PERSONALITY, DANGEROUS DRIVING, AND INVOLVEMENT IN ACCIDENTS: TESTING A CONTEXTUAL MEDIATED MODEL

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Abstract:

The present study tested the role of various personality traits in explaining dangerous driving and involvement in accidents, using a contextual mediated model ($N = 311$). We initially found direct effects of personality traits on dangerous driving indicators (Big-5, Dark Triad, sensation seeking, aggression, and impulsivity). Subsequently, personality variables with predictive power were tested in the mediation model. Indirect effects of anger, psychopathy and sensation seeking on the history of involvement in traffic accidents were found, which was predicted directly by risky driving. The results are discussed based on the characteristics of each trait. Overall, our research replicates and extends previous findings and highlights the importance of psychological evaluations (e.g., personality test) when prospective drivers are applying for a driver license.
Keywords: Traffic psychology, personality, psychopathy, sensation seeking.

> "*Cold windowpane \ A car upturned in the rain*
> *Wait on in vain \ Don't try to bear the blame*"
> Steven Wilson – Drive home

1. Introduction

Traffic accidents are responsible for approximately 1.2 million deaths per year around the world. Also, traffic accidents are responsible for 20 to 50 million non-fatal injuries (WHO, 2015). In Brazil, the number of cars owned by the population increased between 2000 and 2010 (54%), as did the number of deaths per traffic accidents (32.3%), and the mortality rate through traffic accidents (22.5%; Morais Neto et al., 2012). Traffic accidents are the second largest cause of death for people between 15 to 39 years in Brazil (Mascarenhas et al., 2016).

Traffic accidents are not only concerning because of the damage in physical health (injuries and death) or the material loss, but also because of their psychological impact which includes depression, anxiety, and post-traumatic stress (Heron-Delaney,

Kenardy, Charlton, & Matsuoka, 2013; Papadakaki et al., 2016). The serious outcomes from the accidents highlight the relevance to explore their antecedents.

The present research aims to further advance our understanding on variables that predict traffic accidents, providing a model that predicts dangerous driving behavior and involvement in accidents. One set of predictors of traffic accidents are unfortunate situational influences, including low quality streets and highways, lack of traffic signs, mechanical problems in the cars, and unfavorable climate conditions. The other set of predictors of traffic accidents are psychological variables, which have been used to create a profile of the drivers that behave dangerously in traffic. Those psychological variables will be discussed in the next subsection.

1.1. Predictors of Dangerous Driving

The list of psychological predictors of dangerous driving is long and involve a series of behaviors and mental states that can result in accidents (Richer & Bergeron, 2012), such as aggressive driving (e.g., tailgate other drivers), negative cognition and emotions while driving (e.g., anger, rumination, frustration), and risky driving (e.g, driving above the speed limit; Dula & Ballard, 2003; Willemsen, Dula, Declercq, & Verhaeghe, 2008). Additionally, personality traits were found to explain dangerous driving. For example, the Big Five personality traits are related to dangerous driving behavior. Specifically, people who drive more carefully present higher scores in traits as agreeableness, conscientiousness, openness to change, and introversion (Harris, Houston, Vazquez, Smither, & Harms, 2014). Another study found a positive direct effect of neuroticism on anger while driving, and an indirect positive effect on aggressive driving. Also, agreeableness had a negative indirect effect on driving anger and aggressive driving (Jovanović, Lipovac, Stanojević, & Stanojević, 2011).

Other dimensions of personality such as impulsivity, sensation seeking, anger, and hostility also predict driving behavior (Richer & Bergeron, 2012). For example, sensation seeking, which is defined as the propensity to take risks to have new, complex, and intense experiences (Zuckerman, 1994), is an important construct to explain risk acts while driving. Results from an experiment using a driving simulator showed a positive relation between sensation seeking and the number of crashes, and negative correlations with a safe driving style (Marengo, Settani, & Vidotto, 2012). Sensation seeking is also one of the best predictors of speeding (Delhomme, Chaurand, & Paran, 2012). It can further have a moderating effect, interacting, for instance, with the use of alcohol, which in sensation seekers can work as a trigger to drive dangerously (Jonah, 1997). Another dimension associated with dangerous and aggressive driving is impulsivity, which is understood as instant reactions without thinking of future consequences (Dahlen, Martin, Ragan, & Kuhlman, 2005). Impulsive drivers have the tendency to drive in a non-safe way (Marengo et al., 2012). Therefore, both impulsivity and sensation seeking are personality dimensions that help to provide a profile of an individual that tend to drive dangerously.

