SUSCEPTIBILITY TO DRIVER DISTRACTION QUESTIONNAIRE (SDDQ): DEVELOPMENT AND RELATION TO RELEVANT SELF-REPORTED MEASURES

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ABSTRACT

Driver distraction significantly impairs performance and increases the likelihood of vehicle crashes. Understanding the underlying reasons of distraction engagement as well as individuals' susceptibility to different types of distractions is a necessary step to develop effective solutions to mitigate distraction. This paper describes the development and initial evaluation of a questionnaire, the Susceptibility to Driver Distraction Questionnaire (SDDQ), which investigates distraction involvement by making a distinction between voluntary and involuntary engagement in secondary activities, or distractions as referred to in this paper. We present the theoretical underpinnings, the questionnaire itself, as well as the results of an online survey examining the reliability and validity of the newly developed questionnaire. Our analyses show moderate to high levels of internal consistency among the questionnaire items, providing support to the reliability of SDDQ. Our results also suggest that self-reported engagement in driver distraction is correlated with other self-reported unsafe driving behaviors. As expected, personality is associated with attitudes and beliefs that motivate voluntary engagement in distraction, while susceptibility to involuntary distraction is related to cognitive limitations. These results indicate that SDDQ can potentially be a useful tool to study driver distraction and the underlying reasons of distraction engagement.

INTRODUCTION

Driver distraction is an important issue for road safety as engaging in secondary tasks while driving may increase the risk of being involved in a motor vehicle crash (*1-3*). Although distraction involvement in crashes is generally underreported, distraction-related crashes still make up a significant proportion of motor vehicle crashes. According to the U.S. National Highway Traffic Safety Administration (*4*), in 2011, 10% of fatal crashes and 17% of injury crashes were related to driver distraction. Drivers get distracted for a variety of reasons, including intentional engagement in distracting activities (*5*), cognitive limitations (*6*), as well as traffic and environmental conditions (*7, 8*). Further, considerable individual differences exist in distraction involvement (*9*). In order to mitigate distraction, it is necessary to understand the underlying reasons leading to an individual's engagement in distraction.

Driver distraction has been defined as the diversion of attention away from activities critical for safe driving toward a competing activity (*10, 11*). This definition suggests that competing activities become distractions when they coincide with activities critical for safe driving and that not all competing activities are distractions. For crash reporting and regulation purposes, driver distraction has been defined in a broader way. According to the U.S. Department of Transportation, driver distraction is "any activity that could divert a person's attention away from the primary task of driving" (*12*). According to this broader definition, driver distraction may divert attention away from driving and may or may not lead to an increase in crash risk depending on whether the diversion is away from activities critical for safe driving or not. In this paper, we adopt this broader definition; the distractions presented in this paper are secondary activities such as talking on the cell phone, text messaging, and interacting with in-vehicle technologies.

Distraction engagement may be voluntary (*5, 13*) or involuntary (*7*). Voluntary distraction occurs as a result of willingness to engage in distractions. For example, a driver may choose whether and when to talk on a phone. Research on other unsafe driving behaviors, such as speeding and drunk driving, has shown that intention to execute unsafe driving behaviors is linked to attitudes and beliefs (*14, 15*). A driver who believes that she can drive well while conversing on the phone would be more willing to and likely to engage in phone conversations while driving. On the other hand, involuntary distraction is related to a driver's attentional capability, more specifically, the ability to suppress distracting information. Salient stimuli capture attention automatically (*16*). A visual indicator on the dashboard or a ringing phone may divert attentional focus away from the road. Thus, a driver may be distracted by a ringing phone even when she does not want to answer it. Due to cognitive declines associated with aging, older drivers have more difficulty in disengaging attention from a previously attended stimulus (*17*). When distracted by a salient stimulus, older drivers may take a prolonged period of time to redirect attention back to the road, resulting in increased risk of driving errors.

The distinction between voluntary and involuntary distraction plays a significant role in understanding driver distraction. For example, a new in-vehicle technology may be assessed in terms of how it influences voluntary and involuntary aspects of distraction. Further, individual differences in susceptibility to voluntary and involuntary distractions can help in the development of distraction mitigation strategies targeted for the individual driver's needs. Although it is important to assess susceptibility to voluntary and involuntary

distractions in distraction-related studies, due to resource limitations, it is not always possible to test these effects. Further, when evaluating a distraction mitigation system, it is desirable to recruit participants from the tail-end of a distribution of susceptibility to distraction, i.e., participants that are more susceptible to distractions. An easy to administer questionnaire can help achieve both of these objectives.

