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Who is a Distracted Driver? Associations between Mobile Phone Use while Driving, Domain-Specific Risk Taking, and Personality

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Mobile phone use while driving (MPUWD) is an increasingly common form of distracted driving. Given its widespread prevalence, it is important for researchers to identify factors that may predict who is more likely to engage in this risky behavior. The current study investigates associations between MPUWD risk behaviors, domain-specific risk perceptions, and broad personality dimensions. An Italian community sample ($n = 804$) completed a survey regarding MPUWD risk perceptions and engagement in MPUWD, in addition to the HEXACO-PI-R, a broad six-factor personality inventory (honesty-humility, emotionality, extraversion, agreeableness, conscientiousness, openness to experience), and the DOSPERT, a six-factor domain-specific self-report risk-taking measure (health/safety, recreational, social, ethical, gambling, and investment). With respect to domain-specific risk taking, greater frequency of SMS use while driving most strongly was associated with greater risk taking for the health/safety, gambling, and ethical risk domains. Further, greater honesty-humility and conscientiousness, two traits related to cognitive control and risk behaviors, and to a lesser extent openness to experience, were associated with less frequent MPUWD, and positively associated with MPUWD risk perceptions. With growing public safety concern surrounding MPUWD, understanding associated personality factors is not only important for identifying psychological mechanisms underlying risk behavior, but also for more effective prevention and intervention programs.

KEY WORDS: Distracted driving; domain-specific risk taking; HEXACO; mobile phone use while driving, risk taking

1. INTRODUCTION

Distracted driving, defined as any instance in which a driver's attention is taken away from the driving task to focus on another activity instead,[1] is a significant cause of automobile crashes worldwide. For example, the National Highway Transportation Safety Administration estimated that 515,000 people were injured in documented automobile crashes involving distracted driving in the United States in 2014 alone. Additionally, in a study of Italian drivers, an estimated 277,000 individuals were injured or killed as a result of human error caused by distraction; from 2012 to 2014, distracted driving was the leading cause of crashes in Italy.[2] Statistics like these prompted the U.S. Secretary of Transportation Ray La Hood to proclaim that

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distracted driving was a "menace to society," calling for action to reduce preventable deaths and injuries.[3]

Although multiple causes of distracted driving are included in such estimates, mobile phone use while driving (MPUWD) is one source of distraction that has attracted the attention of researchers, the media, and public safety officials alike. With public health and safety in mind, the need to investigate factors associated with MPUWD is imperative. Crash statistics inform the public about risk, but are relatively silent about psychological factors that may help better understand *who* is more likely to engage in this behavior. Moreover, risk communication efforts that present only statistics often fail to evoke a strong enough emotional response to elicit protective action.[4] Individual differences research not only has the potential to identify those individuals at highest risk for potential crashes, but also may ultimately assist in developing more effective and personalized risk communication messages designed to abate this behavior.

The current research was motivated by two key insights and aimed to integrate emerging perspectives in both personality and behavioral decision-making research. First, we consider risk taking as not a unidimensional construct, but instead, a multifaceted, domain-specific construct domain-specific.[5,6] Second, this multidimensionality may yield specific constellations of dispositional predictors that may be associated with different risk domains.[7–9] Leveraging these two insights, we first sought to clarify specific risk domain(s) that individuals perceive with regards to MPUWD. For instance, one could conceptualize MPUWD as an ethical risk (e.g., violating law), a health risk (e.g., danger of crash), and/or a social risk (e.g., not responding to friends). Next, we tested the degree to which MPUWD was associated with individual differences across broad personality dimensions using the HEXACO personality framework, an emerging alternative phenotypic structure to Big Five personality models.[10]

Experimental research has suggested that MPUWD-related driving impairments can be just as profound as those associated with drinking and driving.[11] The public response has been somewhat mixed, though. For example, the American Automobile Association Foundation for Traffic Safety found that nearly 60% of drivers view MPUWD as a potential threat to personal safety.[12] Despite the concern that it invokes and public service campaigns designed to abate use, MPUWD remains high, yielding a legitimate threat to public safety. For example, in a nationally representative sample of younger American drivers (17–26 years), researchers found that approximately one-third of respondents stated that they talked on their mobile phones and 22% sent SMS text messages, on at least half of their driving trips.[13] Even though young drivers may be particularly likely to engage in MPUWD behaviors due to relatively greater reliance on technology compared to other age cohorts,[14] adults engage in these behaviors as well.[15]

1.1. Domain-Specific Risk Taking

Given the widespread MPUWD and its potential negative consequences, understanding the psychological factors that may impact individuals' acceptance of the associated risks becomes increasingly vital. A prominent set of models, labeled psychological risk-return models,[16] posit that individual differences in risk-taking emerge because of individual variation in the assessment of perceived riskiness and expected benefits of engaging in an activity.[6,17,18] For these models, risk taking is conceptualized as a tradeoff between risk perceptions and perceived expected benefits. Specifically, increased risk perceptions are inversely associated with risk taking, whereas greater perceived benefits are positively associated with risk propensity.[6,9,19,20] Though not extensively studied with respect to MPUWD, multiple studies support this model and have shown that increased perceptions of risk associated with distracted driving have been found to have direct, inverse effects on risky driving behaviors and intentions.[21,22] Furthermore, in a nationally representative sample of young drivers in the United States, greater risk perceptions (measured via self-report) inversely predicted MPUWD, whereas perceived attachment to one's phone (which may indirectly reflect perceived benefits) was positively associated with self-reported MPUWD frequency.[13]