Researchers have also tested whether the trait aggressiveness is related to aggressive driving (Lajunen & Parker, 2001), with several studies showing that individuals who are more aggressive are also more easily irritated in traffic, resulting in more traffic violations and aggressive driving (Bogdan, Măirean, & Havarneanu, 2016; Schwebel, Severson, Ball, & Rizzo, 2006; Yang, Du, Qu, Gong, & Sun, 2013).

Another set of traits associated with dangerous driving are the Dark Triad of personality (Machiavellianism, psychopathy, and narcissism; Paulhus & Williams, 2002). These traits have been related to risk taking variables, including drug use, gambling (Crysel, Crosier, & Webster, 2013; Jonason, Koenig, & Tost, 2010), and

aggression (Jones & Paulhus, 2010). We are aware of only one study which assessed the role of the Dark Triad in predicting dangerous driving (Burtăverde, Chraif, Aniţei, & Mihăilă, 2016). Specifically, even after controlling for the Big Five, the Dark Triad traits were still positively related to dangerous driving, with psychopathy being the strongest predictor. However, Burtăverde et al. (2016) did not test whether the Dark Triad is associated with involvement in accidents. Several studies focused on one or two traits of the Dark Triad separately. For example, narcissism was positively associated with negative emotions and aggressive driving (Bushman, Steffgen, Kerwin, Whitlock, & Weisenberger, 2018; Edwards, Warren, Tubré, Zyphur, & Hoffner-Prillaman, 2013; Hennessy, 2016). Fearlessness (aspect of psychopathy), was also related to driving misconduct and involvement in accidents (Panayiotou, 2015). Another study found that psychoticism, which covers some aspects of psychopathy such as coldness, aggressiveness, impulsivity, and lack of empathy (Eysenck, 1992), was the best predictor to risky driving (Tao, Zhang, & Qu, 2017).

1.2. The Present Study

The present study includes a wide set of the before listed predictors to assess their respective roles in predicting dangerous driving, including the indirect effects of personality in the involvement in traffic accidents. It is important to emphasize that the traffic context is dynamic, with different intervening variables that can reduce the explicative power of personality traits in the involvement of these accidents (Dahlen, Edwards, Tubré, Zyphur, & Warren, 2012; Wåhlberg, Barraclough, & Freeman, 2017). Traffic situation can involve tensions that might result in unpredictable behaviors which are inconsistent with more stable aspects of the individual (Bartholomeu, 2008). Therefore, it is important to think in a hierarchical model, where more stable aspects of a person, such as the personality traits (distal variables), are only indirectly related to the

involvement in traffic accidents through dangerous driving (mediator and proximal variable), which in turn has the role of direct predictor (Dahlen et al., 2012; Demir, Demir, & Özkan, 2016). This model is known as contextual mediated model (Sümer, 2003), tested in the current study (Figure 1).
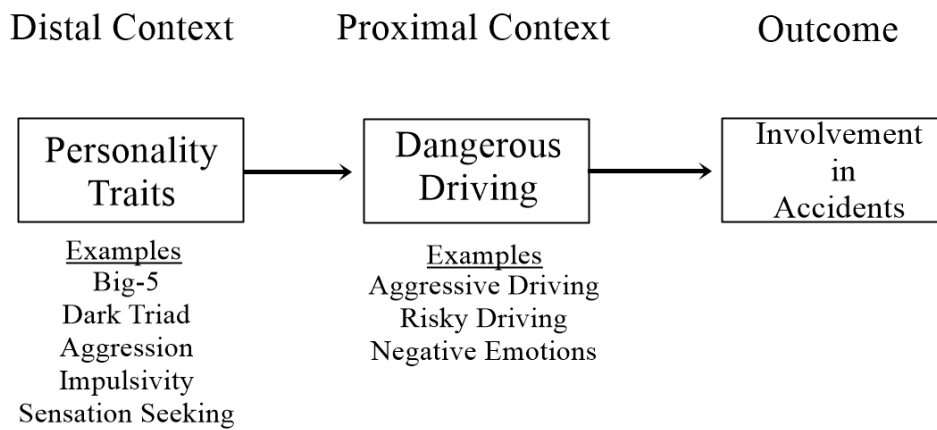
Distal Context	Proximal Context	Outcome
Personality Traits	**Dangerous Driving**	Involvement in Accidents
<u>Examples</u> Big-5 Dark Triad Aggression Impulsivity Sensation Seeking	<u>Examples</u> Aggressive Driving Risky Driving Negative Emotions	

Figure 1. Contextual mediated model (adapted from Sümer, 2003).