Survey methods have previously been used to examine driver distraction. For example, in the National Survey of Distracted Driving Attitude and Behaviors (*18*), a wide variety of distracted driving behaviors and attitudes toward these behaviors were assessed. This study identified two distinct types of drivers (distraction-prone vs. distraction-averse) with consistent distraction-engagement patterns across all distractions included in the survey. The study also found that driver type was highly predictive of attitudes toward distractions. Similarly, in another study examining driver distraction (*19*), a questionnaire was used to measure the frequency of engagement in different distractions and their associations with driving errors. This study identified a number of common distracting activities (e.g., lacking concentration, adjusting in-vehicle equipment, distraction from outside people, objects or events, and talking to passengers). While these questionnaires are effective measures of the degree of involvement in various distractions (*18, 19*) and also assess some of the underlying mechanisms (e.g., attitude, *18*), to our knowledge, no questionnaire has made the effort to distinguish voluntary and involuntary engagement in driver distraction.

This paper presents our effort to understand drivers' voluntary and involuntary attributes leading to engagement in distraction. The following sections describe the development and initial evaluation of the *Susceptibility to Driver Distraction Questionnaire* (SDDQ). We present the theoretical underpinnings and the questionnaire itself, the results of an online survey examining the internal consistency among the questionnaire items, as well as the validity of the questionnaire by comparing it to a set of standardized questionnaires on driver behavior, cognitive ability, and personality.

QUESTIONAIRE DEVELOPMENT

To develop SDDQ, we first constructed preliminary items related to driver distraction engagement, as well as the voluntary and involuntary aspects of distraction. This preliminary set was then narrowed down to the current form based on comments from five external experts in the research domain, results from internal lab discussion sessions, and proof-reading for language by native English speakers.

SDDQ (Table 1) consists of 39-items, and is divided into three sections: 1) engagement in distraction while driving, 2) potential facilitators of voluntary distraction, and 3) susceptibility to involuntary distraction. A set of commonly observed distractions in everyday driving, such as phone use and passenger conversations, is examined across these three sections.

Section 1: Engagement in distraction while driving

The first section assesses the frequency of engagement in distractions while driving. This section has seven items rated on a 5-point Likert scale: 'never', 'rarely', 'sometimes', 'often', and 'very often'.

Section 2: Attitudes and beliefs about voluntary distraction

The second section is aimed at understanding the attitudes and beliefs about voluntary distraction. Questions in this section are structured according to the Theory of Planned Behavior (TPB, *20, 21*). This theory has been successfully applied to understand a wide variety of unsafe driving behaviors, including speeding, drunk driving, and aggressive driving (*14, 22, 23).* TPB states that the intention to exhibit a certain behavior is determined by an individual's attitude toward the behavior, perceived control, and perceived social norms. Consistent with this theory, the voluntary distraction section of the questionnaire contains three subsections: attitude, perceived control, and perceived social norms. Each of these subsections consists of six items rated on a 5-point Likert scale: from 'strongly agree' to 'strongly disagree'.

Attitude. Attitudes toward driver distraction guide willingness and tendency to engage in distracting activities. For example, drivers who disapprove of phone use during driving are less likely to engage in cell-phone-related distractions (*18*). Questions in this subsection assess the degree to which a driver has a favourable or an unfavourable opinion about engagement in distractions (e.g., do you think it is alright for you to drive and chat with passengers?).

Perceived control. Drivers' willingness to engage in distractions may be influenced by their awareness of the effects of these activities on their driving performance. For example, drivers who rate themselves as more skilful are more likely and willing to use a cell phone during driving (*24*). Questions in this subsection examine a driver's perception of the ease or difficulty of performing a secondary task while driving (e.g., do you believe you can drive well even when you chat with passengers?).

Perceived social norms. Intention to engage in potentially unsafe driving is also affected by perceived social norms (*25, 26*), in that a driver is more likely to engage in potentially unsafe driving when he perceives the particular behavior to be common in the community (*27, 28*). Questions in this subsection measure perceptions of other drivers' engagement in distractions (e.g., most drivers around me drive and chat with passengers if there are any), as well as the belief about whether peers or individuals of importance approve or disapprove of engagement in distractions (e.g., most people who are important to me think, it is alright for me to drive and hold phone conversations).