However, a growing body of evidence suggests that considering "risk taking" as a unitary dispositional trait may be too simplistic, and a domain-specific approach may help to better explain these tendencies.[6,7,23] Leveraging this domain-specific perspective, the Domain-Specific Risk Taking (DOSPERT)[6] scale is one such approach. This scale measures risk-taking tendencies across six domains (social, recreational, investment, gambling, health/safety, and ethical).

Moreover, risk taking in these domains may have both unique predictors[8,9,24] and predictive validity.[25] These results resonate with a robust personality literature that also suggests risk-taking constructs such as sensation seeking and impulsiveness are multidimensional. For instance, a distinction may be made between impulsive sensation seeking, which may reflect disinhibition and dysregulated behaviors, and nonimpulsive sensation-seeking behaviors, which may be represented by thrill and adventure-seeking tendencies.[26] Thus, understanding the associations between MPUWD and domain-specific risk tendencies may illuminate unique dispositional factors that are most strongly associated with this behavior.

1.2. Associations between MPUWD and Personality

Previous research provides evidence that personality traits can account for the heterogeneity in risky driving behaviors and attitudes. For instance, several studies have implicated greater sensation-seeking tendencies as a predictor of risky driving behaviors, such as driving while intoxicated, speed limit violations, and reckless driving.[21,27,28] Other research highlighted positive associations between trait "normlessness," a scale that measures the willingness to violate societal laws,[29] and risky driving behaviors (e.g., speeding and rule violations).[21,22] In another study, though, researchers found that individual differences in aggression, hostility, risk taking, deviance tolerance, and low achievement expectations were significantly associated with risky driving (i.e., competitive driving, drinking/driving, risky driving, aggressive driving) in a sample of young adults.[30,31]

Beyond studies investigating single, narrower traits, several studies have examined the associations between broad personality dimensions and risky driving behavior, largely producing convergent results. Researchers have found that greater psychoticism, a broad trait related to disinhibited and reckless behaviors, and lower neuroticism were associated with greater incidence of driving infractions.[32–34] Studies using the five-factor model, or the "Big 5" (neuroticism, extraversion, openness, agreeableness, and conscientiousness), have yielded similar results. Specifically, greater conscientiousness, a trait dimension related to reasoned and planned behaviors, has been associated with lower incidences of risky driving behavior,[35,36] in addition to a wide range of health-risking behaviors.[37–41]

To our knowledge, only one study has examined broad-based personality correlates of distracted driving. In a small sample ($n = 120$), Parr *et al.* found that younger ($n = 48$) and older drivers ($n = 72$) differed with respect to the associations between personality traits and distracted driving tendencies.[42] Whereas only greater extraversion was associated with distracted driving behaviors in adults, greater openness and lower agreeableness were associated with increased distracted driving tendencies in teenage drivers. However, this study also reported that greater, and not lower, conscientiousness was associated with greater distracted driving for younger drivers, a counterintuitive finding when considering the broader personality literature.

1.2.1. The HEXACO Personality Framework

The HEXACO personality framework has become an emerging alternative structure that appears to replicate across natural-language personality studies within the lexical hypothesis tradition.[10,43–45] Although subtle differences exist between the HEXACO and the "Big 5" model with respect to the broad dimensions jointly recovered by the two structural models (neuroticism, extraversion, conscientiousness, agreeableness, and openness), the largest divergence is the recovery of a sixth broad factor: honesty/humility. This dimension characterizes the tendency to be genuine in interpersonal interactions, an aversion to committing fraud and corruption, a disinterest in lavish material goods, and a tendency to be modest and unassuming.

In addition to conscientiousness, which has been robustly found to be inversely associated with risk taking in Big 5 models, honesty/humility has demonstrated considerable predictive validity for risky, unethical, and otherwise counterproductive behaviors, making it a potential candidate for predicting MPUWD.[46–49] Honesty/humility has been associated with the dark triad traits (i.e., psychopathy, machiavellianism, and narcissism), which have also been linked with impulsivity, sensation-seeking behaviors, and risky choices.[50–52] One study found that low honesty/humility, along with conscientiousness, was associated with greater risk-taking behaviors for health/safety and ethical risks, but not recreational or social risks, reinforcing the construct's association with impulsive antisociality.[9,53]

Individuals who reported lower honesty/humility perceived these activities as being less risky, as well as perceiving greater expected benefits associated with the activity.[9] Moreover, in another study, criminals reported lower honesty/humility scores than nonoffenders,[54] indirectly suggesting that this dimension may be associated with law violations.