Following calls to diversify the academic literature through conducting studies in non-Western countries (Bıçaksız & Özkan, 2016; Henrich, Heine, & Norenzayan, 2010), we collected data from Brazil. Understanding the antecedents of dangerous driving in Brazil is especially important, because a high number of road traffic death rate (per 100,000 population and in comparison to many other countries; WHO, 2015). Those numbers of traffic accidents in Brazil are higher than in many Latin-American countries. They cannot be attributed solely to non-psychological factors such as driving under the influence of alcohol, low knowledge of the traffic rules, or bad street conditions. Even with most of accidents being caused by human factors (Wit, Souza, & Cruz, 2016), there are few studies in Brazil testing the predictive role of psychological variables. In the current research we predict that psychological variables (e.g., personality traits) also play a role in dangerous driving and involvement in accidents. This is important because there is, to the best of our knowledge, barely any

psychological research on this topic in Brazil. We further add to the literature by including many predictors of dangerous driving and actual involvement in accidents into one model, which have often been separately investigated, including, anger, impulsivity, Big Five factors, and sensation seeking (e.g., Bıçaksız & Özkan, 2016; Bogdan et al., 2016; Jonah, 1997; Wåhlberg et al., 2017). Additionally, we included the Dark Triad, whose role in dangerous driving and involvement in accidents is still understudied (Demir et al., 2017).

2. Method

2.1. Participants and procedure

Participants were 311 individuals (M_{age} = 29.8; SD_{age} = 9.81; 61.1% women), who were invited through social media to answer a questionnaire about traffic behavior. All participants declared to have a driver license. The driving license was obtained on average 93 months prior to participating in this study (SD = 92.8; $range$ = 1 – 552). Participants were invited through social media (e.g., Facebook) to participate in our study. First, we presented all ethical relevant information about the study. Participants were also given the researchers email addresses to obtain further information about the study or to raise an issue.

2.2. Measures

Dula Dangerous Driving Index (DDDI; Dula & Ballard, 2003). The Brazilian version of DDDI (Monteiro, Medeiros, Nascimento, Oliveira, & Gouveia, in press) was used to measure the three dimensions of dangerous driving with 28 items. The three dimensions are aggressive driving, risky driving, and negative emotions and cognitions while driving. Participants indicated the frequency of specific behaviors using a 5-point scale (1 – *Never*; 5 – *Always*). Example items include "I deliberately use my car/truck to block drivers who tailgate me" (Aggressive Driving), "I will weave in and out of slower

traffic" (Risky Driving), and "When I get stuck in a traffic jam, I get very irritated" (Negative Emotions and Cognitions).

Dark Triad Dirty Dozen (DTDD; Jonason & Webster, 2010). The DTDD is composed of 12 items to measure the Dark Triad of personality. Participants report their agreement (1 – *Strongly disagree*; 5 – *Strongly agree*) to sentences like "I have use flattery to get my way" (Machiavellianism), "I tend to be unconcerned with the morality of my actions" (Psychopathy), and "I tend to want others to pay attention to me" (Narcissism).

Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003). To measure the five big factors of personality, participants reported their agreement (1 – *Disagree strongly*; 7 – *Agree strongly*) to different sentences, as for example "Open to new experiences, complex" (Openness), "Dependable, self-disciplined" (Conscientiousness), "Extraverted, enthusiastic" (Extraversion), "Sympathetic, warm" (Agreeableness), "Anxious, easily upset" (Neuroticism).

8 Item Impulsivity and Sensation Seeking Scale (ImpSS-8; Webster & Crysel, 2012). Participants indicated if they agree or not (*Yes* or *No*) to sentences like "I very seldom spend much time on the details of planning ahead" (Impulsivity) or "I sometimes do ''crazy'' things just for fun" (Sensation Seeking).

