TSUS	SE	RC	RE
Threat Severity 1	0.885				
Threat Severity 2	0.837				
Threat Severity 3	0.576				
Threat Severity 4	0.566				
Threat Susceptibility 2		0.788			
Threat Susceptibility 3		0.744			
Threat Susceptibility 4		0.781			
Threat Susceptibility 5		0.803			
Threat Susceptibility 6		0.736			
Self-Efficacy 1			-0.747		
Self-Efficacy 3			-0.802		
Response Cost 1				0.753	
Response Cost 2				0.694	
Response Cost 3				0.712	
Response Cost 4				0.797	
Response Cost 5				0.784	
Response Cost 6				0.501	
Response Cost 7				0.694	
Response Efficacy 1					0.762
Response Efficacy 2					0.769
Response Efficacy 4					0.635
Response Efficacy 6					0.751

We tested the research model (Figure 1) using multiple linear regression analysis. The model includes twelve independent variables (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism, Sanction Severity, Sanction Certainty, Threat susceptibility, Threat Severity, Self-Efficacy, Response Efficacy, and Response Cost) and one dependent variable (Intent to TWD). Table 9 lists the basic characteristics of these variables. Only those items that loaded properly were included in the analysis.

**Table 8: Factor Analysis – General Deterrence Theory and Big Five (Full Data)**

Survey Item	SEV & CER	OPEN	CONS	EXTRA	AGR	NEUR
Sanction Severity 1	0.779					
Sanction Severity 2	0.771					
Sanction Severity 4	0.400					
Sanction Severity 5	0.497					
Sanction Severity 6	0.592					
Sanction Certainty 2	0.631					
Sanction Certainty 3	0.709					
Sanction Certainty 4	0.754					
Sanction Certainty 5	0.603					
Sanction Certainty 6	0.621					
Sanction Certainty 7	0.720					
Sanction Certainty 8	0.674					
Sanction Certainty 9	0.734					
Openness 1		0.635				
Openness 2		0.701				
Openness 3		0.660				
Openness 4		0.679				
Openness 5		0.715				
Openness 6		0.655				
Openness 7		0.627				
Openness 8		0.524				
Conscientiousness 1			0.686			
Conscientiousness 2			0.699			
Conscientiousness 3			0.604			
Conscientiousness 5			0.729			
Extraversion 1				0.840		
Extraversion 2				0.776		
Extraversion 3				0.589		
Extraversion 4				0.630		
Extraversion 5				0.749		
Agreeableness 1					0.740	
Agreeableness 2					0.640	
Agreeableness 3					0.648	
Agreeableness 4					0.647	
Agreeableness 5					0.524	
Neuroticism 1						0.695
Neuroticism 2						0.622
Neuroticism 3						0.696
Neuroticism 4						0.719
Neuroticism 5						0.739

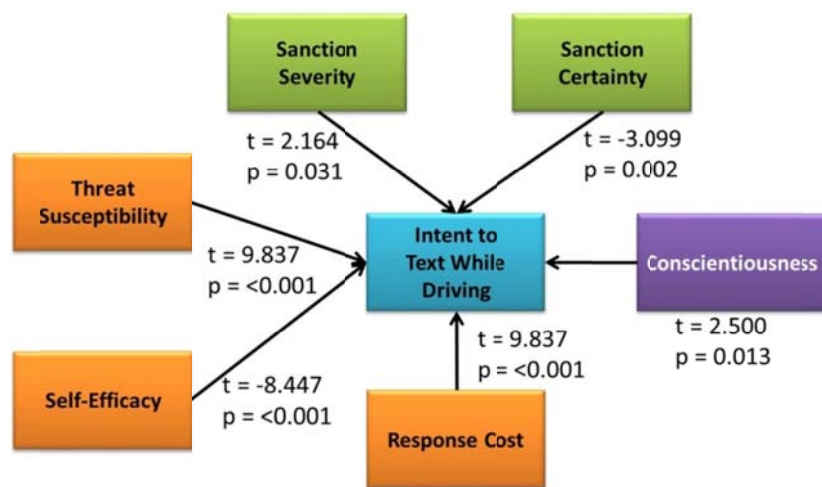
**Table 9: Final Regression Variables (Full Data)**

Factor	N	Minimum	Maximum	Mean	Std. Deviation
Openness	524	1.38	5.00	3.9624	0.66390
Conscientiousness	524	1.00	5.00	4.1461	0.63844
Extraversion	524	1.20	5.00	3.5773	0.87446
Agreeableness	524	1.00	5.00	4.0114	0.68808
Neuroticism	524	1.00	5.00	3.5365	0.83061
Sanction Severity	524	2.00	5.00	4.0947	0.65441
Sanction Certainty	524	1.50	5.00	3.6740	0.81066
Threat Severity	524	2.00	5.00	4.3015	0.62049
Threat Susceptibility	524	1.50	5.00	4.2687	0.65821
Self-Efficacy	524	1.67	5.00	4.2866	0.74435
Response Efficacy	524	1.43	5.00	4.2266	0.63898
Response Cost	524	1.00	4.71	2.0170	0.81070
Intent	524	1.00	5.00	1.7805	0.99439

**Findings**

Based on the regression analysis, the model explains close to fifty-seven percent of the variance in TWD behavior (adjusted  $R^2 = 0.568$ ). Since the overall model was significant ( $F=115.755, p < 0.0001$ ), we tested the significance of each variable.

Six factors were found to have a significant impact on teenage drivers' intent to text while driving (see Figure 3 and Table 10): Threat susceptibility (PMT), Self-Efficacy (PMT), Response Cost (PMT), Sanction Severity (GDT), Sanction Certainty (GDT), and Conscientiousness (Big Five).



