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Past behavior and the decision to text while driving among young adults

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ABSTRACT

This study examined how past behavior influences the decision to text while driving among young adults. Exposure to distracted driving behaviors, such as texting and driving, were measured in conjunction with variables related to the Theory of Planned Behaviour (TPB). Participants completed a questionnaire measuring past distracted driving behaviors and traditional TPB variables (intentions, attitudes, subjective norms, perceived control), as well as self-efficacy and moral norms. Texting and driving was found to be a very prevalent behavior, with 83.5% and 76.6% of participants reporting reading or writing a text message while driving in the last 30 days, respectively. Replicating previous studies, regression analyses found that the traditional TPB variables explained a significant proportion of the variance in intentions to text and drive. However, the addition of past behavior, self-efficacy, and moral norms into the model reduced the predictive strength of the traditional TPB variables while increasing the amount of explained variance. The surprising strength of past behavior, self-efficacy, and moral norms suggests that future campaigns and interventions to reduce distracted driving among young adults ought to focus on crafting messages that disrupt the influence of past behavior on future intentions, and concentrate on moral and self-effectual aspects of the behavior.

1. Introduction

Distracted driving is an increasing road safety threat. Drivers who use a range of technologies, including cell phones, represent a major cause of distracted driving fatalities. In 2014 alone, 3,179 people were killed and approximately 431,000 were injured in crashes involving distracted driving. During the same period, mobile phone use was reported in 18% of fatal car accidents (National Highway Traffic Safety Administration, 2016).

The literature on the impact of texting while driving has primarily focused on the attentional aspects of distracted driving, demonstrating that driving is significantly impaired by cell phone use (see Caird, Johnston, Willness, Asbridge, & Steel, 2014; Overton, River, Hecht, Shafi, & Gandhi, 2014; Ranney, 2008 for reviews). Reed and Robbins (2008) found that, compared to control groups, participants writing a text message drove slower, had a greater likelihood of drifting into adjacent lanes, and experienced greater lane variability (i.e., weaving within one's lane). In another simulated driving experiment, Drews, Yazdani, Godfrey, Cooper, and Strayer (2009) found that reading and receiving text messages nearly doubled the time it took drivers to initiate breaking and increased the likelihood of a crash six-fold. Even minor cell phone related activities, such as speech-based text entry (He et al., 2014) and receiving a cell phone notification (Stothart, Mitchum, & Yehnert, 2015), were

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found to disrupt a driver's attention enough to significantly impair response times. In their review of 28 experimental studies, Caird et al. (2014) concluded that texting behaviors adversely affected drivers' ability to safely respond to traffic events, sustain lane position, or maintain a safe following distance. The evidence strongly suggests that texting while driving is major safety liability, impairing motorists' abilities to direct attention towards driving.

Despite such dangers, texting while driving is highly prevalent among young adults. The National Highway Traffic Safety Administration (2016) estimates that cell phone use is most prevalent among drivers ages 20–29. Some studies have found prevalence rates upwards of 90% among young adults sampled (Atchley, Atwood, & Boulton, 2011; Harrison, 2011; Hill et al., 2015). As noted by Domigan, Glassman, Miller, Hug, and Diehr (2015), as young adults repeatedly use cell phones while driving, the more normalized this behavior becomes, which in turn could lead to a rise in distracted driving related motor vehicle crashes in this already vulnerable population.

1.1. The Theory of Planned Behaviour

Recently, traffic safety researchers have begun to employ the Theory of Planned Behaviour (TPB; Ajzen, 1991) to explain individuals' reasons and beliefs related to the decision to text while driving. According to TPB, reasoned behaviors occur when there are both intentions to engage in that behavior and adequate ability to do so. As illustrated in Fig. 1, Ajzen posits that intentions themselves are influenced by attitudes (favorable or unfavorable evaluations of the behavior), perceived behavior control (PBC; the ease or difficulty associated with performing the behavior) and subjective norms (social pressures associated with the behavior). Thus, targeting beliefs about one of these factors, such as attitudes, should decrease intentions to engage in the behavior, making that behavior less likely to occur.

Several studies have found mixed support for using the TPB framework to study behaviors related to texting while driving (e.g., Bayer & Campbell, 2012; Benson, McLaughlin, & Giles, 2015; Gauld, Lewis, & White, 2014; Nemme & White, 2010). Nemme and White tested the effectiveness of the TPB to predict intentions and subsequent behaviors related to texting and driving. In their study, participants completed a questionnaire on the traditional TPB variables in the context of sending or reading texts while driving. Participants also answered questions related to group and moral norms (whether the behavior violates an individual's sense of what society values as right and wrong). Past behavior was assessed with a single item (i.e., "In the past week, how often did you use your mobile phone to read/send SMS messages while driving?"). After one week, participants reported the numbers of text messages they sent and read while driving during the previous week. Nemme and White found that the traditional TPB variables of attitude, subjective norms, and PBC predicted participants' intentions to send texts while driving, while only attitudes predicted intentions to read texts. The only significant predictors of actual behaviors of sending or reading texts while driving were past behavior, moral norms, and intentions.

