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Associations Between Personality and Driving Behavior are mediated by Mind-Wandering Tendency: A Cross-National Comparison of Australian and Italian Drivers.

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Prof. Samuel Charlton

University of Waikato,

Hamilton, New Zealand

Dear Prof. Charlton, please find enclosed the ms. entitled "Associations Between Personality and Driving Behavior are mediated by Mind-Wandering Tendency: A Cross-National Comparison of Australian and Italian Drivers", to be submitted for consideration on Transportation Research Part F: Traffic Psychology and Behaviour. This work is part of the research carried out during my PhD program, under the supervision of the last author. This research is aimed at examining the relationships between personality traits (i.e., neuroticism, extraversion, openness, agreeableness, and conscientiousness) and aberrant driving behaviors in a sample of Australian and Italian drivers by investigating the mediation effect of Mind Wandering (MW) tendency. The study showed that the association between personality and driving behaviors is partially explained by the driver's tendency to MW behind the wheel by suggesting the usefulness of the assessment of personality measures in the study of driving distraction and fitness-to-drive evaluation purposes.

I hope the ms. may be of interest for the journal audience.

My best regards

Luigi Tinella (on behalf of all co-authors)

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Highlights

- Mind wandering mediates the positive effects of both Neuroticism and Extraversion on aberrant driving behaviors.
- The negative relationship between Conscientiousness and aberrant driving behaviors is partially mediated by the mind wandering tendency.
- Mind wandering mediates the relationship between personality traits and driving over and above the nationality group.
- The screening of at-risk drivers should include the assessments of both personality and mind wandering tendency.

Associations Between Personality and Driving Behavior are mediated by Mind-Wandering Tendency: A Cross-National Comparison of Australian and Italian Drivers.

Abstract

Objective: This study examined the relationships between personality traits (i.e., neuroticism, extraversion, openness, agreeableness, and conscientiousness) and aberrant driving behavior in a sample of Australian and Italian drivers by investigating the mediation effect of Mind Wandering (MW) tendency.

Background: Although unsafe driving behaviors are influenced by both a driver's mind wandering tendency and personality traits, the potential interaction between these variables and their association with driving behavior has not been previously investigated.

Method: Nine-hundred-four active drivers (n = 452 Australians, n = 452 Italians) completed an online survey evaluating self-reported personality traits, driving behaviors, and MW tendency.

Results: A multi-group path analysis showed that MW tendency significantly mediated the effects of neuroticism, extraversion, and conscientiousness on aberrant driving behavior with invariances across nationality groups.

Conclusion: These results suggest that the association between personality and driving behaviors is partially explained by the driver's tendency to MW while driving. Further research is needed to understand the pattern of relationships between variables considering objective measures of MW behind the wheel. The study suggests the usefulness of the assessment of personality measures in the study of driving distraction and fitness-to-drive evaluation purposes.

Keywords: Driver Behavior, Distraction, Personality, Risk assessment, Multivariate analysis

1. Introduction

Distracted driving, "the diversion of attention away from activities critical for safe driving toward a competing activity" (Lee et al., 2009, p. 34), is a road safety concern determining accidents, injuries, and deaths. During the 2019, 3,142 on 36,096 road fatalities in the United States were due to distraction (i.e., 8.7%; NHTSA, 2020) In Australia, distraction was a contributing factor to 14.0 percent of the registered crashes with injuries (Centre for Road Safety 2017). In Italy, during 2020, distracted driving contributed to 40.2 percent of the total registered crashes (Istat, 2021).

Drivers can be distracted by either *external* or *internal* sources of distraction. External distractions include secondary tasks initiated by the driver (e.g., texting) and specific events/cues that attract the driver's attention (e.g., advertising signs). Internal distractions, instead, include inattention to driving tasks due to shifted focus toward internal thoughts (i.e., worries). The 'mind wandering' (MW), an internal distraction, describes the attention diversion away from the current primary task toward internal mentation (Smallwood & Schooler, 2006). People's minds wander approximately half of the waking time, more frequently during repetitive activities and during activities that requires low cognitive effort (Schooler et al., 2011; Killingsworth and Gilbert, 2010). MW might be both spontaneous and deliberate (Seli et al., 2016) and it is 'ubiquitous', that is, interferes with different everyday tasks (Mooneyham and Schooler, 2013) by requiring cognitive resources to maintain the train of thoughts (Smallwood, 2010). MW is mainly associated with reduced performance in tasks of working memory and sustained attention (Unsworth and McMillan, 2013, Lopez et al., 2021a, 2021b).

