



Texting while driving on automatic: Considering the frequency-independent side of habit

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ABSTRACT

This study tested the potential of the frequency-independent components of habit, or automaticity, to predict the rate of texting while driving. A survey of 441 college students at a large American university was conducted utilizing a frequency-independent version of the experimentally validated Self-Report Habit Index (SRHI; Orbell & Verplanken, 2010; Verplanken & Orbell, 2003). Controlling for gender, age, and driver confidence, analyses showed that automatic texting tendencies predicted both sending and reading texts while driving. The findings suggest that texting while driving behavior may be partially attributable to individuals doing so without awareness, control, attention, and intention regarding their own actions. The unique contribution of automaticity explained more variance than overall individual usage, and remained significant even after accounting for norms, attitudes, and perceived behavioral control. The results demonstrate the importance of distinguishing the level of automaticity from behavioral frequency in mobile communication research. Future applications and implications for research are discussed.

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1. Introduction

On the surface, the decision to engage in texting while simultaneously navigating rush hour traffic seems absurd. In addition to operating the vehicle's interface, obeying travel laws, traversing traffic, and locating destinations, the texting individual is required to pinpoint and retrieve his or her mobile device, situate the current conversation, and devise an appropriately human message – placing lives not just in the hands of the driver, but in the fingers. It is no surprise then that the National Transportation Safety Board recently called on all remaining states in the US to forbid such behavior after examining specific cases of texting-based accidents (NTSB, 2011).

Despite increased bans and awareness, the phenomenon of texting while driving continues to escalate (Lowy, 2011). Yet at the same time, national surveys show most people favor driving bans (Strayer, Watson, & Drews, 2011), and people perceive this behavior to be very risky (Atchley, Atwood, & Boulton, 2011). Cell phone and text message distractors have been shown to inhibit individuals' cognitive abilities, evidenced by lower performance on computerized true–false exercises (Smith, Isaak, Senette, & Abadie, 2011). Likewise, texting behind the wheel has been found to impair driving in simulated experiments (Drews, Yazdani, Godfrey,

Cooper, & Strayer, 2009). In their review of cognitive distraction in motor vehicles (Strayer et al., 2011) argue that explaining the misalignments among safety, perceived risk, and behavior is essential both theoretically and for the purposes of elevating public policy and safety. This study takes a step in that direction by examining key predictors of texting while driving, while also addressing conceptual and methodological needs that are apparent in the extant research in this area.

Over the last few years, a series of studies have emerged that investigate the psychological predictors of mobile phone use while driving (Atchley et al., 2011; Feldman, Greeson, Rennan, & Robbins-Monteith, 2011; Nemme & White, 2010; Walsh, White, Hyde, & Watson, 2008; White, Hyde, Walsh, & Watson, 2010; Zhou, Rau, Zhang, & Zhuang, 2012; Zhou, Wu, Rau, & Zhang, 2009). Drawing on cognitive dissonance theory (Atchley et al., 2011) found that once young drivers make the decision to text, they then perceive the road conditions to be less dangerous. Participants claimed that they more frequently read than sent messages, and texted more for the purpose of coordination than relieving boredom. Feldman et al. (2011) investigated the link between mindfulness and texting while driving, and found them to be negatively related. In contrast to participants' reports in the study by Atchley et al. (2011), they found that this relationship appeared to be mediated by motives to regulate emotions, such as anxiety, loneliness, and boredom. Zhou et al. (2012) recently examined the role of compensatory decisions, such as pulling to the side of the road or reminding the caller that the individual was driving. Participants reported

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that they were likely to use these strategies, and such behavior was most predicted by intentions to do so and perceived behavioral risk and control. These studies reveal a complex picture regarding texters' motivations that plays out on a moment-to-moment basis and depends on intentions, risk perception, and personality differences.