**Figure 3: Significant results with path coefficients (Full data)**

**Table 10: Results of Regression Analysis (Full Data)**

Factor	Beta	t	Sig.	Supported
Openness	0.042	1.298	0.195	NO
<b>Conscientiousness</b>	<b>0.073</b>	<b>2.500</b>	<b>0.013</b>	<b>YES*</b>
Extraversion	0.035	1.042	0.298	NO
Agreeableness	0.041	1.260	0.208	NO
Neuroticism	0.008	0.269	0.788	NO
<b>Sanction Severity</b>	<b>0.099</b>	<b>2.164</b>	<b>0.031</b>	<b>YES*</b>
<b>Sanction Certainty</b>	<b>-0.150</b>	<b>-3.099</b>	<b>0.002</b>	<b>YES**</b>
Threat Severity	-0.016	-0.372	0.710	NO
<b>Threat Susceptibility</b>	<b>-0.164</b>	<b>-4.047</b>	<b>&lt;0.001</b>	<b>YES***</b>
<b>Self-Efficacy</b>	<b>-0.353</b>	<b>-8.447</b>	<b>&lt;0.001</b>	<b>YES***</b>
Response Efficacy	0.043	1.042	0.298	NO
<b>Response Cost</b>	<b>0.344</b>	<b>9.837</b>	<b>&lt;0.001</b>	<b>YES***</b>

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001

As seen from the results of this study, at least one construct from each of the theoretical models has a significant impact on texting while driving behavior. For this sample population, self-efficacy has the biggest impact on teenagers' intent to text while driving followed closely by response cost. Based on these results, the more confident a teenage driver feels about their ability to comply with TWD laws, the lower their intent to text while driving. In addition, the more costly it is for a teenage driver to avoid texting while driving, the greater their intent to text while driving. Hence, TWD awareness campaigns should seek to ensure that teenage drivers feel capable of following TWD laws and that perceived costs (e.g., missing messages from important individuals) associated with complying with TWD policies are reduced.

Threat susceptibility, sanction severity, and sanction certainty also have a significant impact on TWD behavior. In terms of threat susceptibility, the greater the risk associated with texting while driving, the less likely it is that teens will engage in the behavior regardless of the severity of the risk. Furthermore, in terms of sanctions, teenagers are deterred more by the belief that punishment will be enforced and not as much by how extreme the potential punishment will be. Based on this finding, it is important that texting while driving laws be enforced and deterrence campaigns should highlight the number of TWD cases that have been prosecuted. One unexpected finding is that the more severe the punishment associated with TWD, the greater the intent to text while driving. Participants acknowledged the possibility of



significant negative consequences; however, they were still likely to text while driving. This finding highlights the importance of identifying additional factors (not just punishments) that may deter this deviant behavior. An effective deterrence campaign must highlight other reasons for young drivers to abstain from texting while driving (e.g., “it is the moral thing to do,” “the life you save could be your own,” “it will contribute to a safer society.”) Simply highlighting the potential infractions, such as tickets and fines, is not necessarily an effective deterrent.

Based on the results, individuals who scored high on the conscientiousness scale are more likely to engage in texting while driving. Conscientious individuals value efficiency and getting things done, hence they may perceive a high response cost associated with avoiding this dangerous behavior. For example, a conscientious teenager may be prone to multitasking because they believe they can get more done if they perform multiple tasks concurrently. Additionally, a conscientious person may not want to put off or end a conversation with a friend or loved one in order to drive from one location to another. With this in mind, future research will explore the interaction of PMT/GDT and the Big Five factors.

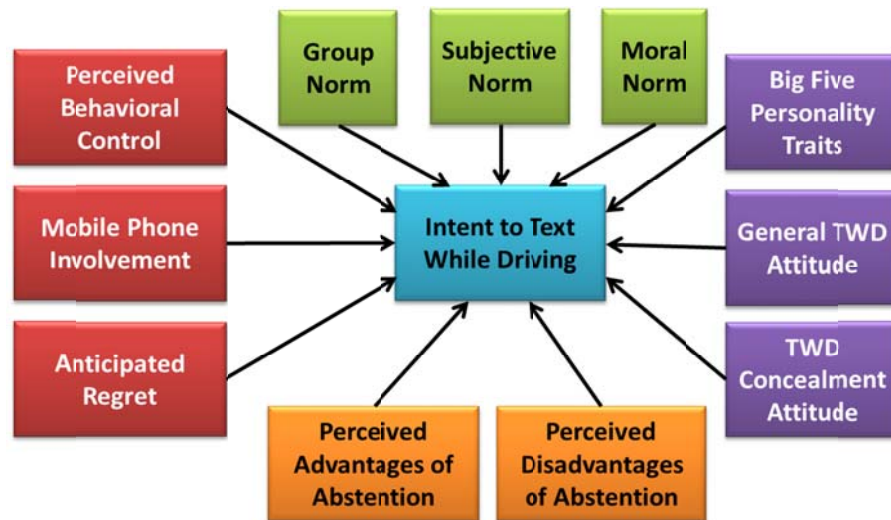
## **STUDY 2: TPB+ AND BIG FIVE SURVEY**

### **Pilot Study**

#### **Approach and Methodology**

After performing the regression analysis for the PMT/GDT survey data, we wanted to find out whether or not there were other factors that might better explain the variations in teenagers’ texting while driving behavior. We followed the same method used for the PMT/GDT study by first reviewing the relevant literature and identified several other characteristics that could be used to categorize teenage drivers in the context of TWD law compliance. The research model developed depicts a link between the eleven characteristics identified in Figure 4 and the dependent variable – “Intent to text while driving.” Using this model, we developed a survey to investigate the influence of the factors associated with the Big Five and an extended version of the Theory of Planned Behavior (TPB+) on TWD intention.