Despite driving being considered to be a low-risk task, it is one of the most complex and dangerous activities (Lee et al., 2008). While several studies have been investigated the effects of external distractions on driving behavior, less is known about

the consequences of MW on driving because of the complexity in collecting measures of this kind of cognitive distraction (Galéra et al., 2012). Driving requires concentration to detect stimuli and execute several subtasks to manage the vehicle (Galski et al., 1992). MW has been reported to be the most frequent type associated with crash-related fatalities (Erie Insurance, 2013). Drivers often experience diversions of their attention to internal thoughts with a dangerous "zoning-out" which distracts them from the driving task, which leads to negative consequences for road safety (Galéra et al., 2012). A case-control study showed that MW was associated with the driver's liability in motor-vehicle crashes (Galéra et al., 2012).

Few studies have explored the relationships between MW and driving behaviors, nor explored potential interactions between environmental and individual factors affecting a driver's MW tendency. Environmental factors associated with MW while driving include environmental demands (i.e., weather conditions) and the perceptual load imposed by the driving environment (i.e., traffic conditions) which had been identified as inversely related with the tendency to MW. MW rates increase with practice and when driving on familiar roads since drivers tend to reduce their focus in roads close to home (Burdett et al., 2016). Perceptual load plays a role in this relationship (Geden et al., 2018) since drivers tend to drive more slowly, pay more attention, and experience higher distraction-related costs during higher load conditions (Horberry et al., 2006; Strayer et al., 2003). These factors are likely to interact with driver-related characteristics determining differences in MW episodes behind the wheel. Individual differences contribute to MW by interacting with external environmental characteristics (i.e., Robinson et al., 2020).

Following the "multi-faceted framework" (Robinson et al., 2020), three groups of individual differences affect MW: contextual, cognitive, and dispositional. These

dimensions have an influence on MW through the moderation of task demands. Contextual factors are state-related individual differences in a specific experience reflecting more "a person's feelings in the moment" (Robinson et al., 2020, p. 3) than a stable individual trait. They include, fatigue, negative-mood, stress, and the task experience (Stawarczyk & D'Argembeau, 2016). Among cognitive variables both working memory capacity and attentional control are associated to MW occurrence in several tasks (McVay & Kane, 2010). Finally, personality traits, affective characteristics, and psychopathological symptoms are classified among dispositional variables.

Individual differences affecting MW include demographic variables (i.e., age and sex) as well as dispositional factors (i.e., driving attitudes). Some studies have shown a negative correlation between age and MW (Giambra et al., 1989). Generally, older people have lower reasons for being engaged in task-unrelated thoughts and MW studies involve mainly young participants (Burdett et al.,2016; McVay et al., 2013). In the study of Qu et al. (2015), male and younger drivers with high levels of MW were more engaged in risky and aggressive driving behaviors and obtained higher penalty points than female and older drivers. MW has been shown to be positively associated with dangerous driving and motor-vehicle crashes (Qu et al., 2015). A reduced executive control may be a key cognitive trait responsible for the impaired inhibition of task-unrelated thoughts (McVay & Kane, 2010). During MW, drivers show reduced visual scanning on peripheral areas of the scenario, more failures in the environmental monitoring, spend less time gazing at the side mirrors (He et al., 2011), and respond slowly to braking events (Yanko & Spalek, 2013).

Regarding the consequences of MW on driving behavior, fewer studies have investigated the role of personality traits. Following the "contextual mediated model of

traffic accident involvement" (Sümer, 2003), personality traits represent distal factors that predict crash involvement indirectly through their relationship with stable tendencies towards aberrant driving behaviors. Risky driving behaviors are associated with specific personality traits (Sommer et al., 2008). Sensation-seeking, disinhibition and sensitivity to reward are associated with younger drivers' risky behaviors (Costantinou et al., 2011), whereas extraversion, conscientiousness, and type A personality have been linked to that of older drivers (Adrian et al., 2011). MW has been shown positively associated to certain personality traits such as impulsiveness (Gay et al., 2008), aggressiveness (Jackson & Balota, 2012), unhappy mood, and negative emotionality (Smallwood et al., 2009).

Surprisingly, the effects of MW on driving behavior, as well as its relationship with driving-related personality traits, have only been studied separately. Since MW has been found to be differentially associated with personality dispositions (Gay et al., 2008), which in turn affect driving behaviors (Zicat et al., 2018; Tinella et al., 2021), it is likely that interactions between MW tendency and different personality traits might differentially influence driving behaviors. For instance, the effects of aggression or negative emotionality on driving behaviors may be partially explained by differences in drivers' MW tendency (Deffenbacher et al., 2003; Yang et al., 2013).

It remains unclear if MW interacts with personality traits by determining stable and specific driving behavioral patterns and whether these patterns can have an influence on the likelihood of crash involvement. Until now, research on distracted driving has mainly focused on the relationship between 'mindfulness' and driving behavior. The construct of mindfulness is defined as an individual's capability to orient their attention to the present moment in a non-judgmental way (Brown & Rayan, 2003). Mindfulness contributes to increase driver's awareness and attention (Kass et al., 2011)

by reducing aberrant driving behaviors (Burdett et al., 2016). Mindfulness trainings have been recognized as effective interventions for the enhancement of road safety (Koppel et al., 2019). Given that MW represents the diversion of attention away from the present moment, it can be considered as the opposite of mindfulness. Previous studies have provided evidence of the negative relationships between mindfulness and driving anger (Stephens et al., 2018), driver's engagements in distracting activities (Koppel et al., 2018; 2020), and aberrant driving behaviors (Young et al., 2019).