Section 3: Susceptibility to involuntary distraction

Questions in this section focus on self-reported ability to suppress potentially distracting stimuli while driving (e.g., while driving, do you find it distracting when a passenger speaks to you?). This section is made up of eight items, scored using a 5-point Likert scale with an additional option of 'never happens'.

Driving requires the ability to suppress information or responses that are irrelevant to the driving task and distractibility reflects how easily an individual is distracted by task-irrelevant information or responses. This ability is an important aspect of human attention *(29),* varies significantly among individuals *(30),* and changes with age *(31, 32).* For example, older individuals are less likely to ignore distractors in a cluttered visual environment (*32*), thus they are more likely to miss critical targets, such as a stop sign or a pedestrian.

Everyday distractibility has previously been measured using the Cognitive Failures Questionnaire (CFQ) (*33*). The eight distractibility items in CFQ measure a person's likelihood of committing an error in everyday tasks due to inattention. These distractibility items correlate well with laboratory attentional tests (*34*). Individuals reporting higher distractibility in CFQ are generally slower at responding to a target in the presence of distracting stimuli (*34*). These results suggest that a self-report method can potentially be a useful way to assess an individual's ability to suppress distracting information.

QUESTIONNAIRE EVALUATION

An online survey was conducted to investigate the relation of SDDQ to demographics as well as relevant self-reported measures of driving behavior, everyday cognitive distractibility, attention deficit, and personality traits, including impulsiveness and sensation seeking.

Participants

Participants were recruited using online advertisements and posts at local communities. To be eligible for the study, participants had to have a valid driver's license. They were encouraged to complete the entire questionnaire to become eligible for a draw to win one of two iPads. Over a month period, 305 survey responses were collected. Among these, 254 participants completed all questions in the survey and were included in the following analyses. The sample analyzed consisted of 131 males and 123 females with ages ranging from 15 to 77 (Table 2).

Measures

In addition to SDDQ, responses were collected on demographics, self-reported driving behaviors, personality, and cognitive abilities. There were 160 questions in total.

In order to investigate the associations between engagement in distraction and other unsafe driving behaviors, we used the Driver Behavior Questionnaire (DBQ, *35*). DBQ consists of 24 items rated on a 5-point Likert scale and is divided into four different categories: (1) *aggressive violations* **–** violations of safe driving associated with aggression; (2) *ordinary violations* **–** violations of safe driving not related to aggression; (3) *errors* **–** mistakes that conflict with desired driving goals; (4) *lapses* **–** unintentional deviations from a planned driving action. DBQ has been shown to be a prominent indicator of driving behaviors observed during on road driving (*35*).

Items from the distractibility subscale of the Cognitive Failures Questionnaire (CFQ) (*33*) were used to measure participants' ability to suppress distraction. As mentioned previously, this scale has been shown to have good construct validity (*36*). Further, it has also been used to assess the role of cognitive failures in traffic crashes (*37*). Another questionnaire used in the current study for the same purpose was the Adult Attention Deficit and Hyperactivity Disorder (ADHD) Self-Report Scale (ASRS, *38*), which is an instrument for screening adult attention deficit in the general population. ADHD is a behavioral disorder characterized by symptoms of inattention, hyperactivity, and impulsivity (*38*). Six items of the ASRS were included in the survey, as they are known to be highly predictive of ADHD symptoms (*39*). Previous research into ADHD has shown a connection between ADHD and

increased crash involvement (*40, 41*), as well as poor simulated driving performance (*42*).

Data on personality traits of impulsiveness (*43)* and sensation seeking (44, *45*) were also collected as these personality traits may contribute to voluntary distraction engagement. Sensation seeking was assessed through the Arnett Inventory of Sensation Seeking (AISS), a 20-item questionnaire (*45, 46*). Research has shown this questionnaire to be a valid measure with high internal consistency (*45, 46*), as well as predictive ability on self-reported risky driving behaviors (*47*). Impulsiveness was assessed using the Eysenck Impulsiveness Questionnaire (I7 Questionnaire, *43*). We adopted the impulsiveness (i.e., inability to withhold impulsive behavior) and venturesomeness (i.e., risk aversion) items, but not the empathy (i.e., sympathy toward others) items, as impulsiveness and venturesomeness would be more relevant to distraction-related behaviors. A link between the impulsiveness subscale and unsafe driving behaviors has been established in previous research (*48*).