Several studies have applied the widely used and validated theory of planned behavior to explain texting while driving (TPB; see Armitage & Conner, 1999, 2001; Azjen, 1991). The basic model includes attitudes, subjective norms, and perceived behavioral control (PBC), which indirectly influence behavior by way of conscious intentions. Studies of mobile phone use support the validity of TPB as a framework for understanding this behavior (e.g., Nemme & White, 2010; Zhou et al., 2009, 2012). Although somewhat different patterns have emerged for calling (Zhou et al., 2009), texting while driving results have shown that attitudes, more than subjective norm or PBC, significantly predict intentions to text and drive (Walsh et al., 2008). More recently, Nemme and White (2010) provided evidence for the role of robust social influence factors by adding moral and group norms to the model, each of which are significant predictors of texting while driving. Using a longitudinal design, the study also found that the control variable of past behavior was the strongest predictor of both intentions to text and drive and reported frequency of this behavior. Since frequent behaviors can lead to habitual processes, the authors noted the potential for habit to influence texting behavior while driving. Past behavioral frequency, however, does not differentiate between conscious and nonconscious decisions, which is vital when measuring habit (LaRose, 2010). Moreover, reported levels of past frequency do not take into account the defining characteristics of habitual behavior. Thus, the current study aims to investigate the role of habit in texting while driving with a focus on *how* (rather than *how much*) the behavior is carried out.

Habit has been identified to play a major role in a number of activities related to media, communications, information systems, and human–computer interaction research (LaRose, 2010; Limayem, Hirt, & Cheung, 2007). Not surprisingly, it has also begun to gain the attention of mobile communication researchers. Employing a social cognitive framework, Peters (2009) found habit, rather than outcome expectations, to be the best predictor of mobile phone usage. Furthermore, Oulasvirta, Rattenbury, Ma, and Raita (2012) recently used logs, programmed into smartphones, to examine the habitual nature of smartphone behaviors. In doing so, the researchers identified the “checking habit” from sessions that were rapidly executed, repeated in an identical manner, and associated with the same cue. The most salient checking habit involved “touching” the home screen for one second. SMS messaging clients were the most used applications after the home screen and were also noted for their high level of habit-like behaviors. The researchers introduced the idea of checking habits as a “gateway” to other applications. In turn, an individual could begin a touching habit and notice an SMS cue unintentionally. Such checking habits represent a type of automatic behavior, or *automaticity*.

Automaticity can be understood as behavior that is triggered by situational cues and lacks control, awareness, intention, and attention (Bargh, Chen, & Burrows, 1996). In a series of studies on smoking behavior, Orbell and Verplanken (2010) showed that habit could be viewed as a form of “cue-contingent automaticity.” A texting cue, for instance, could manifest as a vibration, a “new message” symbol, a peripheral glance at a phone, an internal “alarm clock”, a specific context, or perhaps a mental state. Thus, the triggers can be either external or internal. In the case of more habitual behavior, reacting to these cues becomes automatized to the point that the actor may do so without even meaning to do it. Oulasvirta et al. (2012) argue that the conception of addictive smartphone

usage—similar to Internet behavior (e.g., checking e-mail, see LaRose, Lin, & Eastin, 2003)—may simply be an exaggeration of habitual operations.

Present theories of habit highlight the advantages of looking at behaviors from a frequency-independent perspective (LaRose, 2010; Verplanken, 2006, 2010). In addition to delineating conscious and unconscious behaviors, recent research indicates there is individual variability in both the maximum automaticity and length of time that individuals' habits take to peak (Lally, Van Jaarsveld, Potts, & Wardle, 2010). In the past, and in everyday usage, habits were and still are often equated with behaviors done regularly that are hard to give up (see Chatzisarantis & Hagger, 2007). Conversely, the construct of habitual behavior represents not just a linear relationship with past usage, but individual differences in automaticity. Frequent behaviors can be consciously performed in a reliable manner, and infrequent behaviors can be performed unconsciously.

This is particularly relevant for the area of mobile communication. Mobile phones have now become an ingrained element within society and are almost always at an arm's reach. Paradoxically, they have become “taken for granted” and “forgotten” due to operational necessity (Ling, 2012). Hence, the current study considers whether automatic phone tendencies may be better represented along a continuum independent of frequency. Two mobile phone users, then, could use their devices at an equal rate, but differ in the degree to which they perform the behavior automatically. Consequently, in this study, we hypothesized (H1) that the frequency-independent side of habit, or automaticity, would be a positive predictor of texting while driving. Furthermore, we predicted (H2) that the measure for automaticity would predict the outcome variable (texting while driving), even when controlling for individual differences in the overall frequency of texting.