Brief Aggression Questionnaire (BAQ; Webster et al., 2015). The BAQ is used to measure aggressiveness with 12 items. Participants indicate their agreement (1 – *Totally disagree*; 5 – *Totally agree*) to items like "Given enough provocation, I may hit another person (Physical Aggression), "When people annoy me, I may tell them what I think of them" (Verbal Aggression), "Sometimes I fly off the handle for no good reason" (Anger), "I sometimes feel that people are laughing at me behind my back" (Hostility). (Note that the wordings of the hostility factor is somewhat awkward,

because they seem, in our view, rather measuring suspicion than hostility. We discuss this below in more detail.)

To assess involvement in traffic accidents, we asked participants to estimate the number of accidents they have been involved in throughout their lives as drivers.

3. Results

Table 1 includes the means, standard deviations, internal consistency coefficients, and the correlations between the predictors and the DVs, Dangerous Driving and involvement in accidents. Only agreeableness (negatively), and neuroticism (positively) are correlated with the self-report of involvement in accidents, as well with the total score of the DDDI and its subscales. On the other hand, consistent correlations between other personality traits and dangerous behaviors in traffic were found. For example, we found positive correlations between the total score of the DDDI and its factors with the Dark Triad traits, sensation seeking, physical aggressiveness, and anger. The correlations between the frequency of involvement in traffic accidents with the total score of DDDI, $r = .16$, $p < .01$, and its subscales aggressive driving, $r = .13$, $p < .01$, and risky driving, $r = .18$, $p < .01$ were low. Involvement in traffic accidents with negative emotion and cognition subscale was non-significant, $r = .08$, $p = .07$.

Table 1

Means, standard deviations, internal consistency coefficients and correlations between personality traits and traffic variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. IA	-																		
2. DDDI	0.16**	(0.89)																	
3. NEC	0.08	0.87**	(0.81)																
4. AD	0.13**	0.75**	0.61**	(0.73)															
5. RD	0.18**	0.84**	0.56**	0.45**	(0.80)														
6. MA	0.00	0.36**	0.34**	0.28**	0.31**	(0.71)													
7. PS	0.04	0.30**	0.22**	0.25**	0.33**	0.50**	(0.75)												
8. NA	0.03	0.42**	0.41**	0.36**	0.32**	0.51**	0.34**	(0.88)											
9. IM	0.01	0.15*	0.14**	0.05	0.17**	0.15**	0.21**	0.14**	(0.43)										
10. SS	-0.05	0.23**	0.19**	0.14**	0.25**	0.23**	0.21**	0.20**	0.27**	(0.55)									
11. PA	0.03	0.33**	0.30**	0.28**	0.28**	0.31**	0.29**	0.26**	0.16**	0.26**	(0.67)								
12. VA	0.03	0.11*	0.13**	0.03	0.11*	0.07	0.08	0.07	0.08	0.11*	0.33**	(0.52)							
13. AN	0.08	0.35**	0.33**	0.29**	0.27**	0.30**	0.24**	0.31**	0.27**	0.21**	0.39**	0.19**	(0.75)						
14. HO	0.00	0.16**	0.18**	0.04	0.20**	0.29**	0.29**	0.26**	0.18**	0.15**	0.29**	0.15**	0.35**	(0.68)					
15. EX	-0.02	0.09	0.14**	0.06	0.01	-0.01	-0.07	0.06	0.07	0.12*	0.07	0.22**	0.16**	-0.08	(0.39)				
16. AG	-0.14**	-0.23**	-0.19**	-0.21**	-0.20**	-0.29**	-0.31**	-0.27**	-0.26**	-0.05	-0.26**	-0.21**	-0.41**	-0.20**	-0.04	(0.14)			
17. CO	0.02	-0.11*	-0.05	-0.07	-0.17**	-0.27**	-0.21**	-0.20**	-0.28**	-0.22**	-0.13**	0.06	-0.09	-0.16**	0.06	0.16**	(0.31)		
18. NE	0.10*	0.23**	0.25**	0.22**	0.15**	0.29**	0.16**	0.29**	0.09	0.07	0.29**	0.11*	0.59**	0.33**	0.15**	-0.34**	-0.08	(0.29)	
19. OP	0.03	-0.10*	0.07	-0.08	-0.10*	-0.18**	-0.15**	-0.06	-0.04	0.17**	-0.04	0.17**	-0.05	-0.21**	0.23**	0.11*	0.24**	-0.06	(0.12)