**Figure 4: Research model linking the Big Five and TPB+ factors with TWD intention**

Just as with Study 1, items from previously validated instruments were appropriately adapted when necessary to fit the context of Study 2. The same 28 Big Five items used in Study 1 were used in Study 2. Again, each item was rated from a scale of 1 to 5 where 1 represented strongly disagree and 5 represented strongly agree. Refer to Appendix A for the list of survey items associated with each of the five personality factors. These items were presented randomly as a group after the demographic items were answered. Below is a list showing the number of questions associated with each of the factors:

- General TWD Attitude – 5 items
- TWD Concealment Attitude – 4 items
- Perceived Disadvantages of Abstention – 11 items
- Perceived Advantages of Abstention – 7 items
- Anticipated Regret – 1 item
- Mobile Phone Involvement – 8 items
- Perceived Behavioral Control – 3 items
- Group Norm – 3 items
- Subjective Norm – 3 items
- Moral Norm – 3 items

Appendix D provides a list of the items used to measure each of the factors assessed in this survey. With the exception of the group norm and TWD concealment attitude items, each item was rated on a scale from 1 to 5 where 1 represented ‘strongly disagree’ and 5 represented ‘strongly agree’. For the group norm items, 1 represented ‘none’ and 5



represented ‘all’. For the TWD Concealment Attitude items, each item had a different semantic scale (see Appendix D).

The same screening and demographic questions used in the full data collection portion of Study 1 were used in Study 2 (refer to Appendix C). The informed consent process used in Study 1 was also used in Study 2 and the three blocks of questions followed – 1) screening/demographic questions, 2) Big Five personality assessment (randomly presented), and 3) TPB+ items (randomly presented).

To test our research model, we administered an online survey to drivers in the United States between the ages of 15-21 years, inclusively, who met the following conditions: 1) have a driver’s license or learner’s permit, 2) own or drive a vehicle, and 3) own a cell phone. After the survey was validated, multiple linear regression was used to statistically test the model.

### **Sample Population**

The survey was administered online and completed by 105 teenage and young adult drivers. All of the respondents had either a driver’s license or learner’s permit, owned a cell phone, and drove regularly. Eighty percent of the respondents were age 15 through 19 years old. The other 20% were 20 or 21 years old. Additionally, 63% of the respondents were Caucasian, 72% were female, and 86% drive 3 or more hours per week. The following is additional information obtained from the respondents.

- 62% have read a text message while driving.
- 48% have sent a text message while driving.
- 84% have read a text message while stopped.
- 71% have sent a text message while stopped.
- 72% have driven while sleepy.
- 19% have been distracted enough by their TWD that they thought they were driving recklessly.
- 16% have drifted into another lane due to TWD.
- 21% have driven more than 10 MPH over the speed limit while texting.
- 7% have run a stop sign because they were TWD.
- 3% have hit something because they were TWD.
- 3% have received a ticket for TWD.
- 1% have injured someone else because they were TWD.

### **Data Analysis**

The survey was validated using the same process used for Study 1. Items for each of the sixteen independent variables (5 Big Five factors and 11 TPB+) were tested for reliability using Cronbach's alpha (Cronbach 1970). Based on this analysis, four items were dropped since Cronbach's alpha for each item was less than 0.70. All three group norm items were dropped because no combination of two or more of the items resulted in the minimum statistic desired. The highest statistic that could be obtained was 0.626, which was obtained when only Group Norm 1 and 3 were used. One perceived behavioral control item was eliminated (Perceived Behavioral Control 3) in order to achieve the minimum statistic. In addition, anticipated regret was not analyzed because the wording of the first item was incorrect and so it had to be removed. Table 11 illustrates the statistics associated with the reliability analysis.

A principal component analysis with Equamax rotation was used to assess the convergent and discriminant validity of the TPB+ items. As displayed in Table 12, most items loaded on the proper factor; however, Moral Norm (MNORM) and TWD Concealment Attitude (ATTCSL) items loaded together and Perceived Behavioral Control (PBC) loaded with Intent (INT). Finally, the following cross-loaded items were dropped from further analysis: Moral Norm 1, Mobile Phone Involvement 3 and 4, General TWD Attitude 3 and 4, Perceived Advantages of Abstention 2 and 6, Perceived Disadvantages of Abstention 6 and 10. In addition, the items used to measure Perceived Disadvantages of Abstention were split into two groups. The first group of items related to emergency communication needs (DISABSE) while the second group was related to general texting needs (DISABSG).

Principal component analysis with Varimax rotation was used to assess the convergent and discriminant validity of the Big Five items. As seen in Table 13, most items loaded on the proper factor. The following cross-loaded items were dropped from further analysis: Agreeableness 2 and 4.

We tested the research model (Figure 4) using multiple linear regression analysis. The model included thirteen independent variables (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism, General TWD Attitude, TWD Concealment Attitude, Perceived Disadvantages of Abstention, Perceived Advantages of Abstention, Mobile Phone Involvement, Perceived Behavioral Control, Subjective Norm, Moral Norm) and one dependent variable (Intent to Text While Driving). Group Norm was not included since it did not pass the reliability test and Anticipated Regret was not included because it had only one item. Table 14 lists the basic characteristics of these variables.

**Table 11: Reliability Analysis (Pilot Study)**

<b>Variable</b>	<b># Of Items</b>	<b>Cronbach's Alpha</b>
Openness (OPEN)	8	0.862
Conscientiousness (CONS)	5	0.794
Extraversion (EXTRA)	5	0.825
Agreeableness (AGR)	5	0.792
Neuroticism (NEUR)	5	0.799
General TWD Attitude (GATT)	5	0.778
TWD Concealment Attitude (ATTCSL)	4	0.935
Perceived Disadvantages of Abstention (DISABS)	11	0.865
Perceived Advantages of Abstention (ADVABS)	7	0.865
Anticipated Regret (ANTIRGT)	1	N/A
Mobile Phone Involvement (MPI)	8	0.812
Perceived Behavioral Control (PBC)	2	0.833
Group Norm (GNORM)	2	0.626
Subjective Norm (SNORM)	3	0.828
Moral Norm (MNORM)	3	0.826
Intent (INT)	3	0.922