Data analysis

The following scores were calculated for each participant:

1) Susceptibility to Driver Distraction Questionnaire (SDDQ): An average score (sum / number of items) was calculated separately for each subsection. Each item was assigned a value between 1 and 5 (with 1 representing ‘never’ or ‘strongly disagree’, and 5 representing ‘very often’ or ‘strongly agree’). Any item with a response of ‘never happens’ was not included in the calculation.
2) Driver Behavior Questionnaire (DBQ): A sum score was calculated for individual categories of aggressive violations, ordinary violations, errors, and lapses as suggested by (*49*). Each item was assigned a value between 1 (for ‘never’) and 6 (for ‘nearly all the time’). Overall, the ranges of possible scores for the four categories were 2-12, 6-36, 8-48, and 8-48, respectively. Higher values represent a higher degree of unsafe driving behaviors.
3) Eysenck Impulsiveness Questionnaire (I7): A sum score was calculated for each of the impulsiveness and venturesomeness categories, as suggested by (*43*). I7 includes yes/no questions only and the responses that indicate higher impulsiveness or venturesomeness are assigned a value of 1. The ranges of possible scores for the impulsiveness and venturesomeness categories were 0-19 and 0-16, respectively. Higher values represent greater impulsiveness or venturesomeness.
4) Arnett Inventory of Sensation Seeking (AISS): A sum score was calculated for all items. Each item was assigned a value between 1 and 4 as suggested by (*44*). The range of possible values was 20-80. Higher values correspond to lower levels of sensation seeking.
5) Cognitive Failure Questionnaire (CFQ): A sum score was calculated for the distractibility items. Each item was assigned a value between 1 and 5, as suggested by (*33*). The range of possible values was 8-40. Higher values correspond to greater distractibility, i.e., poorer ability to suppress distracting information.
6) Adult ADHD Self-report Scale (ASRS): A sum score was calculated for the six items mentioned previously. Each item was scored based on a dichotomous symptom rating method (38). For items 1-3, a value of 0 was assigned if the choice was ‘never’ or ‘rarely’, while a value of 1 was assigned if the choice was ‘sometimes’, ‘often’, or ‘very often’. For items 4-6, a value of 0 was assigned if the choice was ‘never’, ‘rarely’, or ‘sometimes’, while a value of 1 was assigned if the choice was ‘often’ or ‘very often’.

The range of possible values was 1-6. Higher values correspond to greater ADHD symptoms.

Pearson product-moment correlations were used to investigate associations among the subsections of SDDQ, as well as the associations of SDDQ subsections with measures of other unsafe driving behaviors, personality, and cognition. In addition, an ANOVA was used to explore age and gender effects on SDDQ responses. Normality and homoscedasticity assumption checks were conducted on residuals.

RESULTS

Reliability of SDDQ

The internal consistency of each section within SDDQ, as indicated by Cronbach's alpha, was computed as a measure of reliability: engagement, $\alpha = .66$; attitude, $\alpha = .67$; perceived control, $\alpha = .80$; perceived social norms from other drivers, $\alpha = .73$; perceived social norms from peers and important individuals, $\alpha = .81$; involuntary, $\alpha = .69$. Given the relatively small number of items within each section (6-8 items), the moderate to high levels of Cronbach's alpha indicate that the newly developed questionnaire is in general reliable.

Validity of SDDQ

Mean scores on all survey measures are presented in Table 3. Due to small sample sizes in the teen (age 15-17, n=1) and the older adult group (age 60+, n=13), the in-depth analyses were performed only on the young adult (age 18-25), young mid-age (age 26-40), and old mid-age groups (age 41-60). For these three groups, we performed general analyses by aggregating their data as well as separate analyses by focusing on each individual age group (Tables 4-5).

Age and gender comparisons on SDDQ responses

Engagement in distractions during driving, potential facilitators of voluntary distraction, and susceptibility to involuntary distraction were compared across different age and gender groups. There was a significant gender difference on voluntary distraction score, $F(1, 234) = 6.78$, $p = .01$, with men (Mean = 3.1, SD = 0.49) scoring higher than women (Mean = 3.0, SD = 0.45), suggesting that men are more likely to hold more positive (or less negative) attitudes and beliefs toward distraction engagement. In addition, there was also a significant interaction between age and gender on voluntary distraction, $F(1, 234) = 4.58$, $p = .01$. More specifically, there were no significant gender differences within the young adult (age 18-25) and the young mid- age (age 26-40) groups. However, among the older mid-age adults (age 41-60), men (Mean = 3.3, SD = 0.45) scored significantly higher than women (Mean = 2.8, SD = 0.46), $t(234) = 3.32$, $p = .001$. Thus, the main effect of gender reported above may be due to the gender effect that was present in the older mid-age group.