Cultural factors have also been identified as predictors of driving behaviors (Nordfjærn et al., 2014). In a cross-cultural comparison, Norwegian drivers showed safer driving behaviors, Africans highest risk perceptions while attitudes toward driving predicted behaviors in Russians and Indians. The "road traffic culture" (e.g., extraverted driver's orientations) plays role in the relationship between personality and driving behaviors. A comparison across 32 countries regarding unsafe driving behaviors revealed differences among nationalities in terms of safety attitudes (Pires et al., 2020). I highest rate of self-reported speeding behaviors was observed in Europe and North America, driving under the influence was mainly observed in Asia-Oceania and Africa, while both mobile-phone use and fatigued driving were found as substantial in European and African regions. To date, there is no evidence on the relationship between personality, MW, and driving behaviors involving direct comparisons of samples of drivers from European and Oceanian countries.

1.1.Aims of the study

This study aimed to investigate the relationship between personality traits (i.e., Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness), MW tendency, and aberrant driving behaviors in a sample of Australian and Italian active

drivers. In particular, we argue that a driver's MW tendency mediates the relationships between personality traits (predictors) and driving behaviors (outcome). A secondary aim of the study was to examine invariances in the above-mentioned model across two samples of Australians and Italians drivers. It was hypothesized that:

(a) personality traits predicted driving behaviors: (i) negatively for the effects of neuroticism, openness, and extraversion (Sommer et al., 2008and (ii) positively for the effects of conscientiousness with differences among the age groups (Costantinou et al., 2011).

(b) high MW was expected to be (i) positively associated with both aberrant driving behaviors and measures of neuroticism (Robinson et al., 2017), while (ii) negatively with extraversion (Ortet et al., 2020).

(c) MW tendency was expected to significantly mediate the relationships between all the considered personality traits and measures of driving behaviors.

2. Methods

2.1. Participants

Nine-hundred-four participants (68% females) from 18 and 64 years old (M ± sd = 38.8 ± 12.8) were enrolled. Participants were required to: a) be aged 18 or older; b) hold a valid current driving license; c) being an 'active driver' (i.e., to drive at least once per week); d) currently live in Australia or in Italy. The overall sample included 452 Australian and 452 Italian drivers. Participants of both nationality groups were paired for age, sex, and years of education, by using the Propensity Score Matching (P–

M - ‘matching’ package of R software; Sekon, 2011). The mean age for the Australians was 38.8 (sd = 12.8) and for the Italians was 38.8 (sd = 12.7). The level of education for Australians was 15.2 (sd = 2.27) and for Italians was 15.4 (sd = 3.73). More information about the participants’ age is presented in Table S1.

All participants, blind to the hypothesis of the study, were volunteers. They were enrolled and completed the online survey between March and June 2021. This research complied with the tenets of the Declaration of Helsinki and ethical committees of both the involved institutions (i.e., Monash University and University of Bari) approved the study protocol (Approval code: 27873 and ET-20-17, respectively).

2.2. Materials and Procedures

Participants were recruited via social media, including the universities newsletters, as well as through the help of proxy informant (university students). Interested participants were provided a link to an online survey hosted by Qualtrics ® which presented details on the study, the consent form, questions on eligibility, questions related to participants’ socio-demographic and driving characteristics, and the below described questionnaires. The survey took approximately 40 minutes to complete.

2.2.1. Personality traits

The 50-items version of the International Personality Item Pool (IPIP-NEO domains; Costa & McCRae, 1992; Goldberg, 1999) has been used as measures of the five broad domains of the NEO Personality Inventory. It consists of 50 items, 10 for each personality trait (i.e., Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness). For each trait, 5 out of 10 questions assess positive manifestations

while the other five negative ones. Respondents had to indicate how well each statement describes themselves on a 5-point likert scale ranging from 1 ("very inaccurate") to 5 ("very accurate"). The inverse scoring was adopted for negative items. The instrument showed consistent reliability on both the nationality groups (i.e., Neuroticism: AUS α = .941, ITA α = .948; Extraversion: AUS α = .967, ITA α = .949; Openness: AUS α = .961, ITA α = .953; Agreeableness: AUS α = .963, ITA α = .961; Conscientiousness: AUS α = .974, ITA α = .956).