Extending Nemme and White's (2010) research, Benson et al. (2015) assessed salient beliefs related to the TPB variables. Benson et al. examined indirect beliefs related to attitudes, subjective norms, and PBC. While self-efficacy was also added to provide insight on participants' confidence and ability to text while driving, unlike Nemme and White, past behaviors were not evaluated. The full model explored the ability of attitudes, subjective norms, PBC, self-efficacy, and moral norms to predict intentions. Like Nemme and White, Benson et al. found that attitudes and moral norms were significant predictors of intentions to send text messages while driving; however, PBC was not a significant predictor in their model. Indirect attitudinal beliefs related to saving time and boredom also predicted intentions to text and drive, as did normative beliefs about the approval of friends and family. These findings suggest that attitudes and norms, rather than PBC, are more reliable predictors of intentions to text and drive.

As past behavior was the strongest predictor of both intentions and self-reported behavior in Nemme and White's (2010) study, others have investigated the role of past behavior and habitual cell phone use (Bayer & Campbell, 2012; Gauld et al., 2014). Gauld and colleagues found that a measure of the addictive tendencies related to mobile phone use predicted intentions and behavior related to concealed texting while driving. Similar to Nemme and White (2010), Gauld et al. employed a main questionnaire to assess TPB variables, and then used a one-week follow-up to evaluate texting behaviors. Attitudes, subjective norms, PBC, moral norms, and mobile phone involvement were all found to be significant predictors of intentions related to concealed texting, while intentions were the only significant predictor of actual behavior. Bayer and Campbell provided further evidence for the important role of habitual mobile phone use has on future distracted driving. They used a frequency-independent measure (e.g., "Texting is something I do without thinking") to assess the automaticity of participants' texting behaviors. Bayer and Campbell's model incorporated frequency-independent texting habits along with age, gender, driving confidence, and overall texting frequency. Although Bayer and Campbell's model included TPB items borrowed from Nemme and White's study to assess attitudes, subjective norms, and PBC, it did not include intentions. Instead, they used how often participants reported sending and reading text messages while driving as the criterion variables. Bayer and Campbell found that habit/automaticity (behavior occurring without explicit intent) positively predicted self-reported texting and driving behaviors. Importantly, this habit/automaticity measure remained a positive predictor even when controlling for TPB variables, as well as overall texting frequency. The robust nature of their measure of texting habits suggests that habitual behavior ought to be examined in addition to the conscious beliefs assessed within the TPB framework.

Overall, most studies have found that compared to subjective norms and PBC, attitudes are a more reliable predictor of intentions to text and drive (Benson et al., 2015; Nemme & White, 2010). These studies have also found support for the addition of moral norms (whether the behavior violates an individual's sense of what society values as right and wrong) to these

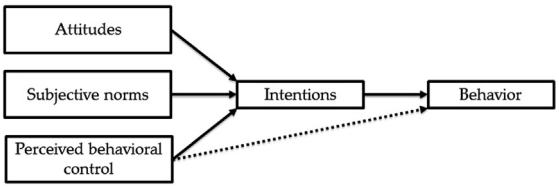

Fig. 1. The Theory of Planned Behavior.

TPB models (Benson et al., 2015; Gauld et al., 2014; Nemme & White, 2010). Of these studies, only Nemme and White and Gauld et al. directly measured actual behaviors. Indeed, past behavior and habitual cell phone use have consistently been found to be significant predictors of intentions to text and drive (Bayer & Campbell, 2012; Gauld et al., 2014; Nemme & White, 2010).

1.2. The current study

Since past behavior and habitual cell phone use have been found to influence distracted driving behavior outside of the TPB variables (Bayer & Campbell, 2012; Gauld et al., 2014; Nemme & White, 2010), the goal of the current study was to use an extended TPB framework to examine the factors that influence young adults' decision to text while driving. We sought to provide further evidence to support using TPB models to assess distracted driving behaviors. TPB models are preferable to alternatives which have been used to study distracted driving (cf., Carter, Bingham, Zakrajsek, Shope, & Sayer, 2014; Rhodes & Pivik, 2011). Compared to other theories, the TPB model offers a more holistic view of human behavior by incorporating beliefs related to all of the following: social norms (i.e., subjective norms), perceived ability (i.e., PBC), personal evaluations (i.e., attitudes), and behavioral intentions. In our view, TPB models capture the widest range of beliefs that could be relevant to distracted driving.