In his comprehensive review of media habits, LaRose (2010) highlights mobile phones as an important avenue for future research due to their presence in constantly shifting contexts. Mobile phone habits present an interesting case because their potential cues and associations are essentially unlimited. Thus, it may be that texting while driving is a behavior acted out despite one's expressed (and best) interest. Habitual processes are known to guide behavior even when individuals possess intentions to alter such habits (see LaRose, 2010) and in times of conflicting motives (Neal, Wood, Wu, & Kurlander, 2011). Because of this, studies that exclusively use the theory of planned behavior variables may be insufficient in accounting for crucial aspects of the outcome. Therefore, we expected (H3) the relationship between texting automaticity and texting while driving to remain significant when accounting for other known conscious predictors of this behavior, including attitudes, norms, and PBC. This analytic structure helps to clarify the role of habit/automaticity when examined on its own and in relation to other key pieces of the puzzle already in place.

2. Methods

2.1. Sample and procedure

A total of 441 undergraduate students at a large university in the middle-eastern part of the US volunteered for this study to fulfill participation requirements for courses in Communication Studies as well as Psychology. While this convenience sample does not allow for generalizability, its characteristics are not unlike other studies laying the groundwork in this area (e.g. Feldman et al., 2011). Sixty-two percent of the participants were female and mean age was 18.43 ($SD = 2.49$). Participants responded to a questionnaire asking about their perceptions and uses of various aspects

of mobile communication technology and key constructs from TPB. All surveys were administered on a desktop computer in a laboratory setting, and typically took 15–25 min to complete. Items were randomized within sections to reduce ordering effects.

2.2. Measures

2.2.1. Criterion variables

Texting while driving was assessed along two dimensions, sending and reading. Sending a text while driving was measured with an item asking participants, “Please indicate how often you perform each behavior on average when you are in each context. Please answer according to what really reflects your experience rather than what you think your experience should be,” with response options on a five point scale (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Almost Always) ($M = 2.05$; $SD = 1.02$). Reading a text while driving was measured the same way, only with participants asked about their reading instead of sending ($M = 2.28$; $SD = 1.05$).

2.2.2. Frequency-independent habit

The measure for habitual texting was adapted from Verplanken and Orbell (2003), which is a 12-item scale designed to capture habits more broadly. The scale has been validated as a measure of the habit construct independent of frequency (Verplanken, 2006). Most recently, Orbell and Verplanken (2010) experimentally validated it as a measure of automatically using implicit tests. Importantly, it was modified to exclude the original items dealing with frequency and include the “lack of intention” dimension of automaticity, as called for in a critique by LaRose (2010). The new item asked participants to respond to the statement, “Texting is something I do without meaning to do it.” See Table 1 for the complete adjusted measure. Each response option for the final 10-item scale involved a 7-point scale, ranging from (1) Strongly Disagree to (7) Strongly Agree, and the items were combined into an additive index ($M = 4.03$, $SD = 1.18$, Cronbach’s alpha = .88).

2.2.3. Age, sex, and driving confidence

The models also contained a block of variables controlling for sex and age as well as two additional items concerning driving confidence, which were thought to influence texting while driving but were not central to the purpose of this study (see Lesch & Hancock, 2004). Driving confidence entailed an additive index of the following two items, each asked on a scale ranging from (1) Strongly Disagree to (7) Strongly Agree ($M = 5.54$; $SD = 1.41$): “I am confident in my driving ability” and “I am not a strong driver.” The latter item, along with all other negatively worded items in the survey, were reverse coded for analysis.

2.2.4. Overall texting frequency

Overall use of text messaging was assessed with two items asking participants how often they (a) send and (b) read text messages

on average. These items were asked using the following scale ranging from 1 to 9: “never,” “monthly,” “weekly,” “2–3 times a week,” “daily,” “2–3 times a day,” “hourly,” “2–3 times an hour,” and “about every 10 min.” Overall sending of texts ($M = 7.67$; $SD = 1.25$) was used in regression models predicting sending while driving, whereas overall reading of texts ($M = 7.73$; $SD = 1.23$) corresponded to models predicting reading while driving. This type of interval approach has been found to be more valid than frequency items asking individuals to estimate a total amount in a given period of time (Boase & Ling, 2011), and has been used in other studies of mobile communication (e.g. Campbell & Kwak, 2011). Numerical estimates of texting counts are complicated by human biases such as salience, recency, and calculation heuristics. Moreover, identical forms of measurement between past and reported behavior, as in Nemme and White’s (2010) TPB study of texting while driving, can inflate such relationships (LaRose, 2010).