2.2.2. Mind wandering tendency

The Spontaneous and Deliberate Mind Wandering Scales (SDMWS; Carriere et al., 2013) was used to assess measures of MW tendency. This short questionnaire evaluates aspects of spontaneous mind-wandering unvoluntary) and deliberate MW (voluntary). It is composed of 8 items, 4 for each factor. Participants reported their level of agreement with each statement representing their everyday MW experiences on a likert scale ranging from 1 ("rarely") to 7 ("a lot"). This tool showed good reliability across nationality samples (i.e., Spontaneous: AUS α = .903, ITA α = .925; Deliberate: AUS α = .877, ITA α = .901). High scores in these scales indicated a high frequency of MW episodes. The total score was considered in the analysis.

2.2.3. Driving Behavior

The Driving Behavior Questionnaire (DBQ; Reason et al., 1990) was used to assess aberrant driving behaviors. It included 28 items assessing three types of driving behaviors (violations, lapses, and errors). Participants reported how often they were engaged in each of the driving situations on a likert scale ranging from "never" (0) to "always" (5). The tool demonstrated good reliability on both the nationality groups (i.e.,

Violations: AUS α = .872, ITA α = .831; Lapses: AUS α = .823, ITA α = .761; Errors: AUS α = .864, ITA α = .838). High scores indicated highly frequent aberrant driving behaviors. The total score was considered in the analysis.

3. Statistical Analyses

A chi-squared test between gender and nationality variables was performed to test for their independence. Independent samples t-tests were performed controlling for differences in self-reported measures between both sex and nationality groups. A series of ANOVAs were performed to test for differences in self-reported measures among age-classes. Bivariate correlation coefficients and related p-values were calculated between all variables. A multi-group path-analysis was estimated by using the software R, lavaan package (Rosseel, 2011), testing for the following mediated paths: the effect of personality traits through the mediation of Mind-Wandering tendency on driving behaviors. Comparing the Age, considered as continuous variable, sex and years of education were controlled as covariates in the predictive model. Figure 1 shows the path diagrams. Our sample consisted of at least 10 observations for each estimated parameters which is above the minimum of cases per parameters used in Path Analysis (Nunnally, 1967; Bentler and Chou, 1987; Bollen 1990). The highest number of parameters in the estimated models was equal to 36 (see "3.2. Path Analysis"). The R-squared (R^2), the normed fit index (NFI) and the root mean square error approximation (RMSEA) were used to assess the model fit. The theoretical model was tested on the two nationality groups constraining, in turn, the equality of (a) regression coefficients, (b) intercepts, and (c) residuals. The three nested models were then compared through Chi-squared tests. For each comparisons the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) were considered (Burnham & Anderson,

2002). The 95% CI was used to evaluate the significance of overall and separated indirect effects. The effect size (Cohen's f2) was estimated for each model (Selya et al., 2012).

Figure 1.

4. Results

4.1.Descriptive statistics and preliminary analyses

Means, standard deviations and bivariate correlation coefficients for the variables of interest in the study are shown in Table 1. The results of Chi-squared test indicated that, in the composition of the sample, gender was significantly associated with the nationality group ($\chi^2 = 5.91$; $p = 0.015$) and with the age groups ($\chi^2 = 58.7$; $p < 0.001$). Given the adequate sample sizes of both gender groups, the variable was considered for the path analysis. Ninety-four participants reported to drive once per week (10.39%), 122 responded to drive 2-3 times a week (13.49%), 238 reported to drive 4-6 times a week (26.32%), and 450 participants reported to drive daily (49.77%). The t-test revealed significant differences between the Australian and the Italian in terms of MW tendency [SDMWS: $t(900) = 8.526$; $p < 0.001$], Neuroticism [N: $t(872) = 4.60$; $p < 0.001$], Extraversion [E: $t(902) = -6.59$; $p < 0.001$], Agreeableness [A: $t(890) = 5.99$; $p < 0.001$], and Conscientiousness [C: $t(902) = -7.64$; $p < 0.001$]. Australians showed higher scores in MW tendency, Neuroticism, and Agreeableness while Italians showed higher scores in Extraversion and Conscientiousness. Regarding gender-groups significant differences emerged in terms of MW tendency [SDMWS: $t(902) = 3.170$; $p < 0.01$], Neuroticism [N: $t(902) = 4.996$; $p < 0.001$], Openness [O: $t(902) = 2.95$; $p < 0.01$], Agreeableness [A: $t(902) = 2.741$; $p < 0.01$], and level of education [Edu: $t(902) = 3.135$; $p < 0.01$], favoring females. Significant differences were found among age-classes in the level of education MW tendency, driving behavior, and personality traits

[Edu: $F(4, 899) = 13.16$, $p < 0.001$; SDMWS: $F(4, 899) = 8.23$, $p < 0.001$; DBQ: $F(4, 899) = 3.829$, $p < 0.01$; N: $F(4, 899) = 4.917$, $p < 0.001$; A: $F(4, 899) = 3.927$, $p < 0.01$; C: $F(4, 899) = 10.902$, $p < 0.001$]. All the personality traits were found significantly associated with measures of driving behavior and, except for Extraversion, with MW tendency which in turn, was found significantly and positively correlated with aberrant driving behaviors. No correlation coefficients between predictors were higher than .75, suggesting no issues of multicollinearity among them.