Additionally, we examined whether other behaviors related to mobile phone use while driving would predict intentions to text and drive. Following the Benson et al.'s (2015) approach, our proposed TPB model also includes factors related to moral norms and self-efficacy. Moral norms have been consistently found to be a significant predictor of intentions to text while driving (Benson et al., 2015; Gauld et al., 2014; Nemme & White, 2010). Although Benson et al. (2015) did not find self-efficacy to be a significant predictor of intentions, this measure of confidence and capability was included to provide an alternative to PBC. While similar in definition, self-efficacy is conceptually distinct from PBC and exhibits dissimilar interactions with intentions and behavior (Armitage & Conner, 1999; Conner & Armitage, 1998; Terry & O'Leary, 1995). Consequently, we hypothesized (H1) that the extended TPB variables (i.e., attitudes, subjective norms, and PBC with past behavior, moral norms and self-efficacy) will predict intentions to text and drive (see Fig. 2).

Habitual engagement in other distracted driving behaviors may provide additional perspective on the decision to text and drive. Studies have found that even minor cell phone related activities, such as speech-based text entry (He et al., 2014) and receiving a cell phone notification (Stothart et al., 2015), can disrupt a driver's attention enough to significantly impair response times. Therefore, an examination of texting-related behaviors could clarify young drivers' distracted driving habits. Bergmark, Gliklich, Guo, and Gliklich (2016) developed an 11-item Distracted Driving Exposure scale (DDE) as a means of assessing a wide-range of distracted driving behaviors.[1] Additionally, DDE scores were correlated with self-reported crash rates. Notably, the DDE includes items that evaluate how often the behavior is initiated, as well as items that uncover when the behavior was initiated. The scale's use of frequency-independent measures allows us to assess habitual behaviors associated with distracted driving. Since past behavior and habitual cell phone use have been consistently found to be the leading predictors of intentions to text and drive (Bayer & Campbell, 2012; Gauld et al., 2014; Nemme & White, 2010), we hypothesized (H2) that past behavior as measured by the DDE will be the strongest predictor of intentions to engage in texting while driving.

2. Method

2.1. Sample and procedure

A total of 259 undergraduate students at a medium-sized university in the mid-Atlantic region of the United States participated in this study. Volunteers received Psychology course credits for their participation. Nearly all participants (94.86%) had a driver's license, and 76.25% owned a car. Participants without a driver's license (n = 14) were excluded from further analysis. Of the remaining participants (n = 245), most were female (80.00%) and the mean age was 19.38 (SD = 1.89, median = 19.00). Over half of participants (59.18%) identified as Caucasian (n = 145), 17.14% as African-American, 11.02% as Asian American, 10.20% as Hispanic, 8.16% as Other, and 7.76% as more than one race. Participants experienced an average of 1.20 years of college (SD = 1.29) with a mean GPA of 3.23 (SD = 0.50).

[1] Bergmark and colleagues validated the DDE on a sample of young adults (ages 18–24) and found that these items were highly related (Cronbach's α = 0.92).

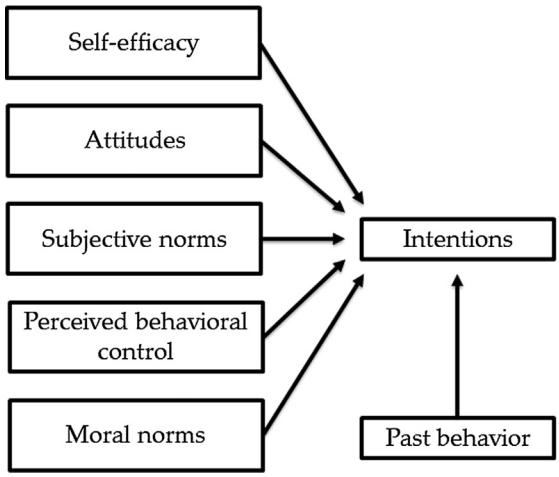

Fig. 2. The proposed extended TPB model.

Participants were tested individually at computers in groups of up to six students per session. The data reported here is a subset of the data taken from a larger study on risk perceptions related to distracted driving. The study was split into seven sections: distracted driving exposure questionnaire, pre-risk assessment questionnaire, the risk assessment, the post-risk assessment questionnaire, the assessment of cognitive abilities, demographic questionnaire, and the assessment of working memory capacity. All participants were given one hour to complete the sections in this order. Only the results of the distracted driving exposure questionnaire and post-risk assessment questionnaire are reported here.

During the post-risk assessment, participants responded to a questionnaire inquiring about their perceptions of the risks associated with distracted driving, including a section on key variables related to the TPB described below.

2.2. Measures

2.2.1. Past behavior

Previous distracted driving behavior was measured using the Distracted Driving Exposure scale (DDE; Bergmark et al., 2016). This 11-item measure assessed cell phone use related distracted driving, focusing on behaviors related to texting, email, and other viewing and writing activities. The DDE was validated on a sample of those ages 18–24, where DDE scores were found to be significantly correlated with self-reported crash rates. Three additional questions were added to assess a wider range of distracted driving behaviors: "In the last 30 days, when have you read messages or viewed information on social media apps or sites while driving?"; "In the last 30 days, have you TALKED on your cell phone while driving?"; and "In the last 30 days, when have you TALKED on your cell phone while driving?" (Cronbach's $\alpha = 0.92$).