**Table 12: Factor analysis – TPB+ Factors (Pilot Study)**

Survey Item	GATT	ATTCSL & MNORM	DISABSE	DISABSG	ADVABS	MPI	PBC & Intent	SNORM
General TWD Attitude 1	0.615							
General TWD Attitude 2	0.662							
General TWD Attitude 5	0.609							
TWD Concealment Attitude 1		0.621						
TWD Concealment Attitude 2		0.628						
TWD Concealment Attitude 3		0.630						
TWD Concealment Attitude 4		0.651						
Perceived Disadvan of Abstention 1			0.824					
Perceived Disadvan of Abstention 2			0.679					
Perceived Disadvan of Abstention 3			0.821					
Perceived Disadvan of Abstention 4				0.477				
Perceived Disadvan of Abstention 5				0.793				
Perceived Disadvan of Abstention 7				0.836				
Perceived Disadvan of Abstention 8				0.671				
Perceived Disadvan of Abstention 9				0.497				
Perceived Disadvan of Abstention 11				0.636				
Perceived Advantages of Abstention 1					0.484			
Perceived Advantages of Abstention 3					0.598			
Perceived Advantages of Abstention 4					0.857			
Perceived Advantages of Abstention 5					0.415			
Perceived Advantages of Abstention 7					0.684			
Mobile Phone Involvement 1						0.752		
Mobile Phone Involvement 2						0.613		
Mobile Phone Involvement 5						0.654		
Mobile Phone Involvement 6						0.794		
Mobile Phone Involvement 7						0.777		
Mobile Phone Involvement 8						0.531		
Perceived Behavioral Control 1							0.705	
Perceived Behavioral Control 2							0.618	
Subjective Norm 1								
Subjective Norm 2								
Subjective Norm 3								
Moral Norm 2		0.582						
Moral Norm 3		0.591						
Intent 1							0.548	
Intent 2							0.614	
Intent 3							0.584	

**Table 13: Factor analysis –Big Five Factors (Pilot Study)**

<b>Survey Item</b>	<b>OPEN</b>	<b>CONS</b>	<b>EXTRA</b>	<b>AGR</b>	<b>NEUR</b>
Openness 1	0.639				
Openness 2	0.719				
Openness 3	0.755				
Openness 4	0.671				
Openness 5	0.710				
Openness 6	0.789				
Openness 7	0.487				
Openness 8	0.585				
Conscientiousness 1		0.663			
Conscientiousness 2		0.760			
Conscientiousness 3		0.650			
Conscientiousness 4		0.813			
Conscientiousness 5		0.598			
Extraversion 1			0.752		
Extraversion 2			0.767		
Extraversion 3			0.698		
Extraversion 4			0.630		
Extraversion 5			0.544		
Agreeableness 1				0.727	
Agreeableness 3				0.745	
Agreeableness 5				0.750	
Neuroticism 1					0.760
Neuroticism 2					0.760
Neuroticism 3					0.750
Neuroticism 4					0.727
Neuroticism 5					0.767

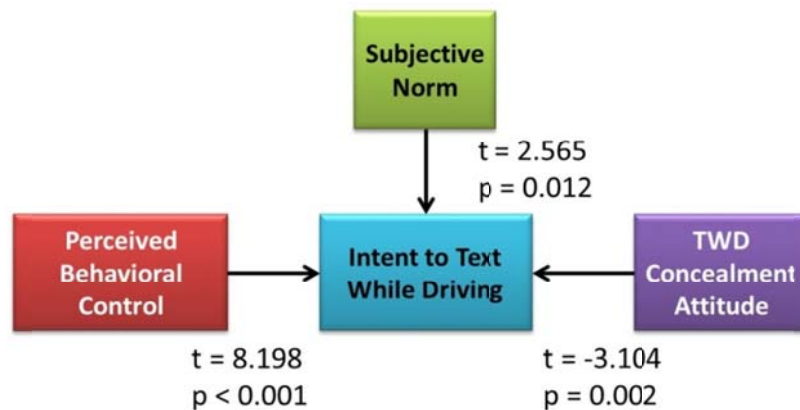
**Table 14: Final Regression Variables (Pilot Study)**

Factor	N	Minimum	Maximum	Mean	Std. Deviation
Openness	105	2.13	5.00	3.9711	0.70615
Conscientiousness	105	2.40	5.00	4.1086	0.63766
Extraversion	105	1.60	5.00	3.5300	0.85106
Agreeableness	105	1.80	5.00	3.9086	0.74783
Neuroticism	105	1.00	5.00	3.4762	0.87810
General TWD attitude	105	2.33	5.00	4.4825	0.62870
TWD concealment attitude	105	2.50	7.00	6.0096	1.26564
Perceived Disadvantages of Abstention – General	105	1.00	5.00	1.9752	0.86411
Perceived Disadvantages of Abstention – Emergency	105	1.00	4.00	2.4286	0.80168
Perceived advantages of abstention	105	2.00	5.00	4.3200	0.69868
Mobile Phone Involvement	105	1.00	4.71	2.9551	0.85101
Perceived behavioral control	105	1.00	5.00	2.3476	1.11830
Subjective Norm	105	1.00	3.67	1.5524	0.71437
Moral Norm	105	1.00	5.00	3.8714	1.04704
Intent to text while driving	105	1.00	5.00	1.9714	1.06228

### Findings

Based on the regression analysis, the model explains almost sixty-eight percent of the variance in TWD behavior (adjusted  $R^2 = 0.677$ ). Since the overall model was significant ( $F=73.555$ ,  $p < 0.0001$ ), we tested the significance of each variable.

Three factors were found to have a significant impact on teenage drivers' intent to text while driving (see Figure 5 and Table 15): Perceived Behavioral Control, TWD Concealment Attitude, and Subjective Norm.