Table 1.

4.2.Path analysis

The Chi-square difference among nested models (Table 2) showed the best fit of the model constraining the regression coefficients only (i.e., model "a": AIC: 14221; BIC: 14326). By adding intercepts as constrained parameter the fit of the tested model significantly worsened (i.e., model "b" versus model "a": $\Delta\chi^2$ (Δ df = 2) = 52.27; $p < 0.001$; AIC: 14269; BIC: 14365). The further inclusion of residuals among model's constraints showed non-significant results (i.e., model "c" versus model "b": $\Delta\chi^2$ (Δ df = 2) = 3.89; $p = 0.142$; AIC: 14269; BIC: 14355). Consequently, the model "a" was retained for the discussion.

The model of pathways among variables revealed significant effects of Neuroticism ($\beta = 0.531$, $p < 0.001$), Extraversion ($\beta = 0.133$, $p = 0.014$), Openness ($\beta = 0.451$, $p < 0.001$), Agreeableness ($\beta = 0.154$, $p < 0.001$) and Conscientiousness ($\beta = -0.193$, $p = 0.001$) on MW tendency. With respect to the effects of predictors on measures of driving behavior significant results were found for the positive influence of MW tendency ($\beta = 0.540$, $p < 0.001$), Neuroticism ($\beta = 0.257$, $p < 0.001$), and Extraversion ($\beta = 0.306$, $p < 0.001$), and for the negative effects of Agreeableness ($\beta = -0.226$, $p = 0.006$). Among sociodemographic variables gender were found to significantly predict

measures of driving behaviors ($\beta = 3.469$, $p < 0.001$). Table 3 shows significant and non-significant effects.

Considering effects mediated by MW, significant results were found for the indirect and total effects of Neuroticism [indirect: $\beta = 0.286$, $p < 0.001$; total: $\beta = 0.544$, $p < 0.001$], Extraversion [indirect: $\beta = 0.072$, $p = 0.015$; total: $\beta = 0.378$, $p < 0.001$], and Conscientiousness [indirect: $\beta = -0.104$, $p = 0.002$; total: $\beta = -0.198$, $p = 0.010$], for the indirect effects of the path predicted by Openness ($\beta = 0.243$, $p < 0.001$) and Agreeableness ($\beta = 0.083$, $p = 0.031$) but not for their own total effects [Openness: $\beta = 0.113$, $p = 0.160$; Agreeableness: $\beta = -0.143$, $p = 0.112$]. This pattern of pathways was observed on the two nationality groups with invariances across samples. Figure 2 shows path diagram with coefficients for each estimated path. The model presented almost equal R^2 values for the two nationality groups (Australians: $R^2 = 0.282$; Italians: $R^2 = 0.264$) both showing a medium effect size (Australians: Cohen's $f^2 = 0.39$; Italians: Cohen's $f^2 = 0.35$) and adequate fit indices (NFI = 0.903; RMSEA = 0.05; Lohelin, 1998). Table 4 shows direct, indirect, and total effects of predictors on measures of driving behaviors.

Table 2.

Table 3.

Table 4.

Figure 2.

5. Discussion

The main aim of the present study was to investigate MW as mediator of the relationship between personality traits and aberrant driving behaviors in a sample of both Australian and Italian drivers. Overall, the results showed that MW tendency fully mediated the positive effects of both Neuroticism and Extraversion and the negative

effects of Conscientiousness on aberrant driving behaviors, in the same way in the two nationality groups. Driving behaviors were found to be predicted both positively by neuroticism and extraversion while negatively by conscientiousness indirectly through the mediation of MW tendency. Both results pointed out the negative influence of MW tendency on self-reported driving behaviors and may indicate its detrimental role by both enhancing the negative effects of both Neuroticism and Extraversion and mitigating those showed by Conscientiousness. The study also aimed to determine the model's invariances across samples of Australian and Italian drivers. Australian drivers reported higher levels of MW tendency, Agreeableness, and Neuroticism than Italians, who in turn reported higher levels of Extraversion and Conscientiousness. Male drivers self-reported higher levels of aberrant driving than female drivers. These effects were found in both nationality-groups. Over and above these differences, the tested model was equally consistent in explaining variances across the nationality groups with adequate fit measures.

By relating measures of personality, mind-wandering tendency, and driving behaviors, the current study demonstrated that the driver's tendency for MW while driving partially explained the effects of personality traits on aberrant behaviors, over and above nationality.