Correlations among subsections of SDDQ

Correlations among the subsections of SDDQ are reported in Table 4. Engagement in distractions while driving was found to be positively associated with potential facilitators of voluntary distraction ($r = .56$, $p < .0001$). Drivers who reported engaging in distractions more often held a more positive attitude toward distractions ($r = .55$, $p < .0001$), and perceived a higher level of control ($r = .51$, $p < .0001$) and a higher level of approval toward distracted driving from peers and family ($r = .27$, $p < .0001$), as well as from other drivers ($r = .30$, $p < .0001$).

Susceptibility to involuntary distraction was in general not associated with self-reported engagement, although the magnitude of correlations became slightly larger with increasing age ($r = -.13, -.08, -.22$ for age groups 18-25, 26-40, 41-60, respectively). However, the involuntary distraction score was found to be negatively correlated with the voluntary distraction score ($r = -.35$, $p < .0001$), suggesting that drivers who found external stimuli (e.g., a ringing phone) distracting held less positive attitudes and beliefs about distraction engagement. Further analyses revealed associations between involuntary distraction and attitudes ($r = -.31$, $p < .0001$), as well as involuntary distraction and perceived control ($r = -.34$, $p < .0001$), implying that drivers who found external stimuli distracting were more likely to hold a negative attitude toward distraction engagement and perceived themselves as being less capable to drive when engaged in distractions. In addition, both aspects of perceived social norms (perceived norms from peers and important individuals, and perceived norms from other drivers) had a moderate, but significant, negative association with involuntary distraction ($r = -.18$, $p = .005$, and $r = -.20$, $p = .002$). With a few exceptions, these findings were also statistically significant when the analyses were conducted separately for the three age groups (Table 4).

Correlations between distraction engagement (SDDQ) and other unsafe driving behaviors (DBQ)

Engagement in distractions while driving was positively correlated with aggressive violations (Table 5) ($r = .28$, $p < .0001$), ordinary violations ($r = .43$, $p < .0001$), and errors ($r = .16$, $p < .05$), indicating that drivers who report a higher level of engagement in distractions are also more likely to self-report a higher level of engagement in other potentially unsafe driving behaviors. This association was statistically significant overall and in particular for the young adult and young mid-age groups (Table 5).

Correlations between attitudes and beliefs about voluntary distraction (SDDQ) and personality (I7 and AISS)

The voluntary distraction score was found to be positively associated with self-reported venturesomeness, meaning that drivers who have a disposition to undertake risks also had more positive attitudes and beliefs about distraction engagement ($r = .21$, $p = .0009$). When focusing on different age groups, this association reached statistical significance for young adults (age 18-25). Voluntary distraction score was also found to be associated with self-reported sensation seeking ($r = -.22$, $p = .0005$), which has long been shown to have a strong association with risky driving behaviors (*46*, *47*). As mentioned earlier, higher scores on voluntary distraction represent more positive attitudes and beliefs toward distraction, while

higher scores on the Arnett Inventory of Sensation Seeking (AISS) represent lower sensation seeking. Therefore, the correlation coefficients between these two measures were generally negative. Overall, both venturesomeness and sensation seeking correlated significantly with voluntary distraction, as they likely tap into overlapping aspects of personality (as shown by a high correlation between the two, $r = -.70$, $p < .0001$).

Correlations between involuntary distraction (SDDQ) and cognitive ability (CFQ, ASRS, and DBQ)

The relation between level of distractibility measured through the involuntary distraction section of SDDQ and the following measures of cognitive ability were investigated: the Cognitive Failures Questionnaire (CFQ), the ADHD Adult Self-Report Scale (ASRS), and errors and lapses assessed in the Driver Behavior Questionnaire (DBQ).

Involuntary distraction was positively associated with CFQ ($r = .13$, $p = .04$), highlighting the importance of cognitive ability on preventing errors that can potentially lead to traffic crashes (*37*). In addition, involuntary distraction was also found to be correlated with errors ($r = .18$, $p = .005$) and lapses ($r = .25$, $p < .0001$) as measured by DBQ, providing support to the contribution of attentional failures to traffic crashes. Although ADHD symptoms and cognitive failures (measured by CFQ) may be attributed to overlapping cognitive mechanisms ($r = .63$, $p < .0001$), the correlation between ADHD symptoms and involuntary distraction did not reach significance ($r = .06$, $p = .39$). The lack of correlation may be due to a lack of sensitivity of the involuntary distraction items in detecting the effect of ADHD on driving. Another potential explanation is that drivers with ADHD may have developed successful self-regulatory strategies to manage their symptoms while driving.