**Figure 5: Significant results with path coefficients (Pilot study)**

**Table 15: Results of Regression Analysis (Pilot Study)**

Factor	Beta	t	Sig.	Supported
Openness	0.243	0.117	0.970	NO
Conscientiousness	0.807	0.024	0.937	NO
Extraversion	0.111	0.159	0.995	NO
Agreeableness	0.101	0.163	0.945	NO
Neuroticism	0.683	0.041	0.982	NO
General TWD attitude	0.094	-0.167	0.512	NO
<b>TWD concealment attitude</b>	<b>-0.208</b>	<b>-3.104</b>	<b>0.002</b>	<b>YES**</b>
Perceived Disadvantages of Abstention – General	0.097	0.165	0.780	NO
Perceived Disadvantages of Abstention – Emergency	0.090	0.169	0.787	NO
Perceived advantages of abstention	0.237	0.118	0.730	NO
Mobile Phone Involvement	0.222	0.122	0.892	NO
<b>Perceived behavioral control</b>	<b>0.588</b>	<b>8.198</b>	<b>&lt;0.001</b>	<b>YES***</b>
<b>Subjective Norm</b>	<b>0.173</b>	<b>2.565</b>	<b>0.012</b>	<b>YES*</b>
Moral Norm	0.306	-0.102	0.494	NO

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001





The results of the pilot study suggest that the individual differences associated with the TPB+ may better explain variations in teenager TWD behavior than the PMT/GDT factors. To substantiate these beliefs, corrections were made to a couple survey items and additional data was collected from a larger pool of people.

## **Full Data Collection**

### **Approach and Methodology**

After collecting the data for the pilot study, an issue with one of the survey items was noticed: one item for Anticipated Regret was not worded correctly. This was corrected prior to the full data collection so that the question read: “If I text while driving in the next week I would feel regret.”

### **Sample Population**

We administered the survey online and 524 teenage and young adult drivers completed it. All of the respondents had either a driver’s license or learner’s permit, owned a cell phone, and drove regularly. Ninety percent of the respondents were age 15 through 19 years old. The other 10% were 20 or 21 years old. Additionally, 67% of the respondents were Caucasian, 50% were female, and 86% drive 3 or more hours per week.

The following is additional information obtained from the respondents regarding their TWD behavior.

- 61% have read a text message while driving.
- 48% have sent a text message while driving.
- 81% have read a text while stopped.
- 69% have sent a text while stopped.
- 73% have driven while sleepy.
- 15% have been distracted enough by their TWD that they thought they were driving recklessly.
- 18% have drifted into another lane due to TWD.
- 17% have driven more than 10 MPH over the speed limit while texting.
- 6% have run a stop sign because they were TWD.
- 2% have hit something because they were TWD.
- 2% have received a ticket for TWD.
- 1% have injured someone else because they were TWD.

**Data Analysis**

We validated the survey by following the same method used for the pilot study. Items for each of the fifteen independent variables (5 Big Five factors and TPB+ factors) and 1 dependent variable were tested for reliability using Cronbach’s alpha (Cronbach 1970). Based on this analysis, four items were removed from the analysis. For instance, all three Group Norm items were dropped because no combination of two or more resulted in a Chronbach alpha greater than 0.70. The highest statistic achieve was 0.682. Additionally, Perceived Behavioral Control 3 was removed in order to achieve a statistic greater than 0.70. Table 16 illustrates the statistics associated with the reliability analysis.

**Table 16: Reliability Analysis (Full Data)**

<b>Variable</b>	<b># Of Items</b>	<b>Cronbach’s Alpha</b>
Openness (OPEN)	8	0.808
Conscientiousness (CONS)	5	0.776
Extraversion (EXTRA)	5	0.826
Agreeableness (AGR)	5	0.763
Neuroticism (NEUR)	5	0.760
General TWD Attitude (GATT)	5	0.753
TWD Concealment Attitude (ATTCSL)	4	0.897
Perceived Disadvantages of Abstention (DISABS)	11	0.865
Perceived Advantages of Abstention (ADVABS)	7	0.909
Anticipated Regret (ANTIRGT)	2	0.834
Mobile Phone Involvement (MPI)	8	0.801
Perceived Behavioral Control (PBC)	2	0.742
Group Norm (GNORM)	2	0.682
Subjective Norm (SNORM)	3	0.811
Moral Norm (MNORM)	3	0.746
Intent (INT)	3	0.906

We used a principal component analysis with Varimax rotation to assess the convergent and discriminant validity of the TPB+ items. As displayed in Table 17, most items loaded on the proper factor. We dropped the following items from further analysis due to cross loading: Mobile Phone Involvement 3 and 4, Attitude 3 and 4. Additionally, two sets of factors loaded together: Perceived Behavioral Control and Intent, Moral Norm and Anticipated Regret. In this study, it is not surprising that Perceived Behavioral Control and Intent load together since the questions related to these factors were very similar. Furthermore, teenagers who believe that they are in control of their TWD behavior and that texting while driving is safe would have a greater likelihood of texting while driving.



Likewise, the items for Moral Norm and Anticipated Regret tap into similar psychological constructs and those teens who feel that it is morally wrong to text while driving are more likely to feel regret if they were to engage in the behavior.

**Table 17: Factor Analysis – Protection Motivation Theory (Full Data)**

Survey Item	GATT	ATTCSL	DISABSE	GDISABS	ADVABS	ANTIRGT & MNORM	MPI	PBC & Intent	SNORM
General TWD Attitude 1	0.593								
General TWD Attitude 2	0.432								
General TWD Attitude 5	0.527								
TWD Concealment Attitude 1		0.777							
TWD Concealment Attitude 2		0.821							
TWD Concealment Attitude 3		0.782							
TWD Concealment Attitude 4		0.744							
Perceived Disadvan of Abstention 1			0.757						
Perceived Disadvan of Abstention 2			0.730						
Perceived Disadvan of Abstention 3			0.824						
Perceived Disadvan of Abstention 4				0.687					
Perceived Disadvan of Abstention 5				0.606					
Perceived Disadvan of Abstention 6				0.519					
Perceived Disadvan of Abstention 7				0.570					
Perceived Disadvan of Abstention 8				0.683					
Perceived Disadvan of Abstention 9				0.714					
Perceived Disadvan of Abstention 10				0.724					
Perceived Disadvan of Abstention 11				0.749					
Perceived Advan of Abstention 1					0.848				
Perceived Advan of Abstention 2					0.838				
Perceived Advan of Abstention 3					0.862				
Perceived Advan of Abstention 4					0.813				
Perceived Advan of Abstention 5					0.633				
Perceived Advan of Abstention 6					0.713				
Perceived Advan of Abstention 7					0.775				
Anticipated Regret 1						0.701			
Anticipated Regret 2						0.817			
Mobile Phone Involvement 1							0.599		
Mobile Phone Involvement 2							0.784		
Mobile Phone Involvement 5							0.654		
Mobile Phone Involvement 6							0.764		
Mobile Phone Involvement 7							0.700		
Mobile Phone Involvement 8							0.450		
Perceived Behavioral Control 1								0.709	
Perceived Behavioral Control 2								0.680	
Subjective Norm 1									0.797
Subjective Norm 2									0.725
Subjective Norm 3									0.791
Moral Norm 1						0.566			
Moral Norm 2						0.575			
Moral Norm 3						0.754			
Intent 1								0.714	
Intent 2								0.748	
Intent 3								0.699	