Openness may also be associated with some risk behaviors, but for perhaps different reasons than conscientiousness and honesty/humility. For instance, higher levels of openness have been associated with greater cannabis use and social and recreational risk taking,[9,55] perhaps due to a greater tendency to be experience oriented and novelty seeking.[52,56,57] In contrast, when considering new regulations for a common behavior such as MPUWD, individuals who report lower openness may demonstrate a lag in rule adherence. Research has suggested that this lag tendency may be associated with a decreased tolerance of new ideas and information, a lower tendency to seek out and accept new information, and/or more generally conservative attitudes regarding political and economic policy.[58,59]

Finally, we predicted that emotionality, the HEXACO dimension most closely associated with neuroticism in Big 5 models, would be associated with heightened risk perceptions related to MPUWD. Emotionality can be defined as a dispositional tendency to experience negative emotional states, feel a need for emotional support from others, and feel empathy and sentimental attachments with others. In past studies, neuroticism and related constructs, such as trait anxiety, have been associated with increased perceptions of risk and lower risk-taking tendencies.[60–66] With respect to risk-return models, emotionality was found to be the only domain-invariant predictor of risk attitudes, but its effect on risk-taking propensity was indirect, mediated through amplified risk perceptions.[9]

1.3. The Current Study

In this study, we examined three specific sets of hypotheses. First, we tested the degree to which MPUWD risk attitudes and behaviors (i.e., frequency of trips engaging in MPUWD) would be associated with endorsement of risk behaviors across several risk domains. Although exploratory in nature, we predicted that frequency of SMS use would be more strongly positively associated with more disinhibited risk-taking domains (i.e., gambling, health/safety, and ethical), compared to experience-oriented risk domains (i.e., social and recreational). Second, we predicted that the greater honesty/humility, conscientiousness, and openness would be associated with lower reported MPUWD behaviors. We also predicted that these traits as well as greater emotionality would be associated with amplified risk perceptions. Finally, consistent with past research,[9] we tested the degree to which risk attitudes mediated the association between HEXACO dimensions and MPUWD behaviors. In line with psychological risk-return models, we expected that MPUWD risk perceptions would partially mediate the associations between HEXACO dimensions and MPUWD. Taken together, we aim to provide convergent evidence linking MPUWD risk attitudes and behaviors with specific dispositional characteristics.

1.3.1. Data Analytic Plan

We began with conducting correlational analyses between MPUWD variables (risk perception and self-reported MPUWD frequency) and (i) domain-specific risk taking and (ii) HEXACO personality variables. Then, we conducted a path analysis to test the degree to which MPUWD risk perceptions mediated the relationship between personality dimensions and reported frequency of MPUWD, both for talking and SMS use. As covariates, we included direct paths to our three MPUWD variables for age and gender, informed by the observed zero-order correlations. Analyses were conducted with MPlus 7.3 software package.[67] Parameters were estimated using the maximum likelihood method. To obtain p-values and confidence intervals for indirect effects, we ran 2,000 bootstrap resamples.[68,69] Model fit was evaluated using several established fit indices, including χ^2, root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), the Tucker-Lewis index (TLI), and the confirmatory fit index (CFI). We began with a fully saturated model, including HEXACO traits that showed significant zero-order correlations with MPUWD; that is, X (personality) $\rightarrow$ Y (MPUWD behavior), in addition to the indirect path $X \rightarrow M \rightarrow Y$ in the same model. We then trimmed nonsignificant paths ($p > 0.01$) to arrive at the final model, though we kept all covariate paths in the model regardless of significance. Finally, we conducted a χ^2 difference test between the final model and a fully mediated model $X \rightarrow M \rightarrow Y$ in order to test if the

more restrictive model fit the data as well as the partial mediation model.

2. METHOD

2.1. Participants

A third-party survey research firm sent 7,044 invitations to an opt-in panel of Italian community residents to participate in this study. Participants were invited to take part in the survey via email, informing them that the survey was available. In the email, participants were provided with a hyperlink that directed them to the questionnaires. Of those who were invited to participate in the study, 921 completed the entire survey.

We excluded 117 participants from the data analyses due to suspicion of careless responding (e.g., completion time less than 10 minutes, stylistic responding such as nay-saying/yea-saying, etc.). This removal yielded an $N = 804$. Median age was 35 years (range 20–58; 58% female). For the participants who completed the study, 92.8% of participants had attained at least a high school diploma or equivalent, with 40.5% of the entire sample receiving a bachelor's degree or higher. This study was approved by the Ethical Review Committee at a mid-sized Italian university. For their participation, the third-party research firm awarded points to the participants, who could trade them in for cash or other prizes.

2.2 Procedure

As part of a larger study, participants were asked to complete a battery of self-report questionnaires.

2.2.1. Driving Behaviors

Participants first completed items regarding personal driving habits and behaviors. Specifically, participants were asked to rate the proportion of trips in which they used a mobile phone while driving a car, both for SMS messaging (MPUWD-SMS) and talking (MPUWD-Talk). Frequency was assessed using the following response scale 0 = *never*, 1 = *fewer than 1/2 of trips*, 2 = *about 1/2 of trips*, 3 = *most trips*, and 4 = *all trips*. For respondents who reported not owning a car ($n = 23$), we coded their responses as missing for these items, but retained the participants' risk perception scores and included them in analyses.