DISCUSSION

This paper presents the development of the Susceptibility to Driver Distraction Questionnaire (SDDQ) and its initial evaluation in an online survey with respect to measures of other unsafe driving behaviors, personality, and cognitive abilities. SDDQ is specifically designed to further our understanding of the underlying reasons of distractions experienced by the individual driver by distinguishing between voluntary and involuntary aspects of distraction. It is important to note here that the definition of driver distraction used in this study is: ‘any activity that could divert a person’s attention away from the primary task of driving (*12*)’.

In general, SDDQ appeared to be a useful self-report method to investigate driver distraction. Internal correlations were moderately high, particularly between the likelihood of engagement and the attitudes and beliefs about distraction. Consistent with the Theory of Planned Behavior (*20-22*), each of the subsections (attitude, perceived control, and perceived social norms) of voluntary distraction was significantly associated with self-reported distraction engagement. Further, drivers who reported a higher level of engagement in distractions as measured by SDDQ were also more likely to self-report a higher level of engagement in other unsafe driving behaviors. The desired separation between voluntary and involuntary aspects of distraction was successful, as items related to voluntary distraction were associated with personality traits of impulsiveness and sensation seeking, while those related to involuntary distraction were associated with cognitive measures. A summary of other interesting tendencies is as follows:

- Drivers with poorer ability to suppress distracting information also have less positive attitudes toward distraction engagement and were less confident in their own ability to manage driving while engaged in distractions.
- Drivers who are apt to take risks also self-report to be more likely to hold more positive (or less negative) attitudes and beliefs that motivate voluntary engagement in driver distraction.
- Drivers who report a higher level of engagement in distractions are also more likely to self-report a higher level of engagement in other potentially unsafe driving behaviors.
- Susceptibility to involuntary distraction was found to be correlated with errors and lapses as measured through the Driver Behavior Questionnaire (DBQ), as well as distractibility measured through the Cognitive Failure Questionnaire (CFQ), providing support to the contribution of attentional failures to traffic crashes.
- The above general patterns of results were consistent across the three age groups that formed the majority of our sample (ages 18-25, 26-40, and 41-60).

In general, although the magnitudes of correlations were comparable across the three age groups (age 18-25, 26-40, and 41-60), there were fewer statistically significant findings for the young mid-age (age 26-40) and old mid-age (age 41-60) groups. These two age groups had fewer respondents (n = 76 and n = 39, respectively) compared to the young adult group (n = 125), therefore, the differences in significance may be attributable to statistical power. We are continuing data collection for this ongoing project. With more participants, particularly the expansion of the teen (age 15-17) and senior (age 61+) groups, we expect stronger results to emerge.

The current study relies on survey methods that enabled us to collect responses from a large number of participants. Although many self-reported measures are good indicators of behavior, personality, and cognitive ability, the true validation of this questionnaire has to be conducted in controlled laboratory as well as naturalistic driving settings. Currently, we are designing a laboratory study in which we will further validate SDDQ through driving behavior assessment in a simulator and the use of rigorous measures of cognitive ability in computerized attentional tasks. A questionnaire that can assess engagement in distractions, as well as the voluntary and involuntary attributes that contribute to distractions, can be used for participant selection for distraction-related studies, and can aid the development of personalized strategies for distraction mitigation.

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LIST OF TABLES

TABLE 1 Susceptibility to Driver Distraction Questionnaire (SDDQ)

(Headings in brackets (e.g., [Attitudes], [Perceived control]) were not presented to the participants)

[Section 1: Distraction Engagement]	Never	Rarely	Sometimes	Often	Very Often
When driving, you:					
a. hold phone conversations					
b. manually interact with a phone (e.g., sending text messages).					
c. adjust the settings of in-vehicle technology (e.g., radio channel or song selection).					
d. read roadside advertisements.					
e. continually check roadside accident scenes if there are any.					
f. chat with passengers if you have them.					
g. daydream.					