The current results confirmed those previous studies that demonstrated a positive association between Neuroticism and both MW rates (Robinson et al., 2017; Kane et al., 2017) and driving behaviors (Koppel et al., 2018). People with neurotic dispositions have a higher focus on internal concerns, and tend to silence these concerns, manifesting in more frequent MW (Robinson et al., 2020). The results presented here partially supports the findings of those reported by Young and colleagues (2019), Stephens and colleagues (2018), and by Koppel and colleagues (2018) in which measures of

mindfulness (opposite to MW) were found negatively related to engagements in distracting activities while driving, aggressive driving, self-reported aberrant driving behaviors and crash involvement, respectively. Our results provide evidence on the relationships between these variables by demonstrating the neurotic personality as distal predictor of driving behaviors exerting their effects through the mediation of MW tendency. Drivers with more neurotic personalities may particularly benefit from mindfulness interventions for enhancing their safety attitudes.

The positive effects of Extraversion on aberrant driving behaviors were significantly mediated by the MW tendency. This result confirmed those previous studies in which Extraversion was found to be positively associated with aberrant driving behaviors and aggressive driving (Lev et al., 2008, Dhalen et al., 2012) while they slightly differ from evidence on the negative relationship between Extraversion and MW (Pereira et al., 2020). Previous studies found moderate correlations between Extraversion and components of mindfulness (i.e., awareness, non-judging, and describing; Giluk et al., 2009). Extroverts are characterized by positive affect (Pavot & Diener, 2011) and the tendency to experience positive emotions (Morizot, 2014). Ortet and colleagues (2020) showed significant relationship between Extraversion and individual well-being. In the study of Pereira and colleagues (2020), low levels of Extraversion were found associated with high MW. Conversely, results of this study showed that the positive effects of Extraversion on driving behaviors are partially explained by the mediation of MW. Extraversion positively affected the MW tendency which in turn positively influenced aberrant driving behaviors. Even in this case, results suggest that the driver's MW tendency plays a key role in explaining the positive influence of Extraversion on aberrant driving behaviors and potentially the benefits of mindfulness programs in more extroverted drivers.

Conscientiousness was found to significantly and negatively predict aberrant driving behaviors through the mediation of MW tendency. The negative effects of conscientiousness on driving behaviors were partially explained by its negative relation with MW which in turn positively predicted aberrant behaviors. This result suggests that MW tendency acts by reducing the desirable effects of conscientiousness on safe driving behaviors. Similar results were obtained in previous works in which measures of conscientiousness were found both negatively associated to MW (Kane et al., 2017) and positively associated with individual who reported being high in mindfulness (Robinson et al., 2017). Conscientiousness is negatively correlated with intentional MW in both high- and low-demand situations (Robinson et al., 2020). Although we have not dissociated between deliberate and spontaneous MW, the results support the idea that a conscientious individual tends to not mind-wander behind the wheel, at least intentionally. Conscientiousness involves being responsible, organized, task-oriented and defines disciplined individual with a strict adherence to principles (John et al., 2008; Chmielewski & Morgan, 2013). Considering this evidence, it makes sense the negative effects of conscientiousness on aberrant driving behaviors observed in this study. More conscientious individuals are engaged in less risky driving behaviors as effect of their social responsibility (Arthur & Graziano, 1996). The present study expends previous findings by showing that the befits of a conscient personality behind the wheel may be disrupted by the driver tendency to mind-wander.

The fit of the model was found to be adequate and similar for both the nationality groups, further supporting the mediation effects of MW on the relationship between Neuroticism, Extraversion, Conscientiousness, and aberrant driving behaviors over and above the nationality group membership. The model showed to explain equal regression coefficients in the two samples suggesting that MW mediated effects found on driving

behaviors seem common thread throughout Australian and Italian drivers. This further strengthens the consistence of the significant pathways found demonstrating cross-national equalities. Significant results were found for the effects of gender with the male group who showed higher aberrant driving behaviors than those reported by female drivers. This result supports those of previous studies who found gender differences in self-reported aberrant driving behaviors, safety attitudes, risk-propension, and likelihood to commit driving violations (Butters et al., 2012; Getzmann et al., 2018). These differences are partially due to the higher self-regulation in females constituting a protective factor against risky driving (Hancock et al., 2012).

This study has shown that effects of Extraversion, Conscientiousness, and Neuroticism on aberrant driving behaviors are relatively explained by the drivers' tendency to 'zone-out' while driving.

Some limitations should be noted. By balancing gender group sizes more representative results may emerge, strengthening the generalizability of the tested model. The inclusion of an older-adult group of drivers may add information on the most growing and vulnerable age group of drivers. Further implementations may regard the use of dissociated measures of intentional and unintentional MW as mediators. These results are based on self-report. The use of objective driving measures (i.e., real-world/simulated driving; Caffò et al., 2020) may clarify whether the model presented here can be generalized to actual driving behaviors (i.e., naturalistic driving; Koppel et al., 2013) collected in both familiar and novel environments (Burdett et al., 2016).