2.2.2. TPB variables

Survey items assessed variables relevant to an extension of the TPB – intentions, attitudes, PBC, subjective norms, self-efficacy, and moral norms. All items described below were from Benson et al.'s (2015) study to ensure consistency. We did not conduct an elicitation study to extract participants' direct beliefs about distracted driving. Although most other studies do not employ this methodology before administering a TPB questionnaire (e.g., Bayer & Campbell, 2012; Gauld et al., 2014; Nemme & White, 2010, but see Benson et al., 2015 for an exception), we acknowledge that there may be some incongruity between the TPB constructs and our sample's direct beliefs about distracted driving.

The TPB items were presented in a set order, as follows.

Intentions to engage in texting while driving were assessed using three items. Participants rated the extent to which they agreed with statements about their intentions on a 7-point scale with response options ranging from (1) Strongly Disagree to (7) Strongly Agree. Participants responded to three statements: "I expect to text while driving in the next 30 days," "It is likely that I will text while driving in the next 30 days," and "I intend to text while driving in the next 30 days." Responses were averaged across the three items to produce a composite scale, with higher scores reflecting greater intentions to text and drive (Cronbach's $\alpha = 0.91$).

Attitudes toward texting while driving entailed five items that asked participants to rate to what extent texting while driving is DANGEROUS or SAFE, USEFUL or WORTHLESS, GOOD or BAD, UNPLEASANT or PLEASANT, and STRESS-FREE or STRESSFULL. Ratings were on a scale from (1) DANGEROUS, WORTHLESS, BAD, UNPLEASANT, or STRESSFUL to (7) SAFE, USEFUL, GOOD, PLEASANT, or STRESS-FREE. The scores for these items were reversed so that higher scores reflect more positive attitudes. The five items were averaged to create a composite scale (Cronbach's $\alpha = 0.83$).

Perceived behavioral control (PBC) of texting and driving was assessed using three items. For the first item, participants used a scale from (1) Complete Control to (7) No Control to rate "How much personal control do you have over whether you text and drive?". The other two items were measured on a scale from (1) Strongly Disagree to (7) Strongly Agree: "The decision to text while driving is beyond my control;" and "The decision to texting while driving is entirely up to me." A composite score was calculated by taking the mean of the three items (Cronbach's $\alpha = 0.24$). Higher scores reflect a greater sense of PBC.

Subjective norms for texting while driving was measured with three items, measured on a (1) Very Likely to (7) Very Unlikely scale. Items included: "Most people who are important to me think that I should text and drive;" "Most people who are important to me would approve of me texting while driving;" and "Most people who are important to me text while driving." The mean of these items was calculated to create a composite score, with higher scores indicating a weaker perception that others approve of texting while driving (Cronbach's $\alpha = 0.84$).

Self-efficacy regarding the ability to text and drive was assessed with three items. The items "I am confident that I could read or send a text message while driving" and "I am capable of reading or sending a text message while driving" were measured on a scale from (1) Strongly Disagree to (7) Strongly Agree. The item "For me to read or send a text message is" was assessed on a scale from (1) Easy to (7) Hard, and was reversed scored. Responses to these items was averaged to form a composite score (Cronbach's $\alpha = 0.87$). Higher scores reflect greater confidence in texting and driving capabilities.

Moral norms for texting and driving entailed three items. Participants rated their level of agreement on a scale from (1) Strongly Disagree to (7) Strongly Agree. Participants responded to the following statements: "I would feel guilty if I read or sent a text while driving;" "I personally think that texting while driving is wrong;" and "Texting while driving goes against my principles." The items were averaged to create a composite score, with higher scores reflecting moral norms less in favor of texting and driving (Cronbach's $\alpha = 0.74$).

2.2.3. Demographic questionnaire

Demographic questions included: gender, age, race, and ethnicity. An additional six questions related to driving were posed related to license ownership, vehicle ownership, distracted driving crash history, and distracted driving penalty history.

2.2.4. Attention check

Two lure items were included in the testing procedure to ensure participants were paying attention. Twice during the survey, participants were instructed to select a specific response to a multiple-choice item on a scale from 1 to 7. Of the 259 participants, 13 (5.0%) participants failed both attention checks and were excluded from further analysis.

3. Results

3.1. General findings

The final sample consisted of 232 participants whose data are included in the following analyses. Regarding the Distracted Driving Exposure (DDE) questionnaire, most participants reported both reading (83.5%) and writing (76.6%) a text message while driving in the last 30 days, and 6.8% of participants reported that they had been involved in a motor vehicle crash connected to texting and driving. Just 2.1% of participants reported being issued a citation for texting while driving. The sample's average DDE score was 18.28 ($SD = 10.63$). An independent-samples t-test revealed men had significantly higher DDE scores ($M = 21.11$, $SD = 10.48$) than did women ($M = 17.57$, $SD = 10.57$), $t(230) = 2.05$, $p = .041$. Furthermore, age was positively correlated with DDE, $r = 0.24$, $p < .001$.