2.2.5. TPB predictors

Survey items also assessed key variables grounded in the theory of planned behavior – perceived behavior control, attitudes toward texting and driving, and perceived norms. Items were taken from Nemme and White’s (2010) study to ensure consistency. Although intentions to text are typically included as part of the framework in longitudinal studies, they are conceptually and methodologically inappropriate for cross-sectional designs (Armitage & Conner, 1999). Such questions ask participants whether they intend to perform the behavior without a follow-up collection, and responses are inherently prone to a consistency bias with the criterion variables. According to the TPB framework, intentions should be predicted by the other three variables. Measures of conscious intentions are known to predict texting while driving (Nemme & White, 2010), but were not of explicit theoretical interest in this study. Thus, they were not included as a measure.

Perceived behavioral control was measured using two items, each on a scale of 1–7 with response options ranging from (1) Strongly Disagree to (7) Strongly Agree. Participants were asked to respond to two statements: “I have complete control over whether I will text while driving” and “It is mostly up to me whether I will text while driving” and the responses were combined to form an additive index ($M = 6.33$; $SD = .94$).

Attitudes toward texting and driving were assessed with a measure consisting of three items asking participants to rate how GOOD or BAD, WISE or UNWISE, and POSITIVE or NEGATIVE it would be for them to text while driving. Ratings were on a scale of (1) BAD, UNWISE, or NEGATIVE to (7) GOOD, WISE, or POSITIVE and the three items were combined to form an additive index ($M = 1.52$; $SD = 1.01$; Cronbach’s alpha = .68).

Perceived norms for texting and driving entailed eight items for which participants were asked their level of agreement from (1) Strongly Disagree to (7) Strongly Agree. Following the TPB framework, three items measured subjective norms: “People who I look up to would approve of me texting while driving,” “People who are

Table 1
Measure of frequency-independent habitual texting tendencies.

Texting is something...	Mean (1–7)	SD	Component loading
I do automatically	4.13	1.72	.83
I do without having to consciously remember	4.01	1.80	.74
I do without thinking	3.84	1.73	.74
I start doing before I realize I am doing it	3.11	1.65	.76
I have no need to think about doing	3.91	1.55	.43
I do without meaning to do it	3.13	1.61	.72
That would require effort not to do it	4.11	1.77	.68
That I would find hard not to do	4.72	1.78	.72
That is typically “me”	3.79	1.65	.71
That belongs to my daily routine	5.41	1.47	.66

important to me would think it is okay to text while driving,” and “People who I respect would think it is appropriate to text while driving.” Additionally, due to the relatively weak predictive power of subjective norms in past research (Armitage & Conner, 2001), items were included that addressed both moral norms and group norms. Both types of additional norms have been shown to be more predictive of actual behavior (White, Smith, Terry, Greenslade, & McKimmie, 2009) and have been validated in this specific context before (Nemme & White, 2010). Moral norms were assessed with the following statements: “I would feel guilty if I texted while driving,” “I personally think that texting and driving is wrong,” and “Texting while driving goes against my principles.” Group norms were assessed with the following statements: “My friends would think it is inappropriate to text while driving,” and “My friends would approve of me texting while driving.” All three types of norms can be considered injunctive norms, and were compiled into an additive index for this construct ($M = 2.49$; $SD = 1.12$; Cronbach’s $\alpha = .80$).

3. Results

The means, standard deviations, and component loadings for each item of the habitual texting measure are displayed in Table 1. Bivariate correlations for all study variables are presented in Table 2. As one would expect, high correlations were found between participants’ sending and reading behavior, both overall and in the driving context.

The hypotheses and corresponding results are organized with three sets of OLS regression analyses that allow for the role of habit (with a focus on automaticity) to unfold in a sequence that sequentially reveals its importance relative to other known predictors. All results are reported in Tables 3 and 4, with three columns depicting two different models that progressively develop the story. As a baseline, tests for the first hypothesis examined how well the measure for habit predicted texting and driving on its own, without overall frequency and TPB variables included in the model. For this analysis and all others, two OLS regression procedures were run with sending texting while driving as one criterion variable and reading texts while driving as the other. The first block of predictors included the controls of age, sex, and driving confidence. The findings show that, when entered after the control block, habit/automaticity is a significant and positive predictor of both sending and reading texts behind the wheel. Thus, H1 is supported. See Table 3.