2.2.2. MPUWD Risk Perceptions

Participants completed an abbreviated, seven-item version of the cell phone risk appreciation (CRAS) measure (see Appendix A)[13,70] that was designed to assess drivers' appreciation of the hazards associated with both distractions in general, and MPUWD (e.g., "People who use mobile phones while driving are likely to cause an accident" and "Talking on the phone while driving is no different than talking to another passenger").[4] Participants responded to items from the following measures on a five-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), unless otherwise noted. Cronbach's $\alpha = 0.86$, mean interitem $r = 0.47$. The CRAS measure was adopted using a back-translation procedure with an independent bilingual translator, and showed similar reliability and interitem correlations as the original English-language measure.

2.2.3. Domain-Specific Risk Taking

Participants completed an Italian version of the 40-item DOSPERT scale.[6,8] The DOSPERT measures individual differences in risk attitudes across six domains: *health/safety* (e.g., "Not wearing a helmet when riding a motorcycle), *ethical* (e.g., "Cheating on an exam"), *recreational* (e.g., "Taking a skydiving class"), *social* (e.g., "Approaching your boss to ask for a raise"), *gambling* (e.g., "Playing in a high-money poker game"), and *investment* (e.g., "Investing 5% of your annual income in a conservative stock"). risks. Participants were asked to "please indicate your likelihood of engaging in each activity or behavior" (i.e., risk taking) on a five-point Likert scale (1 = *extremely unlikely*; 5 = *extremely likely*).

2.2.4. HEXACO-PI-R

Individual differences in personality variables were assessed using the 60-item HEXACO-60 personality measure.[71] The HEXACO-60 measures six broad personality dimensions: honesty/humility, emotionality, extraversion, agreeableness, conscientiousness, and openness, as well as facet-level scales. Cronbach's alphas for the six dimensions ranged from 0.87 to 0.90 in the current study for the broad domains.

[4]To obtain the Italian-language version of the CRAS, please contact the authors.

3. RESULTS

3.1. Descriptive Statistics

For participants who owned an automobile, 37.6% reported talking on their mobile phones and 30.3% reported texting on at least half of their car trips. For these individuals, 75.8% reported both on at least half of their trips. Independent samples *t*-tests revealed significant gender differences in MPUWD-Talk and MPUWD-SMS frequency. Males were more likely than females to report engaging in MPUWD behavior, $t\,(789) = 3.20$, $d = 0.23$ and 3.13, $d = 0.23$, $p < 0.01$, for MPUWD-Talk and MPUWD-SMS, respectively. This coincided with women reporting greater risk perceptions for MPUWD, as evidenced by greater CRAS scores, $t\,(802) = 3.62$, $d = 0.26$, $p < 0.01$. We also found significant but small correlations between age and CRAS scores, $r = 0.15$, $p < 0.01$, suggesting that older participants perceived greater risks associated with MPUWD. With respect to MPUWD frequency, younger participants more frequently used SMS messaging while driving than older adults, though this correlation was weak, $r = 0.11$, $p < 0.01$. We observed a negligible zero-order correlation between age and MPUWD-Talk frequency, $r = 0.01$, ns. To further explore this age difference, we created three age groups (20–30; 31–40; 41–58 years) and also dichotomized the MPUWD frequency variable (1 = *reporting MPUWD on half or more trips*). For the youngest age group, 36.4% and 39.1% of respondents reported MPUWD-SMS and MPUWD-Talk on at least half of their trips, respectively, with 27% reporting doing both. The middle age group showed no difference for MPUWD-Talk (38.6%), but fewer reported MPUWD-SMS trips (31.2%); 23.1% reported engaging in both activities. The oldest age group in the sample reported the lowest amount of MPUWD-Talk (34.8%), MPUWD-SMS (22.2%), and engaging in both activities on at least half of their trips (18.3%).

3.2. Associations between DOSPERT and MPUWD

Table I displays the intercorrelations between the six DOSPERT risk-taking scales and the three MPUWD variables. Overall, neither social nor investment risk taking predicted MPUWD risk perception. We found that lower risk perceptions were associated with greater reported ethical and health/safety risk taking compared to social, investment, and recreational risk taking, confirmed by parallel *z*-tests for testing dependent correlations, all $|z| > 2.37$, $p = 0.02$ and 2.28, $p = 0.02$, for the ethical and health/safety comparisons, respectively.[72] The correlation between gambling risk taking and MPUWD risk perception also was significantly higher than that for social ($|z| = 5.66$, $p < 0.001$) or investment risk taking ($|z| = 9.74$, $p < 0.001$).

Table I. Correlations between DOSPERT Risk-Taking Scales and MPUWD

Scale	Risk Perception	MPUWD-Talk	MPUWD-SMS
Social	0.06	0.05	0.01
Recreational	-0.22^{**}	0.23^{**}	0.29^{**}
Investment	−0.08	0.21^{**}	0.24^{**}
Gambling	-0.28^{**}	0.30^{**}	0.37^{**}
Health/safety	-0.29^{**}	0.30^{**}	0.35^{**}
Ethical	-0.30^{**}	0.28^{**}	0.40^{**}

$^{**}p < 0.001$.