[Section 2: Attitudes and Beliefs about Voluntary Distraction]	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
[Attitude] ***You think, it is alright for you to drive and:***					
a. hold phone conversations					
b. manually interact with a phone (e.g., sending text messages).					
c. adjust the settings of in-vehicle technology (e.g., radio channel or song selection).					
d. read roadside advertisements.					
e. continually check roadside accident scenes if there are any.					
f. chat with passengers if you have them.					
[Perceived control] ***You believe you can drive well even when you:***					
a. hold phone conversations					
b. manually interact with a phone (e.g., sending text messages).					
c. adjust the settings of in-vehicle technology (e.g., radio channel or song selection).					
d. read roadside advertisements.					
e. continually check roadside accident scenes if there are any.					
f. chat with passengers if you have them.					
[Perceived social norms 1] ***Most drivers around me drive and:***					
a. hold phone conversations					
b. manually interact with a phone (e.g., sending text messages).					
c. adjust the settings of in-vehicle technology (e.g., radio channel or song selection).					
d. read roadside advertisements.					
e. continually check roadside accident scenes if there are any.					
f. chat with passengers if there are any.					
[Perceived social norms 2] ***Most people who are important for me think, it is alright for me to drive and:***					
a. hold phone conversations.					
b. manually interact with a phone (e.g., sending text messages).					
c. adjust the settings of in-vehicle technology (e.g., radio channel or song selection).					
d. read roadside advertisements.					
e. continually check roadside accident scenes if there are any.					
f. chat with passengers if there are any.					

[Section 3: Susceptibility to Involuntary Distraction]	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Never Happens
While driving, you find it distracting when						
a. your phone is ringing.						
b. you receive an alert from your phone (e.g., incoming text message).						
c. you are listening to music.						
d. you are listening to talk radio.						
e. there are roadside advertisements.						
f. there are roadside accident scenes.						
g. a passenger speaks to you.						
h. daydreaming.						

TABLE 2 Number of participants by gender and age group

Age:	**15-17**	**18-25**	**26-40**	**41-60**	**61+**	**Total**
# of males:	1	77	35	14	4	131
# of females:	0	48	41	25	9	123
Total:	1	125	76	39	13	254

TABLE 3 Mean scores on driver distraction, driving behaviors, personality, and cognition

		Age				
Measure	**Subsection**	15-17	18-25	26-40	41-60	61+
SDDQ[1]	1.Engagement (Eng)	2.4	2.7	2.8	2.6	2.2
	2.Voluntary (Vol)	3.3	3.1	3.1	3.0	2.9
	3.Involuntary (Inv)	1.6	2.9	3.0	2.8	2.6
DBQ[2]	4.Aggressive violations (AV)	3.0	3.2	3.1	3.1	2.8
	5.Ordinary violations (OV)	12.0	13.1	12.8	12.0	11.5
	6.Errors (Err)	9.0	13.5	13.2	12.0	12.2
	7.Lapses (Lap)	11.0	14.3	14.6	13.4	13.5
I7[3]	8.Impulsiveness (Imp)	3.0	5.7	6.0	5.7	4.4
	9.Venturesomeness (Ven)	9.0	9.0	8.1	7.5	3.8
AISS[4]	10.Sensation seeking (SS)	50.0	46.5	48.8	50.0	56.2
CFQ[5]	11.Distractibility (Dis)	22.0	21.2	20.5	18.0	18.5
ASRS[6]	12.Brief checklist (BC)	0.0	2.1	2.2	1.3	1.1

[1]SDDQ: Susceptibility to Driver Distraction Questionnaire (range: engagement 1-5, voluntary 1-5, involuntary 1-5)
[2]DBQ: Driver Behavior Questionnaire (higher scores – more unsafe driving behaviors, range: aggressive violations 2-12, ordinary violations 6-36, errors 8-48, lapses 8-48)
[3]I7: Eysenck Impulsiveness Questionnaire (higher score – greater impulsiveness, range: impulsiveness 0-19, venturesomeness 0-16)
[4]AISS: Arnett Inventory of Sensation Seeking (higher score – less sensation seeking, range: 20-80)
[5]CFQ: Cognitive Failures Questionnaire (higher score – greater distractibility, range: 8-40)
[6]ASRS: Adult ADHD Self-Report Scale (higher score – greater ADHD symptoms, range: 1-6)