The next hypothesis (H2) tested the expectation that the relationships between habit and texting while driving would hold up as significant after controlling for overall frequency of text messaging. Results of the regression show that, after accounting for the respective measure for overall frequency (sending or reading, depending on the criterion variable), habit remains as a significant

Table 3
Predictors of texting while driving (H1).

	Sending		Reading	
	β	t Value	β	t Value
<i>Control variables</i>				
Age	.04	.88	.06	.93
Sex (high: female)	-.12*	-2.52	-.11*	-2.17
Driving confidence	.27**	4.88	.25**	5.31
R ² (%)	4.8**		5.6**	
<i>Direct predictors</i>				
Habit/automaticity	.36**	7.75	.29**	6.11
Incremental R ² (%)	12.1**		7.8**	
Final R ² (%)	16.9**		14.0**	

Note: Entries are standardized regression coefficients.
* $p < .05$.
** $p < .01$.

Table 4
Predictors of texting while driving (H2–H3).

	Sending		Reading	
	β	t Value	β	t Value
<i>Control variables</i>				
Age	.03	.65	.03	.68
Sex (high: female)	-.05	-1.09	-.05	-1.01
Driving confidence	.19**	4.47	.22**	4.92
Overall sending/reading texts	.18**	3.88	.15**	3.14
R ² (%)	14.4**		12.5**	
<i>Direct predictors</i>				
Attitudes	.07	1.45	.03	.60
Norms	.41**	9.19	.39**	8.22
PBC	.02	.48	.01	.17
Habit/automaticity	.25**	5.48	.19**	3.87
Incremental R ² (%)	23.5**		18.2**	
Final R ² (%)	37.9**		30.7**	

Note: Entries are standardized regression coefficients.
** $p < .01$.

and positive predictor of both sending and reading texts while driving. Moreover, the frequency-independent measure of automaticity explains more variance than overall frequency of texting. Hence, H2 is also fully supported. Tests for the final hypothesis (H3) involved expanding the regression models to account for the TPB variables of PCB, attitudes, and norms. This was done in order to examine whether habit accounted for a significant amount of variance in texting while driving above and beyond that attributable to those established predictors. The table shows that this hypothesis was also fully supported with significant and positive associations between habit and sending as well as reading texts while driving. See Table 4.

Table 2
Bivariate correlations for study variables.

	1	2	3	4	5	6	7	8	9	10	11
1. Age											
2. Gender	-.17**										
3. Confidence	-.02	-.23**									
4. Overall sending	-.17**	.25**	.08								
5. Overall reading	-.16**	.24**	.08	.96**							
6. Habitual texting	-.04	.28**	-.11*	.46**	.45**						
7. Attitudes	.06	-.27**	.04	-.05	-.06	-.04					
8. Norms	.14**	-.24**	.03	-.01	-.03	.03	.41**				
9. PBC	-.06	.08	.13**	-.02	-.01	-.13	-.29**	-.28**			
10. Driver sending	.04	-.08	.22**	.26**	.25**	.29**	.24**	.45**	-.11*		
11. Driver reading	.06	-.09	.25**	.26**	.25**	.23**	.18**	.41**	-.09	.87**	

* $p < .05$.
** $p < .01$.

4. Discussion

Texting while driving is a large problem that has only garnered a small amount of psychological research so far. Much of that work has attempted to use the Theory of Planned Behavior (TPB) as a framework for investigating the predictive role of variables related to conscious decision-making. TPB offers the strength of being broadly applicable, which has been useful in identifying key components for explanations of many human behaviors, including texting while driving. At the same time, TPB falls short in explaining the unique dynamics of texting behind the wheel by concentrating exclusively on conscious variables. The phenomenon of risky texting remains pervasive in spite of increasing awareness of its danger, pointing to a need for new angles of insight. Emerging research on media habits, and mobile habits in particular, offers one such perspective.