These results offer a source of information for the assessment of personality determinants of fitness-to-drive, both by confirming that different personalities influence differentially driving behaviors, and by suggesting that these relationships are explained through individual differences in the tendency to MW. Results may also be

420 useful for professionals of mobility-centers to screen at-risk drivers that may
421 particularly benefit from safe driving programs.

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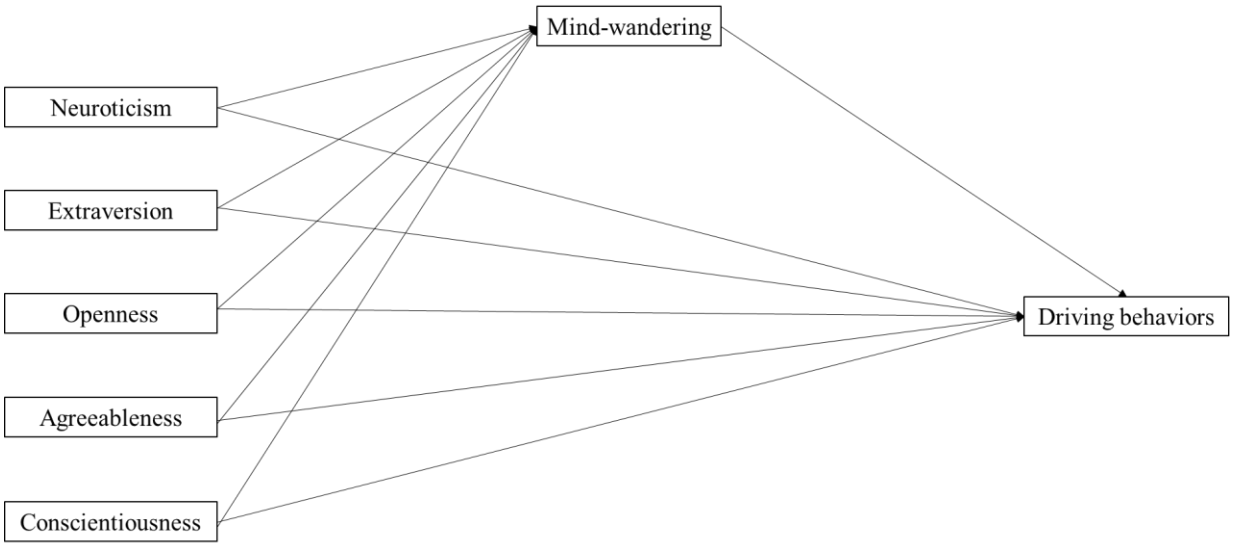
690 **Figure 1.** Graphical representations of the tested multi-group path-analysis model.

691



692

693 **Table 1.** Correlation matrix between the variables. Mean (M) and Standard Deviation (SD)

694 for each variable. Independent t-test are reported. *p< 0.05, **p< 0.01, ***p< 0.001.

												AUS		ITA				
	Group	AGE	SEX	EDU	N	E	O	A	C	DBQ	SDMWS	M	SD	M	SD	*t*	*df*	*p*
Group	-											-		-				
AGE	,005	-										38.9	12.8	38.8	12.7	0.146	902	0.884
SEX	-,081*	,201***	-									-		-		5.91	1	<.05*
EDU	,546***	,151	,116	-								15.2	2.27	15.4	3.63	-0.781	902	0.435
N	,064	,064	-,026	,006	-							28.9	8.65	26.5	7.18	4.603	872	<.001***
E	,115**	,126***	-,013	,071	,411***	-						28.4	7.79	31.9	8.14	-6.595	902	<.001***
O	,090**	,043	,032	,244***	,149***	,167***	-					37	6.87	36.2	6.38	1.715	897	0.807
A	-,031	,087*	,061	,165	,147***	,284***	,613***	-				36.9	6.14	36.4	5.46	5.996	890	<.001***
C	-,012	,059	,024	,161	,157***	,292***	-,216**	,746***	-			33.6	7.21	37.2	7.21	-7.643	902	<.001***
DBQ	,159***	-,040	-,017	,022	,154***	,178***	-,028	-,087*	-,089*	-		20.2	15	21.2	15.6	-1.046	902	0.296
SDMWS	-,048	,000	,089**	,099	,149***	,125***	-,081*	-,071	,338***	-,006	-	31	12.5	23.7	13	8.526	900	<.001***

695 Group=Nationality Group; AGE=age in years; GEN=gender of participants; EDU=years of
696 education; N=Neuroticism; E=Extraversion; O=Openness; A=Agreeableness;
697 C=Conscientiousness; DBQ=Driving Behaviour Questionnaire; SDMWS=Spontaneous and
698 Deliberate Mind Wandering Scale; AUS=Australians; ITA=Italians.

Table 2. Chi-square (Chi-sq) difference (Chisq diff) test among nested models.