TABLE 4 Pearson correlations among sections in SDDQ

Correlation between measures[1]		**Age**			
Measure 1	Measure 2	18-60	18-25	26-40	41-60
Engagement (Eng)	– Involuntary (Inv)	-.12	-.13	-.08	-.22
Engagement (Eng)	– Voluntary (Vol)	.56*	.51*	.58*	.70*
	– Attitude	.55*	.53*	.52*	.67*
	– Perceived control	.51*	.46*	.57*	.62*
	– Perceived social norms 1[3]	.27*	.24*	.30*	.37*
	– Perceived social norms 2[4]	.30*	.25*	.25*	.54*
Involuntary (Inv)	– Voluntary (Vol)	-.35*	-.39*	-.34*	-.33*
	– Attitude	-.31*	-.38*	-.21	-.37*
	– Perceived control	-.34*	-.36*	-.34*	-.36*
	– Perceived social norms 1	-.18*	-.19*	-.21	-.11
	– Perceived social norms 2	-.20*	-.21*	-.19	-.21

*significant correlation ($\alpha = .05$)

[1] given the small sample size in age groups 15-17 and 60+, we only analyzed correlations for combined age 18-60 and age groups 18-25, 26-40, and 41-60

[2] perceived social norms 1: perceived norms from other drivers

[3] perceived social norms 2: perceived norms from peers and important individuals

TABLE 5 Pearson correlations among all measures for combined age 18 – 60 (left within a cell in bold), as well as for age groups 18 – 25 (top right within a cell), 26 – 40 (mid right within a cell), and 41 – 60 (bottom right within a cell)

Measure[1]	SDDQ			DBQ				I7		AISS	CFQ	ASRS
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1.Eng	–											
2.Vol	**.56***	.51* .58* .70*	–									
3.Inv	**-.12**	-.13 -.08 -.22	**-.35***	-.39* -.34* -.33*	–							
4.AV	**.28***	.31* .22 .31	**.15***	.11 .21 .19	**-.01**	-.02 -.09 .16	–					
5.OV	**.43***	.50* .43* .03	**.25***	.28* .31* -.01	**-.06**	-.06 -.18 .16	**.49***	.49* .51* .42*	–			
6.Err	**.16***	.17 .16 .09	**-.03**	-.02 .01 -.21	**.18***	.25* .05 .11	**.44***	.53* .32* .28	**.40***	.47* .22 .36*	–	
7.Lap	**.09**	.15 -.07 .04	**-.05**	-.01 -.11 -.13	**.25***	.32* .09 .26	**.31***	.40* .12 .29	**.32***	.38* .16 .30	**.70***	.71* .59* .81*	–	
8.Imp	**.14***	.23* -.07 .28	**.03**	.06 -.07 .13	**.03**	-.06 .07 .16	**.24***	.17 .27* .43*	**.23***	.34* .04 .27	**.26***	.25* .16 .45*	**.25***	.19* .25* .43*	–			
9.Ven	**.19***	.22* .13 .24	**.21***	.30* .02 .28	**-.12**	-.09 -.18 -.11	**.11**	.09 .16 .06	**.24***	.27* .25* .03	**-.02**	-.04 .04 -.21	**.00**	.01 .08 -.20	**.19***	.26* .13 .15	–		
10.SS	**-.26***	-.20* -.34* -.33*	**-.22***	-.18* -.14 -.44*	**.11**	.10 .13 .14	**-.18***	-.15 -.27* -.06	**-.20***	-.21* -.24* .04	**.02**	.04 -.04 .18	**.06**	.04 .03 .20	**-.30***	-.32* -.34* -.24	**-.70***	-.67* -.69* -.76*	–		
11.Dis	**.12**	.18* -.05 .20	**.08**	.08 .05 .02	**.13***	.17 .07 .07	**.13***	.14 .07 .14	**.14***	.17 .03 .09	**.30***	.27* .14 .55*	**.45***	.42* .34* .71*	**.19***	.13 .20 .37*	**.00**	-.08 .00 .04	**.03**	.09 .02 .06	–	
12.BC	**.17***	.21* .04 .26	**.10**	.07 .10 .08	**.06**	-.01 .15 -.01	**.13***	.19* .05 .10	**.24***	.32* .13 .15	**.21**	.21* .06 .39*	**.30***	.29* .25* .38*	**.30***	.27* .29* .44*	**.08**	.10 .03 .04	**-.07**	-.03 -.09 -.02	**.63***	.58* .67* .61*	–

* significant correlation ($\alpha = .05$)

– indicates the correlation between a measure and itself

[1] please refer to Table 3 for the full terms of the abbreviations