The aim of this study was to test whether a habitual orientation toward texting predicts texting behind the wheel. Habitual tendencies were recently introduced as a potential factor due to the predictive power of past behavior (Nemme & White, 2010). This study extends on that work by examining automaticity (as opposed to mere frequency of past behavior) as an explanation for texting while driving. Analyses revealed that all three hypotheses were supported. After controlling for age, sex, and driving confidence, the frequency-independent version of the Self-Report Habit Index used in this study (Verplanken & Orbell, 2003) predicted 12% of the variance for sending and 8% of the variance for reading texts while driving (H1). Moreover, it remained uniquely significant even when controlling for reported levels of overall texting frequency (H2), and while accounting for other known predictors associated with TPB, including norms, attitudes, and perceived behavioral control (H3). The results for other predictors are largely consistent with those in previous studies in this area (Nemme & White, 2010; Zhou et al., 2009). The robustness of the composite variable of norms (subjective, moral, group) shows the importance of including the various types of norms in future models (see Table 4). Notably, attitudes and perceived behavioral control were insignificant in the final models, indicating that efforts to change norms may be the most successful in altering intentions. Driving confidence played a significant role in predicting the criterion variables, which speaks to its inclusion in understanding the complete equation. It may also relate to the role of cognitive dissonance uncovered by Atchley et al. (2011). Certain individuals may feel that they can overcome the perceived risk of dangerous driving, if they are skilled (in their own opinion) at the wheel.

The results illustrate the need to separate individuals' amounts of mobile communication from the ways in which they use and are oriented toward it (see Campbell & Kwak, 2010, 2011). Similarly, these findings also support recent research on mobile phone involvement (Walsh, White, Cox, & Young, 2011; Walsh, White, & Young, 2010), another underlying form of psychological attachment to the technology. Walsh et al. (2010) explain that how psychologically "involved" one is with the technology "is qualitatively different from the frequency or amount that people use their mobile phone" (p. 200). The differences between quantity and quality open up important avenues for research investigating why people text and drive. While it is clear that frequency is a crucial step in the development of habitual tendencies, individual differences in automaticity appear to also explain this behavior, at least among our sample. Obviously, more frequent texters will be more likely to text behind the wheel, but the extent to which this behavior is automatic or unconscious seems to be vital for understanding it.

This distinction is something for researchers to be sensitive to while assessing habit. These results support current habit theory, which emphasizes moving beyond frequency and recognizing

individual differences in automaticity and development (Lally et al., 2010; Verplanken, 2010). At the same time, a number of questions are raised regarding how an individual's present level of mobile automaticity may fluctuate depending on lifetime usage, recent usage, contextual factors (such as driving), and dispositional traits like mindfulness. Methodologically, this study offers a heuristic for studying the automaticity of texting behavior. Our adjusted version of Verplanken and Orbell (2003) SRHI can be utilized in future studies of texting, the most frequently performed phone behavior for young people (Lenhart, Ling, Campbell, & Purcell, 2010). In doing so, researchers should seek opportunities to develop and refine it. Some specific recommendations for this are offered below.

This study also takes a step forward by filling a notable gap in the (albeit nascent) body of work developing in this area of driving safety. Other studies on texting while driving have emphasized the importance of explicitly conscious predictors of texting and driving, including intentions, norms, attitudes, perceived behavioral control, and compensatory strategies. In spite of the contribution of these variables, conscious factors fall short of fully explaining actual behavior. Some of the missing pieces to the conundrum may be traced to an automatic cue-response loop that does not fully process the situational constraints at the moment. In line with current research on habits (Neal et al., 2011), the results here provide evidence that automatic texting behavior may be advanced in spite of societal norms and individual intentions. Because of this, changing the mobile phone behavior of drivers may not be as simple as altering the law, as called for by the National Transportation Safety Board (NTSB, 2011). It is now becoming clear that a number of alternative psychological processes underlie this behavior, such as cognitive dissonance (Atchley et al., 2011) and automaticity. Thus, this study adds ballast to a theoretical framework that should account for both rational decision making and unconscious (or less conscious) predictors of texting and driving. Just as importantly, it points to areas of further inquiry that may help in developing new strategies for mitigating this problem and understanding the role of automaticity in mobile communications.

5. Limitations and future directions

5.1. Limitations

One limitation of this study is its cross-sectional design, which does not provide empirical grounds for causal claims. That said, some of the flows of causality can be conceptualized in a theoretical sense. For example, it seems more elegant theoretically to argue that habit, as an overarching orientation toward texting, leads to texting behind the wheel rather than the reverse. Actually, it is quite plausible that they influence each other, but it seems that in this case texting while driving would serve more as a reinforcement of habit rather than a facilitator of it. These kinds of questions can be addressed in future research using longitudinal and/or experimental approaches that offer empirical evidence of causal flows. As discussed by Armitage and Conner (1999), cross-sectional surveys lead to a consistency bias when accounting for intentions for future behavior, which have shown to also predict texting while driving (Nemme & White, 2010). As a result, intentions were excluded from this study, though they were indirectly measured via attitudes, norms, and perceived behavioral control. Here again, longitudinal designs will be useful.