Model	Df	AIC	BIC	Chi-sq.	Chisq diff	Df diff	p
a.	20	14221	14326	51.454			
b.	22	14269	14365	103.726	52.273	2	<0.001***
c.	24	14269	14355	107.619	3.893	2	0.143

AIC=Akaike Information Criterion; BIC=Bayesian Information Criterion; "a."=regression coefficients as constraints; "b."=intercepts and regression coefficients as constraints; "c."=residuals, intercepts, and regression coefficients as constraints. *p< 0.05, **p< 0.01, ***p< 0.001.

705 **Table 3.** Path analysis results: standardized estimates, standard errors, Z scores, p value, and

706 R squared (explained variance) for both the outcome and the mediator.

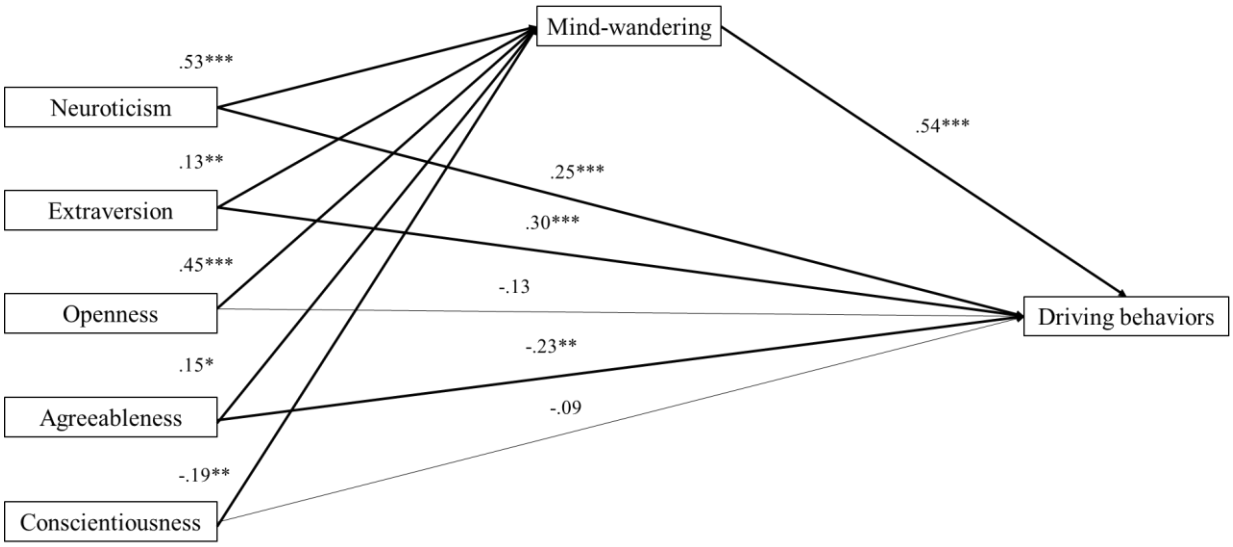
	Estimate	Std.Err	z	p	R2	
On DBQ					.282 (AUS)	.264 (ITA)
Neuroticism (N)	0.257	0.063	4.065	<0.001		
Extraversion (E)	0.306	0.062	4.938	<0.001		
Openness (O)	-0.130	0.075	-1.728	0.084		
Agreeableness (A)	-0.226	0.082	-2.770	0.006		
Conscientiousness (C)	-0.093	0.070	-1.339	0.181		
Sdmws	0.540	0.038	14.211	<0.001		
Age	0.039	0.036	1.076	0.282		
Sex	3.469	0.980	3.539	<0.001		
Education	0.127	0.151	0.839	0.401		
On SDMWS					.222 (AUS)	.166 (ITA)
Neuroticism (N)	0.531	0.051	10.309	<0.001		
Extraversion (E)	0.133	0.054	2.465	0.014		
Openness (O)	0.451	0.062	7.237	<0.001		
Agreeableness (A)	0.154	0.070	2.189	0.029		
Conscientiousness (C)	-0.193	0.059	-3.251	0.001		

707

Table 4. Direct, indirect, and total effects of personality traits on driving behaviours (DBQ), * indicates $p < 0.05$, ** indicates $p < 0.01$, *** indicates $p < 0.001$.

effect	direct effect	Indirect effect sdmws	total effect sdmws
Neuroticism (N)	0.257***	0.286***	0.544***
Extraversion (E)	0.306***	0.072*	0.378***
Openness (O)	-0.130	0.243***	0.113
Agreeableness (A)	-0.226**	0.132***	-0.168
Conscientiousness (C)	-0.093	-0.104**	-0.198*

711 **Figure 2.** Model "a" in which regression coefficients were constrained. Coefficients are
712 reported for each regression path. * Indicates $p < 0.05$, ** indicates $p < 0.01$, *** indicates p
713 < 0.001. Significant paths ($p < 0.05$) are bolded.



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