However, we found a divergent pattern for MPUWD-Talk and MPUWD-SMS frequency. For MPUWD-Talk, we found that the MPUWD-Talk—social risk-taking correlation was significantly lower than the correlations observed for the other risk domains (all $|z| > 3.78$, $p < 0.001$). The correlations for the other domains were not significantly different from one another. However, correlations between MPUWD-Talk and the ethical, health/safety, and gambling risk domains were slightly stronger than recreational and investment risk-taking correlations. In contrast, the correlations between MPUWD-SMS and (i) ethical, (ii) health/safety, and (iii) gambling scores were significantly greater than those observed in the investment (all $|z| > 2.89$, $p < 0.01$) and recreational ($|z| = 3.42$, $p < 0.001$, 2.00, $p = 0.04$, and 2.44, $p = 0.01$, respectively) risk domains. The MPUWD-SMS—social risk-taking correlation was significantly lower than that between MPUWD-SMS and all other domains (all $|z| > 5.87$, $p < 0.001$).

Finally, we compared the difference in effect size magnitude between MPUWD-Talk and MPUWD-SMS for each risk domain. Consistent with the domain specificity hypothesis, we found that the correlations for MPUWD-SMS—ethical risk taking ($|z| = 4.32$, $p < 0.001$), and MPUWD-SMS—gambling risk taking ($|z| = 2.51$, $p < 0.01$) was significantly stronger than these domains' corresponding correlations with MPUWD-Talk. The other domains did not show this pattern, though health/safety

risk taking demonstrated the expected pattern of correlations.

3.3. Associations between DOSPERT Scales and HEXACO Trait Dimensions

For purposes of replicating past research findings,[9] we calculated the intercorrelations between the DOSPERT scales and the HEXACO trait dimensions (see Appendix B). Overall, we observed a pattern consistent with the previous results. First, we found that honesty/humility and conscientiousness showed stronger correlations with ethical and health/safety risk taking than the other risk domains. Conversely, openness showed the strongest association with social risk taking, and emotionality was most strongly associated with recreational risk taking. We noted some minor differences between the current results and the original study. Most germane to the current study, openness was inversely associated with health/safety and ethical risks, but showed zero correlation in the original study. We also did not find systematic associations between agreeableness and risk taking in any domain. Taken together, we find general support between the two studies, in light of the numerous differences between samples (i.e., cultural, different versions of the measures, age range of sample, and assessment modes).

3.4. Associations between HEXACO and MPUWD

Following our predictions and the observed correlations between DOSPERT domains and MPUWD behaviors, we tested the latter's associations with HEXACO personality dimensions. As shown in Table II, four HEXACO dimensions were associated with increased MPUWD risk perception. Individuals reporting greater levels of conscientiousness, honesty/humility, openness, and, to a lesser extent, emotionality, also reported greater CRAS scores. These HEXACO dimensions were approximately equally associated with lower frequency of MPUWD-Talk. However, we observed a divergent pattern for MPUWD-SMS frequency. Specifically, both the correlations between MPUWD-SMS—honesty/humility, and MPUWD-SMS—conscientiousness, respectively, were stronger than the association between MPUWD-SMS and openness. Emotionality was not associated with MPUWD-SMS frequency. We did not find associations between extraversion and agreeableness for any of the MPUWD variables.

Table II. Correlations between HEXACO Scales and MPUWD

Scale	Risk Perception	MPUWD-Talk	MPUWD-SMS
Honesty Humility	0.25**	−0.19**	−0.23**
Sincerity	0.28**	−0.16**	−0.20**
Fairness	0.22**	−0.18**	−0.23**
Greed avoidance	0.00	0.00	0.03
Modesty	0.09	−0.12**	−0.14**
Emotionality	0.16**	−0.14**	−0.09
Fearfulness	0.05	−0.07	0.01
Anxiety	0.16**	−0.16**	−0.15**
Dependence	−0.02	−0.02	0.05
Sentimentality	0.23**	−0.12**	−0.15**
Extraversion	0.09	0.01	−0.06
Social self-esteem	0.08	0.02	−0.05
Social boldness	0.05	0.04	−0.01
Sociability	0.06	0.00	−0.02
Liveliness	0.06	−0.03	−0.09
Agreeableness	−0.01	0.02	0.03
Forgiveness	−0.08	0.07	0.05
Gentleness	0.04	−0.02	0.02
Flexibility	−0.10	0.04	0.07
Patience	0.11	−0.03	−0.09
Conscientiousness	0.28**	−0.15**	−0.28**
Organization	0.17**	−0.09	−0.17**
Diligence	0.28**	−0.13**	−0.26**
Perfectionism	0.28**	−0.15**	−0.22**
Prudence	0.09	−0.07	−0.16**
Openness	0.21**	−0.13**	−0.19**
Aesthetic appreciation	0.10	−0.10	−0.07
Inquisitiveness	0.21**	−0.09	−0.20**
Creativity	0.18**	−0.12**	−0.16**
Unconventionality	0.10	−0.06	−0.12**

** $p < 0.001$.

3.5. Path Analysis

Finally, we conducted a path analysis to assess the degree to which the risk perceptions mediated the relationship between personality and MPUWD frequency (see Fig. 1). With respect to the model covariates, we found that holding other variables constant, age had a marginally significant ($p < 0.05$) positive direct effect for MPUWD-SMS, in which older individuals reported less MPUWD-SMS frequency. Older participants were also significantly more likely to report greater MPUWD perceived risks. Gender did not account for unique variance in either MPUWD risk perception or either MPUWD frequency variables.