The descriptive statistics for the TPB variables are illustrated in Table 1. Levene's test for homogeneity of variance was statistically significant, therefore the t-tests for unequal variance are reported. Participants exhibited moderate intentions to engage in texting while driving ($M = 3.04$, $SD = 1.62$), with no differences between men and women, $t(65.02) = 1.53$, $p = .132$. Attitudes towards texting and driving were negative ($M = 2.15$, $SD = 0.95$). Women ($M = 2.07$, $SD = 0.93$) had significantly more negative views about distracted driving than did men ($M = 2.44$, $SD = 1.03$), $t(66.36) = 2.23$, $p = .029$. Participants perceived themselves to have high levels of control over behaviors related to texting while driving ($M = 6.38$, $SD = 0.81$), believed that others did not approve of the behavior ($M = 5.49$, $SD = 1.11$), and viewed texting and driving to be slightly immoral ($M = 4.71$, $SD = 1.34$). While the sample's average score for self-efficacy was neutral ($M = 3.90$, $SD = 1.51$), men's score ($M = 4.55$, $SD = 1.33$) were higher than those reported by women ($M = 3.73$, $SD = 1.51$), $t(78.98) = 3.67$, $p = <.001$. Additionally, age was significantly correlated with intentions to text and drive ($r = 0.13$, $p = .048$); older participants reported being more intent on texting and driving.

3.2. Correlation analysis

The relationship among past behavior and the variables related to the TPB model was assessed. Table 1 shows the calculated correlation matrix, as well as the means and standard deviations of all measures. Intentions to text and drive shared a significant, positive relationship with attitudes ($r = 0.52$, $p < .001$), self-efficacy ($r = 0.62$, $p < .001$), and DDE ($r = 0.60$,

Table 1
Descriptive statistics and correlations among TPB variables and past behavior.

Variables	*M*	*SD*	1	2	3	4	5	6	7
1. Intentions	3.04	1.62	–						
2. Attitudes	2.15	0.96	0.52*	–					
3. PBC	6.38	0.81	−0.06	−0.12	–				
4. Subjective Norms	5.49	1.11	−0.24*	−0.25*	0.11	–			
5. Moral Norms	4.71	1.34	−0.57*	−0.67*	0.19*	0.17*	–		
6. Self-Efficacy	3.90	1.51	0.62*	0.55*	−0.06	−0.13*	−0.53*	–	
7. DDE	18.28	10.63	0.60*	0.45*	−0.15*	−0.11	−0.44*	0.44*	–

Note: PBC = Perceived Behavioral Control; DDE = Distracted Driving Exposure. All TPB variables have a possible range of 1–7, DDE has a possible range of 0–66.

* $p < .007$ (Bonferroni corrected p value).

$p < .001$). Those with more positive attitudes towards texting and driving, a greater sense of being able to read or send a text message while driving, and more exposure to distracted driving behaviors were more like to intend to engage in distracted driving in the future. Intentions were negatively correlated with both subjective norms ($r = -0.24$, $p < .001$) and moral norms ($r = -0.57$, $p < .001$). Individuals with a greater sense that others would disapprove of them texting and driving and those who believed texting while driving was morally wrong were less likely to intend to do so.

Past behavior, as measured by the DDE, was positively correlated with attitudes ($r = 0.45$, $p < .001$) and self-efficacy ($r = 0.44$, $p < .001$). Those with more previous exposure to distracted driving were more likely to have more positive attitudes towards the behavior and the beliefs that they could successfully text and drive. Past behavior was negatively correlated with moral norms ($r = -0.44$, $p < .001$), indicating that those with greater exposure to distracted driving were less like to view the behavior as immoral.

3.3. Regression analysis

A multiple regression analysis was conducted to assess the ability of the TPB variables to predict intentions to text while driving. In the first step of the analysis, the intentions variable was regressed on attitudes, subjective norms, and PBC. The variables moral norms and self-efficacy were entered on step two, and past distracted driving behavior was added on step three. The results are illustrated in Table 2.

In the first step of the regression analysis, attitudes, subjective norms, and PBC accounted for 29% of the variance in intentions to text while driving. Attitudes (standardized $\beta = 0.50$, $p < .001$) and subjective norms (standardized $\beta = -0.17$, $p = .044$) were both significant predictors. Those who had more positive attitudes towards texting while driving were more likely to do it, whereas those who perceived stronger subjective norms against texting while driving were less likely to do it.

The addition of moral norms and self-efficacy significantly improved the model, F change $(2, 226) = 43.82$, $p < .001$. This model accounted for 49% of variance in intent to text and drive. Both moral norms (standardized $\beta = -0.28$, $p < .001$) and self-efficacy (standardized $\beta = 0.41$, $p < .001$) were significant predictors. Those with weaker moral norms against distracted driving were more likely to intend to text and drive. Individuals with higher self-efficacy were more likely to intend to drive distracted. While subjective norms (standardized $\beta = -0.12$, $p = .016$) remained a significant predictor in this model, attitudes (standardized $\beta = 0.08$, $p = .226$) did not significantly predict intentions with the addition of variables related to moral norms and self-efficacy.