We utilized a principal component analysis with Varimax rotation to assess the convergent and discriminant validity of the Big Five items as well. As seen in Table 18, all

items loaded on the proper factor with the exception of Conscientiousness 3, which was dropped due to cross loading.

**Table 18: Factor Analysis – Big Five Factors (Full Data)**

Survey Item	OPEN	CONS	EXTRA	AGR	NEUR
Openness 1	0.566				
Openness 2	0.713				
Openness 3	0.611				
Openness 4	0.643				
Openness 5	0.714				
Openness 6	0.663				
Openness 7	0.537				
Openness 8	0.457				
Conscientiousness 1		0.725			
Conscientiousness 2		0.673			
Conscientiousness 4		0.776			
Conscientiousness 5		0.656			
Extraversion 1			0.775		
Extraversion 2			0.789		
Extraversion 3			0.676		
Extraversion 4			0.665		
Extraversion 5			0.615		
Agreeableness 1				0.706	
Agreeableness 2				0.472	
Agreeableness 3				0.666	
Agreeableness 4				0.691	
Agreeableness 5				0.676	
Neuroticism 1					0.705
Neuroticism 2					0.585
Neuroticism 3					0.759
Neuroticism 4					0.706
Neuroticism 5					0.784

The research model (Figure 4) was tested using multiple linear regression analysis. The model includes fifteen independent variables (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism, General TWD Attitude, TWD Concealment Attitude, Perceived Disadvantages of Abstention – General, Perceived Disadvantages of Abstention - Emergency, Perceived Advantages of Abstention, Anticipated Regret, Mobile Phone Involvement, Perceived Behavioral Control, Subjective Norm, Moral Norm) and one dependent variable (Intent to TWD). Table 19 provides the basic characteristics of these variables. Only those items that loaded properly were included in the analysis.

**Table 19: Final Regression Variables (Full Data)**

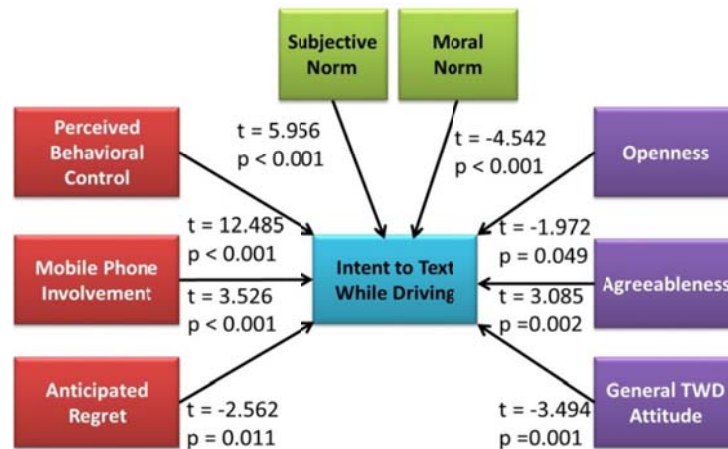
Factor	N	Minimum	Maximum	Mean	Std. Deviation
Openness	524	1.25	5.00	4.0115	0.63300
Conscientiousness	524	1.75	5.00	4.1904	0.63818
Extraversion	524	1.00	5.00	3.6110	0.91200
Agreeableness	524	1.40	5.00	4.0439	0.70884
Neuroticism	524	1.00	5.00	3.5232	0.87588
General TWD attitude	524	1.67	5.00	4.4176	0.69456
TWD concealment attitude	522	1.00	5.00	4.2425	0.94615
Perceived Disadvantages of Abstention – General	524	1.00	5.00	1.8467	0.74554
Perceived Disadvantages of Abstention – Emergency	524	1.00	5.00	2.8804	1.14552
Perceived Advantages of Abstention	524	1.00	5.00	4.2331	0.87606
Anticipated Regret	524	1.00	5.00	3.8655	1.05332
Mobile Phone Involvement	524	1.00	5.00	2.9578	0.77473
Perceived behavioral control	524	1.00	5.00	2.5134	1.14520
Subjective Norm	524	1.00	5.00	1.5127	0.72201
Moral Norm	524	1.00	5.00	3.8457	0.93495
Intent to text while driving	524	1.00	5.00	1.9609	1.04361

## Findings

Based on the regression analysis, just over sixty-six percent of the variance in TWD behavior is explained by the model (adjusted  $R^2 = 0.664$ ). Since the overall model was significant ( $F=129.623$ ,  $p < 0.0001$ ), we tested the significance of each variable.

Eight factors were found to have a significant impact on teenage drivers' intent to text while driving (see Figure 6 and Table 20): Perceived Behavioral Control, Moral Norm,

Subjective Norm, General TWD Attitude, Mobile Phone Involvement, Anticipated Regret, Agreeableness, and Openness.