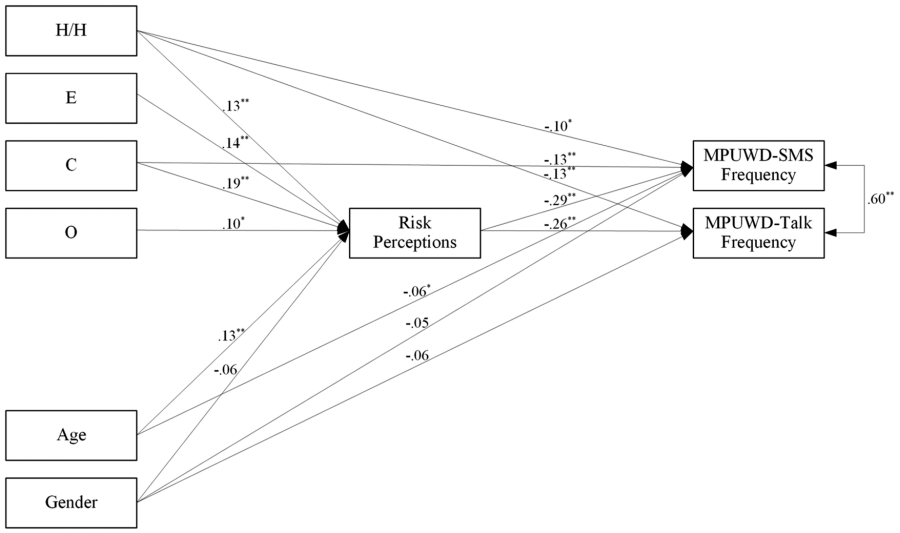

Fig. 1. Final path model predicting MPUWD frequency. $^{*}p < 0.05$; $^{**}p < 0.01$. χ^2 (6) = 15.11, $p = 0.019$; CFI = 0.987; TLI = 0.955; RMSEA = 0.043; SRMR = 0.019. H/H = honesty/humility; E = emotionality; C = conscientiousness; O = openness. Only variables with a significant path coefficient to a MPUWD variable (risk perception or MPUWD frequency) are shown.

As shown in Fig. 1, the final model revealed that CRAS scores had a significant inverse path to both MPUWD frequency measures. Moreover, honesty/humility had significant direct paths to MPUWD-SMS and MPUWD-Talk frequency, whereas conscientiousness only showed a direct inverse path to MPUWD-SMS.

With respect to the CRAS scores, the final path model found significant, positive direct effects for each of the personality variables included in the model, holding age and gender constant (15.2% of the variance explained). As shown in Table III, the indirect effects for the four personality → risk perception → MPUWD frequency paths also were significant. In total, the final model accounted for 17.4% of the variance in MPUWD-SMS frequency, and 10.7% of the variance in MPUWD-Talk frequency. The χ^2 difference test confirmed that the final model better fit our data than a full mediation model, removing all direct paths with the exception of the covariates, $\chi^2_{\text{diff}} = 39.53$, $p < 0.01$. These results suggest that risk perceptions associated with MPUWD partially mediate the association between HEXACO dimensions and self-reported MPUWD frequency.

4. DISCUSSION

Although a preventable public health concern, a sizeable proportion of drivers continue to engage in behaviors that may cause distractions. The current study found that approximately one-third of our sample frequently engaged in MPUWD, both for talking and SMS messaging, suggesting a considerable amount of MPUWD behaviors. Given this high rate of use, it follows that a better understanding of the psychological factors that are associated with MPUWD behavior has the potential to decrease injuries and fatalities that may occur. Our findings not only suggest that MPUWD, especially for SMS use, may be associated with other maladaptive risk behaviors, but also broad-based personality traits can account for the heterogeneity in variance of these behaviors. Specifically, we found that four broad traits, conscientiousness, emotionality, openness, and honesty/humility, were associated with the tendency to report more frequent MPUWD. Moreover, the associations between these trait dimensions were, in part, mediated by risk perceptions.