The addition of past behavior in step three significantly increased the amount of variance explained by the model, F change $(1, 225) = 46.92$, $p < .001$. DDE (standardized $\beta = 0.35$, $p < .001$) was a significant predictor of intent. Increased past behavior was related to greater intention to engage in distracted driving. Subjective norms (standardized $\beta = -0.12$, $p = .007$), moral norms (standardized $\beta = -0.23$, $p < .001$), and self-efficacy (standardized $\beta = 0.33$, $p < .001$) were all significant predictors in this final model. Overall, this model accounted for 58% of the variance in intentions to drive distracted.

A fourth model was calculated, removing all non-significant predictors. The revised model explained 57% of the variance in intentions to text while driving. DDE (standardized $\beta = 0.35$, $p < .001$) was the strongest predictor of intentions, followed by self-efficacy (standardized $\beta = 0.34$, $p < .001$), moral norms (standardized $\beta = -0.22$, $p < .001$), and subjective norms (standardized $\beta = -0.12$, $p = .007$).

4. Discussion

Our study extends research that has integrated past behavior with the Theory of Planned Behavior (TPB) when studying distracted driving. The TPB has been useful in identifying the conscious beliefs that contribute to intentions to drive distracted. The TPB framework has been successfully applied to the decision to text while driving in several studies (Bayer & Campbell, 2012; Benson et al., 2015; Gauld et al., 2014; Nemme & White, 2010). However, the TPB does not account for past behavior and habits. Previous work has established the predictive power of past behavior and habit in explaining texting and driving behaviors (Bayer & Campbell, 2012; Benson et al., 2015; Nemme & White, 2010). Therefore, our goal was to examine

Table 2
Regression of intentions on attitudes, subjective norms, perceived behavioral control, self-efficacy, moral norms, and distracted diving exposure.

Variables	B	*SE* B	95% CI	*β*	*T*	*p*
Step 1: $R^2 = 0.29$, $F(3, 228) = 30.75$						<.001
Attitudes	0.83	0.10	0.64–1.03	0.50	8.57	<.001
Subjective Norms	−0.17	0.08	−0.34 to −0.01	−0.12	−2.02	.044
Perceived Behavioral Control	0.02	0.11	−0.20 to 0.24	0.01	0.14	.886
Step 2: $R^2 = 0.49$, $F(5, 226) = 42.91$						<.001
Attitudes	0.14	0.12	−0.09 to 0.37	0.08	1.21	.226
Subjective Norms	−0.18	0.07	−0.32 to −0.03	−0.12	−2.43	.016
Perceived Behavioral Control	0.07	0.10	−0.12 to 0.26	0.04	0.76	.446
Moral Norms	−0.34	0.08	−0.50 to −0.18	−0.28	−4.23	<.001
Self-Efficacy	0.44	0.06	0.31–0.56	0.41	6.90	<.001
Step 3: $R^2 = 0.58$, $F(6, 225) = 50.85$						<0.001
Attitudes	0.02	0.11	−0.19 to 0.23	0.01	0.15	.878
Subjective Norms	−0.18	0.07	−0.31 to −0.05	−0.12	−2.74	.007
Perceived Behavioral Control	0.13	0.09	−0.05 to 0.30	0.07	1.46	.146
Moral Norms	−0.28	0.07	−0.42 to −0.13	−0.23	−3.68	<.001
Self-Efficacy	0.35	0.06	0.23–0.47	0.33	5.90	<.001
Distracted Driving Exposure	0.05	0.01	0.04–0.07	0.35	6.85	<.001
Step 4: $R^2 = 0.57$, $F(4, 227) = 75.68$						<0.001
Subjective Norms	−0.17	0.06	−0.30 to −0.05	−0.12	−2.71	.007
Moral Norms	−0.27	0.06	−0.39 to −0.14	−0.22	−4.10	<.001
Self-Efficacy	0.36	0.06	0.25–0.47	0.34	6.28	<.001
Distracted Driving Exposure	0.05	0.01	0.04–0.07	0.35	6.87	<.001

Note: $N = 232$.

whether habits related to other behaviors involving mobile phone use while driving would predict intentions to text and drive.

We predicted that an extended TPB model with the addition of self-efficacy and moral norms would predict intentions to text while driving (H1). Furthermore, we hypothesized that past behavior would also predict distracted driving intentions (H2). The results of this study support these hypotheses. The extended TPB model incorporating moral norms and self-efficacy accounted for 49% of the variance for intentions to text and drive. Moreover, the addition of DDE improved the model and was the strongest predictor of intentions. Attitudes and PBC were nonsignificant in the third model, and removing these variables yielded a model that still accounted for 57% of the variance in intentions. Our results are similar to those found in previous studies. For instance, Nemme and White (2010) found that subjective norms, but not attitudes, predicted actual texting and driving behavior. Bayer and Campbell's (2012) model found social/moral norms to be a significant predictor, but neither attitudes nor PBC were significant predictors. Our results suggest that messaging campaigns designed to alter young adults' intentions to text while driving would be most successful by focusing on subjective norms, moral norms, and self-efficacy.