Range		1 – 5	1 – 5	1 – 5	1 – 5	1 – 5	1 – 5	1 – 5	1 – 2	1 – 2	1 – 5	1 – 5	1 – 5	1 – 5	1 – 7	1 – 7	1 – 7	1 – 7	1 – 7
M	0.76	1.86	2.45	1.53	1.61	1.77	1.80	2.58	1.24	1.30	2.22	3.47	2.45	2.70	4.28	5.17	5.10	3.90	5.35
SD	0.99	0.44	0.61	0.49	0.49	0.63	0.75	0.98	0.24	0.29	0.99	0.82	0.99	1.02	1.48	1.13	1.31	1.33	1.11

Note: **p < .01; *p < .05 (Uni-caudal). Identification of variables: IA = Involvement in Accidents; DDDI = Total Score of Dula Dangerous Driving Index; NEC = Negative Emotions and Cognitions; AD = Aggressive Driving; RD = Risky Driving; MA = Machiavellianism; PS = Psychopathy; NA = Narcissism; IM = Impulsivity; SS = Sensation Seeking; PA = Physical Aggression; VA = Verbal Aggression; AN = Anger; HO = Hostility; EX = Extraversion; AG = Agreeableness; CO = Conscientiousness; NE = Neuroticism; OP = Openness. Values on the diagonal within parentheses indicate internal consistency coefficients (alpha for DDDI, Dirty Dozen, BAQ, and ImpSS-8; and correlation for each item pair of Big Five factors).

The next step was to test the predictive role of the personality traits simultaneously with the total score of the DDDI, and its three subscales. We performed a regression analysis (stepwise), controlling for age and gender, and found that the predictors of the general index of dangerous actions in traffic (DDDI total score; $R^2 =$ .26) were narcissism ($\beta = .30$, $p <.01$), anger ($\beta = .21$, $p <.01$) physical aggression ($\beta =$ .14, $p <.01$), and gender ($\beta = -.12$, $p <.05$). For negative emotion and cognition in traffic ($R^2 = .24$) the predictors were narcissism ($\beta = .32$, $p <.01$), anger ($\beta = .16$, p < .01), physical aggression ($\beta = .14$, $p < .01$), and extraversion ($\beta = .10$, $p < .05$). Aggressive driving was predicted ($R^2 = .21$) by narcissism ($\beta = .27$, $p < .01$), anger ($\beta = .17$, $p <.01$), hostility ($\beta = -.18$, $p < .01$), physical aggression ($\beta = .15$, $p < .01$), and psychopathy ($\beta =$ .12, $p <.05$). Finally, risky driving was predicted ($R^2 = .22$) by psychopathy ($\beta = .18$, p <.01), narcissism ($\beta = .17$, $p < .01$), anger ($\beta = .15$, $p < .01$), gender ($\beta = -.15$, $p < .01$), and sensation seeking ($\beta = .13$, $p < .05$).