**Figure 6: Significant results with path coefficients (Full data)**

The results of this study show that several constructs from the TPB+ model have a significant impact on texting while driving behavior. Regarding the traditional TPB constructs, three of them were found to be significant when it comes to teens' TWD behavior: Subjective Norm, Perceived Behavioral Control and General TWD Attitude. The items used to assess Subjective Norm were worded such that TWD behavior would be interpreted as acceptable; therefore, it is not unusual that those who scored high on the Subjective Norm scale also scored high on the intent to text while driving. The Perceived Behavioral Control items provided the opportunity for respondents to express how easy they perceive texting while driving to be. Based upon the regression results, the easier teens felt texting while driving is, the greater their intent to text while driving in the future. In regards to the General TWD Attitude items which related more to the level of risk associated with texting while driving, the analysis results indicate that the riskier teens perceived TWD behavior to be, the less likely they are to engage in the behavior in the future.

Since the Mobile Phone Involvement items were used to assess how addicted the respondents were to their cell phone, it appears logical that those who had higher scores for this construct also had a greater intent to text while driving. On the other hand, those participants who had higher Anticipated Regret scores, meaning they would feel remorse if they were to text while driving, are less likely to text while driving in the future. Regarding Moral Norm, respondents who scored higher on that scale were less likely to engage in the undesirable behavior since texting while driving was not in line with their beliefs.

**Table 20: Results of Regression Analysis (Full Data)**

<b>Factor</b>	<b>Beta</b>	<b>t</b>	<b>Sig.</b>	<b>Supported</b>
<b>Openness</b>	<b>-0.057</b>	<b>-1.972</b>	<b>0.049</b>	<b>YES*</b>
Conscientiousness	0.033 <sup>i</sup>	1.106	0.269	NO
Extraversion	0.051 <sup>i</sup>	1.646	0.100	NO
<b>Agreeableness</b>	<b>0.088</b>	<b>3.085</b>	<b>0.002</b>	<b>YES**</b>
Neuroticism	0.002 <sup>i</sup>	0.084	0.933	NO
<b>General TWD attitude</b>	<b>-0.119</b>	<b>-3.494</b>	<b>0.001</b>	<b>YES***</b>
TWD concealment attitude	-0.049 <sup>i</sup>	-1.409	0.160	NO
Perceived Disadvantages of Abstention – General	0.028 <sup>i</sup>	0.911	0.363	NO
Perceived Disadvantages of Abstention – Emergency	0.027 <sup>i</sup>	0.922	0.357	NO
Perceived Advantages of Abstention	0.038 <sup>i</sup>	1.344	0.179	NO
<b>Anticipated Regret</b>	<b>-0.108</b>	<b>-2.562</b>	<b>0.011</b>	<b>YES*</b>
<b>Mobile Phone Involvement</b>	<b>0.094</b>	<b>3.526</b>	<b>&lt;0.001</b>	<b>YES***</b>
<b>Perceived behavioral control</b>	<b>0.407</b>	<b>12.485</b>	<b>&lt;0.001</b>	<b>YES***</b>
<b>Subjective Norm</b>	<b>0.179</b>	<b>5.956</b>	<b>&lt;0.001</b>	<b>YES***</b>
<b>Moral Norm</b>	<b>-0.198</b>	<b>-4.542</b>	<b>&lt;0.001</b>	<b>YES***</b>

\*p < 0.05, \*\*p < 0.01, \*\*\*p<0.001

Lastly, the results of the regression suggest that two of the Big Five personality traits significantly impact the intent to text while driving. Individuals who scored high on the Openness scale are less likely to engage in texting while driving. These individuals tend to be more imaginative and creative and they like to reflect. Driving may provide these individuals with an opportunity to engage in creative thinking and reflection; hence, they are less likely to interrupt this time by texting. While driving, open individuals may utilize this time away from technology to deliberate and engage in critical thinking. Future research should explore the relationship between openness and critical thinking since both are characterized by similar traits, such as curiousness and creativity.

Individuals with high Agreeableness scores were more likely to text while driving. Agreeable individuals are cooperative and considerate of others. They may perceive it to be impolite to make a person wait for a response to a text message and, therefore, they are more





likely to engage in texting while driving in order to be respectful to the person attempting to communicate with them. With this in mind, future research will explore the interaction of TPB+ and the Big Five factors.

## CONCLUSIONS AND RECOMMENDATIONS

The results of these two studies provide evidence of individual differences that impact teenager TWD behavior. The data helped identify characteristics of teenage drivers who are more (or less) likely to comply with TWD policies. These differences can be used to develop customized driver training protocols that will be more effective in discouraging teenage TWD behaviors. Future studies investigating additional personality factors along with other individual differences, such as the rationality of individual decision-making and cultural factors, may prove to be instrumental in establishing a comprehensive profile that is associated with the motivation to comply with TWD laws.

The next phase of this research is to use the results to develop specialized training protocols that can better deter teenagers from texting while driving. Since the results of study 1 indicate neither the possibility of sanction nor the threat of a serious accident impact their decisions to text while driving, other messages need to be considered in order to effectively convince them of the dangers of texting while driving.

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## LECTURE PRESENTATIONS

- “Influence of personality on teen texting while driving perceptions.” University Transportation Center Conference, Birmingham, Alabama, March 26-27, 2015.
- “Distracted driving among teens: How can we educate and protect our youth?” Humanitarian Technology Conference, Boston, Massachusetts, May 12-14, 2015.
- “Transportation safety topic: distracted driving.” North Carolina Agricultural and Technical State University Summer High School Transportation Institute, June 29, 2015.
- “Teenage texting and driving: how dispositional and situational factors impact behavior.” Applied Human Factors and Ergonomics Conference, Las Vegas, Nevada, July 27-30, 2015.



## APPENDIX A

### Big Five Personality Traits Assessment Items

I see myself as someone who...

(1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree)

#### Openness

- Is inventive.
- Is original, comes up with new ideas.
- Values artistic, aesthetic experiences.
- Has an active imagination.
- Likes to reflect, play with ideas.
- Is sophisticated in art, music, or literature.
- Is ingenious, a deep thinker.
- Is curious about many different things.

#### Conscientiousness

- Does a thorough job.
- Does things efficiently.
- Makes plans and follows through with them.
- Is a reliable worker.
- Perseveres until the task is finished.