Even though participants in our study held unfavorable beliefs towards texting while driving, distracted driving exposure was highly prevalent in this study. Around 83% of participants reported having read a text message while driving in the previous month, and around 76% had written a text message while driving during that period. Although these prevalence rates may seem high, this figure is within the range found in the literature (Atchley et al., 2011; Harrison, 2011; Hill et al., 2015). Additionally, with an average score of 6.38 out of 7, participants reported believing themselves to be in control of the decision to text while driving. Again, this is similar to results found in most other studies using the TPB framework (Bayer & Campbell, 2012; Benson et al., 2015; and Nemme & White, 2010, but not Gauld et al., 2014). However, because PBC was not a predictor of intentions to engage in distracted driving in neither this study nor any others, it is unlikely that beliefs about control drive the decision to text while driving.

Beliefs surrounding self-efficacy could explain why distracted driving is prevalent despite widespread subjective norms against it. In Harrison's (2011) limited survey of college students' distracted driving habits, participants reported being fairly neutral in their opinion as to whether knowing the dangers of texting while driving would alter their behavior. In contrast, Hill et al.'s (2015) comprehensive sample of young adults found a connection between perceived driving skills and distracted driving; participants who were most confident in their ability to text while driving reported the most distracted driving. Hill et al.'s study replicated research on mobile phone use in general, which suggests that self-efficacy for multitasking while driving is a strong predictor of distracted driving (Walsh, White, Hyde, & Watson, 2008; White, Cunningham, & Tichener, 2011). Evidence that self-efficacy influences intentions to drive distracted may also explain the disconnect between risk perception and distracted driving (Atchley et al., 2011; Nelson, Atchley, & Little, 2009). Our results have important ramifications for those designing traffic safety media campaigns. It is not enough that interventions focus on the dangers associated with distracted driving; rather, these interventions might also need to tackle young adults inflated confidence in their ability to safely drive while distracted.

Our study also provides further evidence that past behavior should be considered when designing interventions on distracted driving behaviors. Although the TPB focuses on consciously held beliefs, it is apparent that habitual behaviors influence future intentions. A similar criticism of TPB was provided by Bayer and Campbell (2012), who found that habit/automaticity positively predicted self-reported exposure to texting and driving behaviors independent of the TPB variables. The robustness of this habit measure led Bayer and Campbell to call for studies to deconstruct the dynamics underlying the automatic dimensions of behaviors related to texting while driving. Although the notion that automatic behaviors are the primary cause of the distracted driving problem is an attractive notion, this finding needs to be interpreted with some caution. Bayer and Campbell's study neglected to evaluate intentions to engage in distracted driving. Traditionally, TPB models attempt to predict future behavior through the pathway seen in Fig. 1. In their study, Bayer and Campbell omitted a measure of intentions while using a measure of distracted driving frequency as a dependent measure. They justify this exclusion by arguing that the use of intention measures in cross-sectional studies is inappropriate both for being measured without a follow-up and for being prone to a consistency-bias. The exclusion of intentions may have been premature, since other research suggests that intentions consistently predict self-perceived behavior (e.g., Armitage & Conner, 1999). Encouragingly, Nemme and White (2010) found that intentions predicted subsequent distracted driving behaviors in their TPB model. Therefore, Bayer and Campbell offer an imperfect model of TPB when compared to other studies in the distracted driving canon.

The model generated in our study improves upon previous research that has used a TPB framework to evaluate beliefs about the decision to text and drive. Subjective and moral norms were found to influence distracted driving intentions, replicating the findings of other researchers (Bayer & Campbell, 2012; Benson et al., 2015; Gauld et al., 2014; Nemme & White, 2010). Unique to the current study is the finding that self-efficacy significantly predicted distracted driving intentions. Although Benson et al. (2015) incorporated a self-efficacy variable into their model, their measure of confidence and ability to text and drive was not a significant predictor of intentions in their study. The current study used the same self-efficacy questionnaire as Benson et al., which yielded nearly equivalent descriptive statistics. Nonetheless, in similar regressions of intentions on TPB variables, self-efficacy was a much stronger predictor of intentions in the current model. The main difference between Benson et al. and the current study is in the demographics of the sample. The current study drew from a pool of American college students (ages 18–33), whereas Benson et al.'s participants were from a more general population in Northern Ireland (ages 18–69). Aside from the demographic differences, it is unclear why such a large discrepancy occurred. Additional research is needed to clarify if the influence of self-efficacy on distracted driving intentions is present in younger, but not older, American drivers. If confirmed, this age-based difference could show how including self-efficacy themes in anti-distracted driving messaging would impact younger, American demographics.