With respect to domain-specific risk taking, we found that MPUWD, especially SMS use, was more strongly positively associated with risks that may be considered impulsive or having an antisocial component (i.e., gambling, health/safety, and ethical risks), than more "experience-seeking" risk domains (i.e., recreational and social). Additionally, the social risk domain did not predict MPUWD, providing evidence that individuals do not perceive using MPUWD in

Table III. Estimates of Indirect Effects

Scale	Unstandardized Estimate	Lower 95% CI	Upper 95% CI	Standardized Estimate	Lower 95% CI	Upper 95% CI
MPUWD-SMS						
H/H	−0.05**	−0.08	−0.02	−0.04**	−0.06	−0.02
E	−0.06**	−0.09	−0.02	−0.04**	−0.06	−0.02
C	−0.08**	−0.12	−0.04	−0.05**	−0.08	−0.03
O	−0.04*	−0.07	−0.01	−0.03*	−0.05	−0.01
Age	−0.00**	−0.01	−0.00	−0.04**	−0.06	−0.02
Gender	−0.02**	−0.06	−0.01	−0.02**	−0.06	0.02
MPUWD-Talk						
H/H	−0.05**	−0.08	−0.02	−0.03**	−0.05	−0.01
E	−0.05*	−0.09	−0.02	−0.04*	−0.06	−0.01
C	−0.08**	−0.12	−0.04	−0.05**	−0.08	−0.02
O	−0.04*	−0.06	−0.01	−0.03*	−0.05	−0.01
Age	−0.00*	−0.01	−0.00	−0.03**	−0.05	−0.01
Gender	−0.03*	−0.06	−0.01	−0.01*	−0.03	0.00

*$p < 0.05$; **$p < 0.001$.

a similar light as making interpersonal choices that might involve potentially negative consequences. Of note, we did not find that MPUWD was exclusively associated with only one domain, which would have suggested strict domain specificity. Although the DOSPERT theoretically predicts relative independence between factors, empirical results are mixed and often show significant correlations between risk domains, similar to the current results.[6,8,17] However, using bifactor modeling,[73] researchers found evidence supporting multidimensionality, even after accounting for a general risk-taking factor.

Largely consistent with past studies investigating the associations between personality and other risky driving behaviors, we found that greater conscientiousness and honesty/humility were associated with fewer reported risk behaviors and heightened risk perceptions. These findings reinforce past work investigating personality correlates of risky driving behaviors.[30,33,38] Similarly, the current results also reinforce a burgeoning literature that explicates the association between honesty/humility and risk taking, especially in health/safety and ethical domains. Research has suggested associations between this broad dimension and sensation seeking, in particular, disinhibited tendencies and impulsive antisocial behaviors.[52,53] The effort to stop SMS messaging while driving has been a specific target of public service campaigns in recent years. In contrast, talking on a mobile phone while driving remains legal if one uses a hands-free apparatus.

One potential reason for these findings may be the tendency to follow societal and precautionary laws and rules. Individuals low in honesty/humility may be more likely to violate social contracts, whereas individuals low in conscientiousness were less likely to follow precautionary rules.[74] Laws created to abate MPUWD, which are common worldwide, including the location of the current study, carry an element of both. They involve contracts with society and have the potential to impact the lives of others, in addition to establishing precautionary measures to preserve one's own physical health. This point especially may be the case for SMS use.

Although not often implicated in health/safety and ethical behaviors, we observed significant associations between MPUWD and openness. However, when holding other variables constant, openness only demonstrated indirect effects via increased risk perceptions. Openness has been associated with novelty-seeking behaviors, and may overlap in content with sensation seeking—which is robustly associated with a variety of risk-taking behaviors, including risky driving,[7,27,75] Also, low openness may be related to resistance to changes in laws, especially if the perception of risk is initially low. Further, individuals lower in openness are less likely to seek out and appreciate new information about risks, and may even discount new information based on scientific studies.[57,76,77] This general resistance to new information may result in a lag between a growing public acknowledgment of risks and actual behavior.

It may also relate to a general cognitive strategy to avoid engagement in rational decision making in favor of more heuristic, associative processes.[78]

More broadly, our findings are consistent with research investigating the association between personality and risky driving behavior. We must note that these findings, in part, run contrary to those observed in the only other study to our knowledge that specifically examined personality correlates of distracted driving.[42] Parr *et al.* found that only extraversion predicted distracted driving tendencies in adults. We did not find this to be the case; in fact, extraversion was neither associated with risk perceptions nor actual reported MPUWD frequency. Moreover, supported by a broader literature, our findings suggest that lower conscientiousness is associated with greater distracted driving, counter to that reported in Parr *et al.*,[42] who found no correlation in adult participants, and positive correlations with distracted driving tendencies in teenagers. However, our results are largely consistent with their observed correlations with respect to openness and distracted driving in teenagers. Additionally, if one considers how agreeableness in Big 5 models corresponds with agreeableness and honesty/humility dimensions in the HEXACO model,[44] the current results provide convergent evidence of the association between low agreeableness and risky driving,[38,79] and extend it to an adult population.

4.1. Limitations and Future Directions

Although these results provide convergent evidence for the associations between HEXACO dimensions and MPUWD, we do acknowledge some limitations of the current study. First, because of time fatigue concerns, we only used comparatively shorter versions of both the HEXACO and the CRAS measures. This limitation is especially important for the former because it would have allowed a more refined measure of traits at the facet level, instead of highest loading markers of each. Similarly, we did not assess perceived risk-mitigating MPUWD behaviors such as Bluetooth-enabled MPUWD hands-free use. Because hands-free MPUWD is still considered legal, individuals may perceive it to be less risky than holding a mobile phone and talking. However, despite the differential legality of these two modes, some behavioral evidence suggests little difference between the two in terms of distraction.[11] As more automobiles become wired for hands-free phone use, we feel that comparing the perceived risks between the two modes may be a fruitful direction for future research.