After establishing which personality traits predict dangerous driving, the next step was to explain the involvement of individuals in traffic accidents through testing the contextual mediated model of involvement in traffic accidents. For this, we only selected the variables which were related to the factors of the DDDI. In addition, we also controlled for participants' age, because older participants are more likely to have been involved in accidents. Compared to similar research (e.g., Chraif, Aniţei, Burtăverde, & Mihăilă, 2016), our approach is more conservative because we did not allow all personality traits to correlate. As reported above, we included personality traits and gender as distal variables, which explain dangerous driving (proximal variables), which, in turn, directly explain the involvement in traffic accidents. The statistical analysis was performed with AMOS by entering all relevant variables together in one model, investigating the paths from distal variables to proximal variables, and from
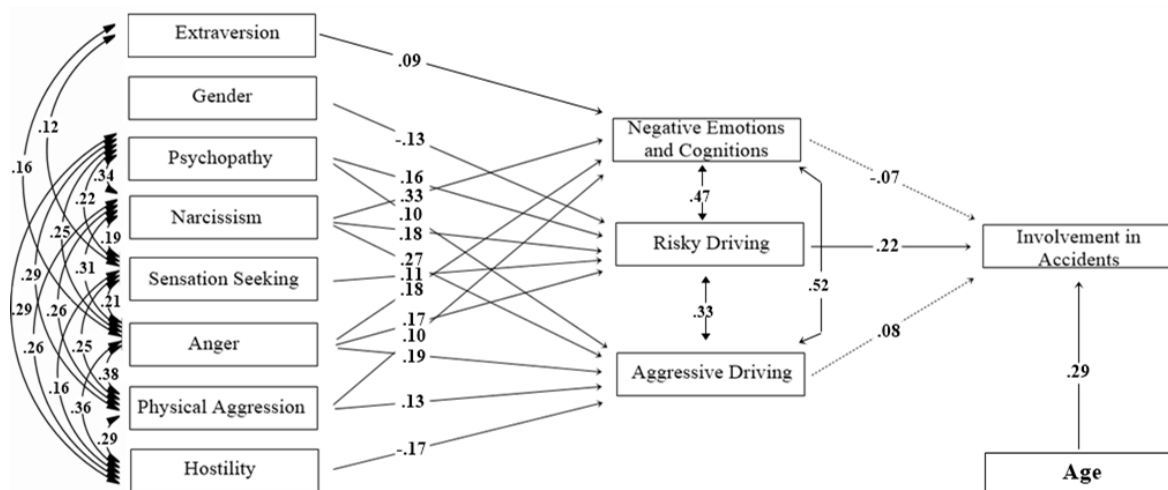
proximal variables to the involvement in accidents.

Figure 2. Contextual mediated model. Dashed arrows represent non-significant paths.

The independent variables of the path model are psychopathy, narcissism, physical aggression, hostility, anger, extraversion, sensation seeking, gender, and age. The three proximal variables were the factors of the DDDI: negative cognition and emotion, risky driving, and aggressive driving. Finally, the dependent variable is involvement in accidents. We performed a path analysis to test the model, and the modification indices suggested that the personality traits were inter-correlated, as were the errors of the DDDI factors. After we allowed them to correlate, the model presented an acceptable fit: [χ^2/df = 2.72; GFI = .95; AGFI = .89; CFI = .91; RMSEA (IC90%) = .07 (.06 - .09)]. 5000 Bootstrapped samples showed indirect effects for psychopathy (λ = .04, IC90% = .02 - .08, p <.01), anger (λ = .04, IC90% = .01 - .07, p <.05), sensation seeking (λ = .02; IC 90% = .01 - .05, p < .05), and gender (λ = -.03; IC 90% = -.06 - -.01, p < .01) on involvement in accidents. Figure 2 shows all the direct effects, and the only predictors of accidents, risky driving (λ = .22, IC90% = .11 - .32, p = .01), and age (λ = .29, IC90% = .21 - .37, p = .01).

4. Discussion

One of the major causes of mortality due to external factors are traffic accidents (Morais Neto et al., 2012, WHO, 2015). These may occur due to contextual factors, but also factors within individuals like personality traits, which is reflected by regulations of the Brazilian government, who made it mandatory for prospect drivers to undergo a psychological evaluation to obtain a driver license, which includes a personality evaluation (Wit et al., 2016). Despite its importance, only a few studies have investigated the role of personality in understanding traffic behavior in Brazil (Silva & Alchieri, 2007). Thus, the present research aimed to further advance our understandings of predictors of dangerous driving and involvement in accidents. Specifically, we sought to explain the involvement in traffic accidents using a hierarchical model, where the more stable variables of personality explain dangerous driving, which in turn directly explain the involvement in accidents (see Dahlen et al., 2012, Sümer, 2003).

We have considered a range of personality traits which have been found to be associated with dangerous driving in previous studies, and have not been studied together before. Considering these variables together allowed us to replicate and extend previous findings, thus adding to the literature the influence of personality traits in dangerous driving. In our results, we found that the most consistent predictors of the dangerous driving were the subclinical variations of narcissism and psychopathy, physical aggression, and anger, replicating previous findings (Bogdan et al., 2016; Burtăverde et al., 2016; Bushman et al., 2018; Lajunen & Parker, 2001). We discuss our findings in more detail below.