Moreover, the current study provided evidence that habit/automaticity influences distracted driving intentions despite norms discouraging this behavior. In light of similar findings from Bayer and Campbell (2012), the question becomes, how do researchers integrate nonconscious habits with the TPB, which is driven by the assumption that (reasoned) behaviors occur due to conscious beliefs? Although the conscious consideration of beliefs regarding attitudes, capabilities, and intentions is important in the beginning stages of enacting a behavior, the TPB posits that habitual behaviors do not require such conscious assessment (Ajzen & Fishbein, 2000; Ajzen & Sexton, 1999; Bamberg, Ajzen, & Schmit, 2003). Beliefs associated with well-practiced behaviors can be retrieved with limited cognitive effort. However, Bamberg et al. (2003) showed that relevant events, such as the offer of a prepaid bus ticket, can induce more reasoned action. In their study of travel mode choice in college students, Bamberg et al. found that past behavior had a significant impact on both intentions and behavior. However, past behavior lost its predictive ability after an intervention was introduced. Once a compelling alternative was provided, students could deliberate whether it was more beneficial to proceed with their habitual behavior of transit or select an alternative. Here, past behavior provided an insight into travel choices that have become semi-automatic habits. When unchallenged, one's previous actions strongly predicted what one may do in the future.

Bamberg et al. (2003) also noted that while habits may include actions that are performed without much cognitive effort, there are many actions which do require cognitive regulation. In the case of texting while driving, the decision to respond to a notification may be automatic, but the mechanics of typing the text message and driving the car require active monitoring. Herein lies the problem with texting and driving: deciding to engage in the act is simple, but negotiating the execution is complicated and dangerous (cf., Caird et al., 2014; Overton et al., 2014; Ranney, 2008). An intervention like the one Bamberg et al. employed is unlikely to be effective since there is a more complex collection of behaviors that comprise distracted driving. Obviously, decreasing the number of drivers on the road would reduce the number of distracted driving fatalities. Although it may be sound logic to say that individuals who are not driving cannot drive distracted, there are many exogenous factors to consider, such as the availability of ride-share programs or public transportation (Nieuwenhuijsen & Khreis, 2016; Santos, Behrendt, Maconi, Shirvani, & Teytelboym, 2010; Scheepers et al., 2014). Although public media campaigns are not directly behavioral interventions, they may be the most likely means of reducing adolescents' distracted driving.

The current study supports the use of interventions that focus on messaging which considers the psychological factors underlying the decision to text while driving – in conjunction with past behavior and habits.

4.1. Limitations

A limitation with this study is the focus on self-reported beliefs and habits, rather than actual behavior. The inclusion of a direct measurement of texting and driving behaviors would allow researchers to test the entirety of the TPB model, since

intentions have been shown to predict actual behaviors (Ajzen, 1991). Although Nemme and White (2010) found that intentions, moral norms, and past behavior were strong predictor of self-reported distracted driving behaviors, no study has evaluated the relationship between the TPB variables and directly-measured distracted driving behaviors. Future research could incorporate driving simulators or log texting data as an alternative to self-reported measures of behavior.

Another limitation of the study relates to the conditions under which we administered the TPB questionnaire. While the items assessing intentions were given a 30 day timeframe, the other items did not specify any timeframe. There may be some concern that this questionnaire violated the principle of compatibility (Ajzen, 2011). Therefore, we recommend that future research include consistent temporal framing among TPB items.

Additionally, before responding to the TPB questionnaire, participants viewed information about the risks associated with distracted driving (though, the DDE was completed beforehand). While there is the possibility that viewing this information may have biased participants, there is reason to be optimistic that this was not the case. The samples' average responses to the TPB items are very similar to those from Benson et al. (2015), from which these items were taken. While this suggests that the problem of bias should be of minimal concern, future research ought to minimize the likelihood of such a contagion.

Finally, since this study only sampled college students, the generalizability of this study to all young adults is limited. Future research should be aware that a more representative study would improve the external validity of research in this field.

4.2. Conclusions

Texting while driving was highly prevalent among young adults in this study, despite negative beliefs and discouraging norms surrounding distracted driving. We found that believing texting while driving is immoral and disapproved of by others predicted lowered self-reported intentions to do so. However, distracted driving habits and beliefs that one is capable of texting while driving positively predicted intentions. The finding that habitual distracted driving strongly predicts intentions, beyond conscious beliefs regarding norms and self-efficacy, presents a challenge to those designing interventions using the theory of planned behavior. Traffic safety professionals are advised to consider how habitual behaviors related to cell phone use can be targeted in order to reduce distracted driving fatalities. Based on our results, messaging related to subjective norms, moral norms, and self-efficacy may be the most relevant to changing young drivers' intentions to drive distracted. Future research should concentrate on connecting the TPB framework to directly assessed behaviors related to distracted driving. Such efforts would ensure that interventions are effective in targeting, and reducing, car crashes related to text messaging.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.trf.2018.09.027.

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