More direct measurement of behavior should be an important consideration in subsequent studies. It is important to note that the automaticity measure is based on self-reports, potentially causing the underlying construct of nonconscious behavior to be

underrepresented. Although the measure used has been experimentally validated (Orbell & Verplanken, 2010), implicit measures such as the IAT (Implicit Association Test) or Stroop test can be implemented in future research designs to test the contribution of automaticity more precisely and from different perspectives (Hofmann, Friese, & Roefs, 2009; Orbell & Verplanken, 2010). Additionally, driving simulators have been very useful in research on the effects of mobile communication on driving abilities (see Strayer et al., 2011), and may serve as an alternative to self-report data for researchers interested in explaining this behavior. An ideal experiment would utilize log texting data (see Boase & Ling, 2011) while individuals are driving to circumvent problems of social desirability.

Another limitation of the study is that the results cannot be generalized to the larger population. As foundational work in this area, this study lacked support for a representative sample, and therefore the results must be interpreted as illustrative in nature. Individuals were not asked whether they had drivers' licenses or were aware of current driving laws, and future studies should take these factors into account. These findings offer an empirical basis for developing hypotheses about the larger population, but it is also likely that age and generational trends will emerge. Last, it should be mentioned that automatic processes might operate in a similar fashion for other phone applications and mobile devices. A broader focus of driver distraction was not part of this study, but deserves attention in the future.

5.2. Habit and automaticity of mobile communication

Although the extensive role of habit in our lives has become increasingly understood in recent years (Duhigg, 2012), research on mobile phone habits is just beginning. Much more than the common example of habitual email checking, texting represents an open link between individuals in the moment. Due to the constant presence of social cues that can be triggered, counter-strategies cannot be reduced to the phone itself. Researchers must be aware the phone is an appendage to the social being (Campbell, 2008). In addition to noticing the phone itself, colorful message indicators, auditory tones, and vibrations, individuals may be triggered to communicate by a variety of timing cues, social contexts, and mental states. If the social alarm clock goes off, the texter may be prompted to find the device whether or not it is in visual range. Indeed, a phone in a glove compartment may actually be *more* dangerous if the individual begins rummaging around for it in the midst of driving. In this way, automatic texting behavior represents much more than classical conditioning (Bargh & Ferguson, 2000), and has the potential to be activated by higher mental processes such as innate motivations and goals (Bargh & Morsella, 2010). The findings here take an initial step toward understanding the layers of latent psychological processes at play.

Future studies are necessary to further deconstruct the automatic nature of texting behavior. More nuanced conceptualization and measurement of automaticity is one promising avenue. It has been shown that underlying elements of automaticity – lack of attention, awareness, control and intention – are not mutually exclusive (see LaRose, 2010). Thus, researchers should try to directly and discretely capture these underlying dimensions in efforts to understand the dynamics among them in predicting texting while driving. In this sense, our heuristic serves as a starting point for further development and refinement of a robust measure of a potentially complex psychological orientation. In addition, researchers should account for more nuanced aspects of the act of texting itself. For example, it is plausible that the “checking” aspect of texting is the most automatic part of the behavior. If so, this would mean that the “autopilot” kicks in at different points

of the texting experience, possibly serving as a gateway to more or less conscious engagement.

On a related note, this study found that the measure of automaticity was significantly more predictive for sending than it was for reading a text while driving. At first glance, this may seem unexpected. However, it may be that more automatized users carry through with the response while more self-aware users are more able to stop themselves. The implication here is that, once triggered to the phone, high automaticity may heighten the momentum of the full behavior. The phenomenon of texting while driving is complicated further by the automatic nature of driving itself. Reflexive driving allows individuals to avoid crashing the vehicle without substantial thinking. At the same time, the cognitive resources required to successfully operate a motor vehicle take away from individuals' abilities to self-monitor (Fujita, 2011; Hofmann et al., 2009). Future experimental studies are needed to understand whether habitual, as opposed to more conscious, texting differentially impairs one's ability to operate a motor vehicle. Such efforts to deepen our understanding of the links between habit and behavior may lead to different strategies for addressing different aspects of behavior at different points in the process.