Narcissists have a sense of superiority and merit, an inflated and unstable self-concept, which requires constant external validation (Pincus & Lukowitsky, 2010; Raskin & Terry, 1988). Due to such characteristics, they may exhibit aggressive behaviors when they feel threatened (Bushman & Baumeister, 1988; Jones & Paulhus,

2010), and it is possible to extend this aggressive behavior pattern to traffic. Narcissists are extremely sensitive in perceiving threats, and may interpret benign or ambiguous behavior as an offense or personal attack (Lustman, Wiesenthal, & Flett, 2010). Common traffic situations, such as provoking other drivers, obstructing passages or disturb other road users in other ways, may cause an aggressive reaction of narcissists (Burtăverde et al., 2016; Edwards et al., 2013; Przepiorka, Blachnio, & Wiesenthal, 2014).

Narcissism also predicted negative cognition and emotion when driving, including anger while driving, which can be understood as a potential response to the perceived source of transgression (Hennessy, 2016). Given that people with narcissistic traits can also be exhibitionists (Raskin & Terry, 1988), they might use the traffic as a place to display their abilities or talents to impress others, for example through risky driving (Burtăverde et al., 2016).

Psychopathy predicted aggressive driving and risky driving. This is likely because psychopathy is associated with poor behavioral control, an intense search for exciting situations, and a tendency to act aggressively (Patrick, Fowles, & Kruger, 2009). Therefore, people with psychopathic tendencies are more likely to be aggressive not only in general, but also while driving (Burtăverde et al., 2016; Jones & Paulhus, 2010; Jones & Neria, 2015). In addition, psychopathy correlates with various risk behaviors (Crysel et al., 2012), so that psychopathic traits describe a profile of individuals that are willing to take risks in search of stimulating and exciting situations. Risks in traffic, such as speeding or dangerous overtaking, can be a way of expressing this intense need for excitability related to psychopathy (Kajonius, Persson, & Jonason, 2015; Panayiotou, 2015).

Like psychopathy, sensation seeking predicted risky driving. This is in line with previous findings (Dellhomme et al., 2012; Jonah, 1997). According to Constantinou, Panayiotou, Konstantinou, Loutsiou-Ladd, and Kapardis (2011), the low sensitivity to punishment and sensation seeking are related to the underestimation of the danger, leading people with these traits to act in a riskier way, defying the danger. Specifically, this explanation can be expanded to psychopathy, so that this trait is based on a low sensitivity to punishment and that the tendency to take risks is one of the elements that constitute psychopathy (Hauck Filho, Salvador-Silva, & Teixeira, 2015, Patrick et al., 2009).

The effects of anger and physical aggression on dangerous driving are more direct. People with high anger and aggressiveness scores act aggressively towards other drivers and pedestrians and are also more likely to experience fury attacks while driving (Bogdan et al., 2016; Lajunen & Parker, 2001; Schwebel et al., 2006; Yang et al., 2013). We found that men are more prone to report a riskier driving style than women. This is in line with previous research which found that men tend to have a higher number of tickets for traffic violations on average (e.g., speeding, ignoring traffic signs, illegal passing, weaving in and out of a lane; Factor, 2018; Tucker, Pek, Morrish, & Ruf, 2015). These violations represent typical risky driving behaviors. Furthermore, gender is a distal variable (Sümer, 2003), and does therefor not directly predict involvement in accidents. However, gender has an indirect effect in involvement in accidents. This suggests that men have more fatal accidents than women (WHO, 2015) because of a riskier driving style.

Unexpectedly, we found negative relations between hostility and aggressive driving. However, a closer look at the three hostility items revealed that they measure suspicion rather than hostility. Indeed, Webster et al. (2015, p. 4) have used two items

from other suspicion subscales, but still labelled the factor as hostility. The exact wording of all three items is "I sometimes feel that people are laughing at me behind my back.", "When people are especially nice, I wonder what they want", and "Other people always seem to get the breaks." People who are suspicious might also be more careful, which in turn is presumably negatively related to aggressive driving. Thus, we recommend that the effects of hostility/suspicion are interpreted with care.