#### Extraversion

- Is outgoing, sociable.
- Is talkative.
- Has an assertive personality.
- Generates a lot of enthusiasm.
- Is full of energy.

#### Agreeableness

- Is considerate and kind to almost everyone.
- Likes to cooperate with others.
- Is helpful and unselfish with others.
- Has a forgiving nature.
- Is generally trusting.

#### Neuroticism

- Can be moody.
- Is depressed, blue.
- Gets nervous easily.
- Can be tense.
- Worries a lot.



## APPENDIX B

### Protection Motivation and General Detection Theory Survey Items

(1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree)

#### Threat Severity

1. If I were to have an accident while texting and driving, it would be severe.
2. If I were to have an accident while texting and driving, it would be serious.
3. Texting while driving can cause harm to other drivers.
4. Texting while driving can result in damage to vehicles.

#### Threat Susceptibility

1. I am putting myself at risk when I text and drive.
2. I am likely to get into an accident if I text while driving.
3. It is possible that I will have an accident if I text while driving.
4. It is likely that texting while driving will result in a traffic accident.
5. It is likely that texting while driving will cause harm to other drivers.
6. It is likely that texting while driving will cause damage to other vehicles.

#### Self-Efficacy

1. I am likely to follow texting while driving laws.
2. It is possible that I will follow texting while driving laws in order to protect other people.
3. I am certain that I will follow texting while driving laws.

#### Response Cost

1. Not texting while driving is difficult to do.
2. I would have to make major changes to how I communicate if I could not text and drive.
3. Not texting while driving will cause me to miss important messages from my friends and family.
4. Following the texting while driving laws is difficult for me.
5. Following the texting while driving laws is challenging for me.
6. Following the texting while driving laws would impact me negatively.
7. Following the texting while driving laws would create disadvantages for me.



### Response Efficacy

1. Not texting while driving will successfully prevent traffic accidents.
2. Not texting while driving is the best solution for preventing traffic accidents.
3. If we refrain from texting while driving, we can minimize the threat of traffic accidents.
4. If I follow the texting while driving laws, I can make a difference in helping to secure the highway systems.
5. Texting while driving laws work to protect people from getting involved in traffic accidents.
6. Texting while driving laws effectively protect people from getting into traffic accidents.
7. When following texting while driving laws, drivers are more likely to be protected from being involved in traffic accidents.

### Sanction Severity

1. If I were caught texting while driving, I think the punishment would be high.
2. If I were caught texting while driving, I would be severely punished.
3. It would create a problem in my life if I were arrested for texting while driving.
4. It would create a problem in my life if I received a ticket for texting while driving.
5. It would create a problem in my life if I lost the respect of my peers for not following the texting while driving laws.
6. It would create a problem in my life if I lost the respect of my family/legal guardians for not following the texting while driving laws.

### Sanction Certainty

1. If I were to text while driving, the probability I would be caught is low.
2. If I were to text while driving, I would probably be caught.
3. I would be punished if I did not follow the texting while driving laws.
4. I would lose my driving privileges if my parents/guardians learned that I had been texting while driving.
5. I would face criminal charges if the police caught me texting while driving.
6. I would lose the respect of my peers for not following the texting while driving laws.
7. I would be restricted from participating in extracurricular opportunities if my parents/guardians learned that I did not follow the texting while driving laws.
8. I would lose the respect of my parents/guardians if they learned that I had been texting while driving.
9. There is a strong chance that I would be punished if I were caught texting while driving.



## APPENDIX C

### Screening, Demographic, Texting Behavior, and Miscellaneous Survey Items

#### Screening Questions

Age

- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22+

Do you own or frequently drive a motor vehicle (motorcycles do not count)?

- Yes
- No

On average, how many hours per week do you drive

- 1
- 1-2
- 3-5
- 6-10
- 11 or more

Do you own a cell phone?

- Yes
- No

Which of the following applies to you?

- I have a driver's license
- I have a learner's permit
- I do not have either a driver's license or learner's permit

#### Demographic Items

Gender

- Male
- Female

What is your race/ethnicity?

- White
- Black/African American
- Hispanic/Latino
- Other



Grade

- 9<sup>th</sup>
- 10<sup>th</sup>
- 11<sup>th</sup>
- 12<sup>th</sup>
- College

Texting Behavior

How often do you text on your cell phone?

- Never
- Rarely
- Sometimes
- Often
- All the time

How often do you send a text message while driving?

- Never
- Rarely
- Sometimes
- Often
- All the time

How often do you read a text message while driving?

- Never
- Rarely
- Sometimes
- Often
- All the time

Regarding texting and driving, have you ever drifted into another driving lane because you were texting?

- Yes
- No

Regarding texting and driving, have you ever been so distracted by texting that you know you are being reckless?

- Yes
- No

Regarding texting and driving, have you ever driven more than 10MPH over the speed limit while you were texting?

- Yes
- No





Regarding texting and driving, have you ever received a ticket for texting and driving?

- Yes
- No

Regarding texting and driving, have you ever ran a stop sign because you were texting?

- Yes
- No

Regarding texting and driving, have you ever hit something because you were texting?

- Yes
- No

Regarding texting and driving, have you ever injured someone else because of texting and driving?

- Yes
- No

How often do you use dictation software (such as SIRI) to text while driving?

- Never
- Rarely
- Sometimes
- Often
- All the time

### Miscellaneous

What are the restrictions on using a cell phone while driving in your state?

- There are no restrictions on using a cell phone while driving
- Drivers under 18 are allows to talk on a cell phone as long as they use a hands-free device
- Drivers under 18 are not allowed to use a cell phone while driving
- No drivers in my state are allowed to use a cell phone, including adults
- I don't know

I will lose my license if I don't follow the texting while driving laws.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

I will receive a ticket if I don't follow the texting while driving laws.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree



How often do you wear a seatbelt while driving?

- Never
- Rarely
- Sometimes
- Often
- All the time