5.3. Changing dangerous behavior

A number of future tracks should be considered for developing strategies for behavior modification. First, the findings in this study warrant comparison to research indicating that trait mindfulness predicts the frequency of texting while driving (Feldman et al., 2011). Studies using factor analysis have shown that automatic-like behavior represents a facet of the mindfulness construct (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). Hence, another important extension of this study is to investigate how automatic texting tendencies are associated with trait mindfulness. Research has shown that mindfulness moderates the occurrence of counter-intentional habits (Chatzisarantis & Hagger, 2007). If it has the capacity to weaken the relationship between texting while driving and habit, then strategies to enhance mindfulness may serve a great benefit in curbing texting while driving.

Second, habit-reversal therapy (HRT; Azrin & Nunn, 1973) has been shown to be effective at curbing a wide array of habit disorders (Bate, Malouff, Thorsteinsson, & Bhullar, 2011; Miltenberger, Fuqua, & Woods, 1998). It is unclear whether such methods could be applied to the non-clinical behavior of texting, particularly if one is not trying to eliminate the habit of texting entirely. However, self-help versions of habit-reversal training are now being explored to allow people to utilize such strategies on their own (Moritz, Fricke, Treszi, & Wittekind, 2012). In addition, Duhigg (2012) highlighted the potential for scaled down versions of these techniques to be applied in everyday life. This can be done through altering the routine, or response, to the list of identifiable cues and supplanting the reward with something equivalent. It remains to be seen, however, whether these approaches can be effective in adjusting behavior that is as ubiquitous as texting is within young social circles (Lenhart et al., 2010).

The incongruent relationship between goals (not crashing a car) and habits (texting) can also be conceptualized as a failure of self-control. Aside from mindfulness techniques and habit-reversal therapy, other cognitive strategies to enhance self-control may offer a third line of potential. For some people, the social rewards offered by texting appear to represent the sort of everyday impulse of chocolate (Hofmann, Baumeister, Forster, & Vohs, 2011). At first glance, the essential challenge of this problem is getting individuals to consciously evaluate the surrounding situation and cues that elicit texting, rather than just reacting to signals. Effortful inhibition of temptation requires the conscious decision to choose distant, abstract goals (e.g., long life) over proximal, specific rewards

(Fujita, 2008). Unfortunately, the immediacy, salience, and unbounded nature of phone cues make it easy for users to zoom in on the device and forget the world around them. Recent conceptions of self-control highlight the advantage of combating temptations automatically (Fujita, 2011). It may be possible for individuals who are prone to automatic mobile phone behavior to enact abstract safety goals unconsciously using methods of stimulus and/or response control. Hence, the best cure for automatic texting mechanisms may be automatic self-control mechanisms. This is especially appropriate given the singular role of texting automaticity, independent of frequency, within our sample. In line with this framework, strategies such as asymmetric associations (stimuli paired with distal goals or negativity), implementation intentions (when X, then do Y), cognitive reconstruals (stimuli transformations), and “self-distancing” have shown promise in lowering reactivity and enhancing judgment across an array of behaviors (Aydük & Kross, 2010; Fujita, 2011; Gollwitzer & Sheeran, 2006; Hofmann, Deutsch, Lancaster, & Banaji, 2010; Kross & Grossman, 2011). Future experimental studies should be conducted to test the viability of these strategies against unconscious phone impulses. The findings for texting automaticity from this study offer preliminary evidence that these types of approaches may be useful in addressing the problem of texting while driving.

6. Conclusions

Moving forward, the results of this foundational research call for a rerouted discussion of the texting while driving phenomenon. In laying out their notion of unconscious behavioral guidance systems, Bargh and Morsella (2010) illuminate the bias inherent in focusing on consciousness in human behavior. They even go so far as to state that much of behavior throughout history has been “zombie-like.” While we do not embrace the dystopian notion that mobile communication is turning people into zombies, we recognize the need to push theory on texting behavior into the territory of unconscious and semi-conscious mechanisms. The findings from this study suggest that unconscious phone tendencies may persist despite explicit constraints in society and intentions in the individual, and represent a distinct construct from the overall rate of the behavior. Furthermore, these tendencies, which explain more than the average frequency of texting, should be accounted for in future research trying to understand mobile phone behavior.

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