In line with previous findings (Dahlen et al., 2012; Demir et al., 2016), some personality traits showed direct effects on the proximal variable dangerous driving but not on the involvement in accidents. Nevertheless, we confirmed the contextual mediated model of involvement in traffic accidents (Sümer, 2003). Specifically, we found that the best predictor of accidents was risky driving (Richer & Bergeron, 2012). Further, only psychopathy, anger, and sensation seeking had indirect effects in the involvement in accidents. As described above, people with psychopathy tendencies and sensation seekers are more likely to underestimate risks, leading them to act in a risky manner in traffic – even when exposed to mortality salience (Constantinou et al., 2011; Rosenbloom, 2003; Zuckerman, 1979). For instance, anger is an aggressive emotion and some episodes in traffic can elicit strong emotional distress, especially in the chaotic Brazilian traffic (e.g., traffic jam). Angry people presumably drive in riskier ways and behave more aggressively while driving, thus being more frequently involved in accidents (Deffenbacher, Deffenbacher, Lynch, & Richards, 2003; Deffenbacher, Oetting, & Lynch, 1994; Underwood, Chapman, Wright, & Crundall, 1999).

Despite being related to all dangerous driving factors, narcissism had no indirect effect on the frequency of accidents. This can be explained by the fact that narcissists are self-centered and seek to protect their life and physical integrity. Thus, they are avoiding situations that put them at risk (Burtăverde et al., 2016). However, considering

the indirect effects of psychopathy, anger, and the sensation seeking, the contextual mediated model was supported (Sümer, 2003), indicating that personality traits play an important role in understanding involvement in accidents, explaining them indirectly.

4.1.Limitations, Future Research, Conclusion

Despite the importance of our findings, some limitations should be considered. Although our sample did not only consist of student, it was non-probabilistic, limiting any possibility of generalization of the results. Another limitation refers to the type of instrument used to measure variables. In this case, the personality traits were assessed through short measures (e.g., TIPI, BAQ), resulting in low levels of internal consistency coefficients. Furthermore, some deviant personality traits were evaluated, as well as socially reprehensible behaviors in traffic. Thus, some people might have responded in a social desirable way. Finally, another potential limitation is to rely on the self-report of people on the number of accidents they have been involved in, and it is possible that many have made inaccurate estimates (cf. Wåhlberg & Dorn, 2015). However, almost no study about involvement in accidents used objective measures (none of the studies we cite does it[1]), because it is beyond the scope of most studies to collect objective data about the involvement in accidents, if this exists at all (e.g., because many minor accidents might never be reported to the authorities). Researchers might therefore rely on dash-cam recordings (i.e., cameras in cars facing forwards through the windshield) or driving simulator. Both methods are not without their own limitations (e.g., dash-cam recordings are illegal in several countries and recordings are often limited to a few days due to storage space), but they would allow mixed-method approaches where the limitations of each method could be reduced. Additionally, future research should aim

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[1] A few studies used simulators to assess involvement in traffic accidents (e.g., Marengo, Settani, & Vidotto, 2012; Schwebel, Severson, Ball, & Rizzo, 2006). However, we are not aware of any study that has investigated whether driving in a simulator is a good estimate for the number of accidents they have been involved in throughout their lives as drivers (our main DV).

to focus on larger and heterogeneous samples, besides being able to evaluate the frequency of collisions considering the performance of people in simulators, as has been done by other researchers (Marengo et al., 2012, Richer & Bergeron, 2012).

In conclusion, our research helps to understand to what extent different personality traits can influence dangerous driving and involvement in accidents. We investigated the relations of personality traits with dangerous driving and involvement in accidents in a way that has not been done in past research, resulting in a more accurate understanding of their influences. Specifically, in Brazil it is compulsory to be psychologically evaluated to be able to get a driver license. For example, driving license applicants need to complete measures to assess aspects such intelligence, attention, and personality. However, researchers demurred that the understanding of traffic psychology in Brazil is still too limited to justify this mandatory evaluation of personality traits (Silva & Alchieri, 2007; Silva & Alchieri, 2008). The present research explores how a range of personality traits that can influence driving (e.g., risky driving, aggressive driving) and the propensity of getting involved in accidents. Thus, further studies could include diversified samples and professional drivers (e.g., of taxis, buses, and trucks). These studies can replicate and extend our work by also including driving simulations, to make evidence based recommendations to the Federal Psychology Committee in Brazil or governmental bodies in Brazil and beyond to assess the aptness of applicants for driver licenses. Overall, our findings can help to identify individuals that are more likely to put themselves and others in traffic at risk (cf. Edwards et al., 2013, Panayotu, 2015).

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