Second, our study was not designed to be an explicit test of psychological risk-return models. First, instead of solely measuring perceived harm, as is the case in many psychometric studies of risk, the CRAS expands the definition of risk perception, encompassing a more global assessment of one's appreciation of the general risks involved rather than specially an estimate of personal risk. This measure was designed purposely in this manner, because for behaviors that may not bear an immediate punishment (but do offer immediate rewards), individuals often have a perfunctory evaluation about the perceived dangers of an activity.[69] Researchers have suggested that smoking behaviors begin due to a lack of deeper appreciation of the nature of addiction and the multitude of health problems associated with smoking.[80,81] A similar argument may be made about MPUWD. Presumably, a sizeable number of individuals use their phones each day, not considering the level of distraction it may cause while driving, potentially leading to lower perceived risks and increased MPUWD.[82] We feel that these points may become obfuscated in a single-item risk-perception assessment common in the literature. Second, we did not assess perceived expected benefits of MPUWD behaviors, which would have allowed us to fully test the individual contributions of personality on specific components of the risk-return model. We encourage researchers to consider developing a more global measure of perceived expected benefits for MPUWD, which may include social, financial, and personal benefits that might be expected from engaging in this behavior. Taken together with a measure like the CRAS, research may be able to more intricately understand the antecedent variables that relate to these specific factors, and ultimately how they influence behavioral tendencies.

Another avenue for future investigation may be to test the degree to which both the HEXACO and DOSPERT scales predict different kinds of driving behaviors. Specifically, our study cannot speak to the degree to which different driving behaviors may have a unique constellation of personality correlates, or if "distracted driving" can be considered its own domain. It should be noted that even distracted driving itself is not limited to mobile phone use, but could be extended to other sources of distractions, such as passengers

or eating/drinking. With this in mind, we speculate that specific behaviors may have distinct personality predictors. For instance, trait hostility or aggression may be a better predictor of aggressive driving, but less so for distracted driving. Understanding these nuances may help to refine measurement of what researchers consider "risk" behaviors, and promote more specific measures of driving risk tendencies.

Educators and safety advocates could develop programs to change risk attitudes by highlighting "deeper" risk knowledge, such as appreciating the causes and duration of distractibility that could lead to driving errors, and that MPUWD has the potential to cause as serious of an accident as one resulting from other causes like speeding and intoxicated driving. McKenna[83] argues that a key method to improving traffic safety culture is to direct education efforts toward increasing its perceived legitimacy. One way to increase perceived legitimacy is to reinforce that distracted driving affects everyone on the road, and not just the driver. Our findings, though, suggest that solely increasing risk appreciation may not be enough. If the individuals who are most likely to engage in this behavior are careless, reckless, and pay less attention to rules/laws, then other means might be necessary to prevent crashes, including improved safety technology, both in the car and on the phone, and providing tailored messages to these individuals that may increase adherence to safety laws.

It is apparent that mobile phone use will not decrease anytime in the near future, as they continue to replace traditional landlines. Further, phones of the future will offer functions that will far surpass even the functionality of today's "smartphones." As with all tools, there are appropriate and inappropriate times in which to use a mobile phone. Understanding who engages in this behavior, and why, has the potential to reduce preventable traffic fatalities and injury. We hope that these results provide a foundation for developing evidence-based means by which lives may be saved worldwide.

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APPENDIX A: CELL PHONE RISK APPRECIATION SCALE ITEMS USED IN CURRENT STUDY

(1) Texting while driving limits a person's ability to control one's car.
(2) Using a cell phone while driving affects everyone on the road, not just the person using it.
(3) Driving next to someone who is talking on a cell phone makes me more cautious.
(4) Talking on a cell phone while driving is dangerous.
(5) Compared with drunk driving (your blood alcohol level is a little bit over the legal limit), talking on your phone while driving similarly affects your reflexes.
(6) People who use cell phones while driving are likely to cause an accident.
(7) People who use cell phones while driving are acting irresponsibly.

APPENDIX B: CORRELATIONS BETWEEN DOSPERT SCALES AND HEXACO TRAIT DIMENSIONS

	H/H	E	X	A	C	O
DOSPERT Risk-Taking Scale						
Social	−0.05	0.01	0.22**	−0.09	0.06	0.28**
Recreational	−0.22**	−0.29**	0.13**	0.03	−0.22**	0.06
Gambling	−0.37**	−0.14**	0.02	0.00	−0.28**	−0.12**
Investment	−0.19**	−0.09*	0.05	0.03	−0.09**	0.05
Health/safety	−0.36**	−0.18**	−0.03	−0.04	−0.33**	−0.11**
Ethical	−0.50**	−0.14**	−0.14**	−0.12**	−0.34**	−0.20**

** $p < 0.001$.
H/H = honesty/humility; E = emotionality; X = extraversion; A = agreeableness; C = conscientiousness; O = openness.

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