Transportation Research Part F 14 (2011) 43–53

Contents lists available at ScienceDirect

Transportation Research Part F

journal homepage: www.elsevier.com/locate/trf

The effects of personality traits on driving-related anger and aggressive behaviour in traffic among Serbian drivers

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ARTICLE INFO

Article history:
Received 3 August 2009
Received in revised form 10 September 2010
Accepted 14 September 2010

Keywords:
Aggressive driving
Driving anger
Five-factor (traits) personality model
Structural model

ABSTRACT

Aggressive driving is a worldwide phenomenon of an almost epidemic proportion. To understand this phenomenon, we have to determine which elements provoke drivers to feel anger and express aggression while driving. The main goal of this study was to determine the ways in which the five-factor personality traits model was related with aggressive behaviour during driving. We hypothesised that neuroticism correlates with aggressive driving indirectly through anger, whereas the other traits are directly connected with aggressive driving. In our analyses, we controlled for the age of the interviewed participants and their driving experience; gender was not a significant factor and as such was not controlled for in the analyses. Regression analyses showed that neuroticism, agreeableness and conscientiousness predicted driving-related anger and aggression. The results revealed that the data fit well with our theoretical model. The relationship between neuroticism and aggressive driving is mediated by the driver's anger, whereas agreeableness and conscientiousness had both a direct and indirect relations with aggressive driving. Our model accounts for a relatively high percentage of the aggressive driving variance, suggesting the usefulness of assessing global personality traits for the prediction of aggressive driving.

1. Introduction

Aggressive driving, an increasingly frequent form of behaviour during driving (American Automobile Association, 1997; Joint, 1995; Lex Motor Group, 1996), is considered to be an important problem in almost all countries. In the United States of America, the Department of Transportation estimated that in 1996 about two-thirds of the 41,907 registered fatalities from cars accidents could be attributed to aggressive driving (Martinez, 1997). In a study conducted in Great Britain, it was found that 90% of the participants experienced incidents caused by 'road rage' within the previous 12 months. In that study, around 60% of the drivers admitted that they had lost their calm behind the steering wheel within the previous year, and 1% claimed that they had experienced a physical attack by another driver (Joint, 1995).

There are many reasons why driving a car may be a stressful activity. Being in a hurry, impatience, traffic congestion, competing with other drivers, feelings of inferiority, and the wrong actions of other drivers are some of the sources of frustration and stress in traffic. Any of these events may provoke hostile and destructive behaviour and aggression.

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1369-8478/$ - see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.trf.2010.09.005

Aggressive behaviour is defined as any form of behaviour aimed to exert psychological and physical pain on another person (Baron & Richardson, 1994; Berkowitz, 1993; Coie & Dodge, 2000). Similarly, drivers' aggression can be defined as any form of a drivers' behaviour that is conducted with the intention to hurt (physically or psychologically) or cause damage to other road users (Ellison-Potter, Bell, & Deffenbacher, 2001; Lajunen, Parker, & Stradling, 1998). According to aggression researchers, the amount of anger felt during a frustrating situation depends on both the person's interpretation of the situation and the objective situational characteristics (Berkowitz, 1993). The drivers who express aggression in traffic impose their behaviour onto others without paying any attention to others' intentions and rights in traffic. Aggressive behaviour results in a higher risk for accidents and a greater number of traffic accidents with casualties. Research has confirmed that anger, arguing with other drivers and aggressive driving are all connected with traffic accidents (Hemenway & Solnick, 1993; Parry, 1968; Tillman & Hobbes, 1949; Underwood, Chapman, Wright, & Crundall, 1999; Whitlock, 1971). The frequency of aggressive driving (American Automobile Association, 1997; Joint, 1995; Lex Motor Group, 1996) makes this phenomenon a large potential threat for drivers.

To reduce or eliminate aggressive driving, it is necessary to implement measures that will treat its determinant and not its manifestation. Therefore, behavioural research is needed to determine the causes of aggressive behaviour. Previous research has considered the following two categories of specific causal factors: (1) situation and environment factors and (2) individual properties of aggressive behaviour.

Situational and environmental factors. A large number of studies have examined the impact of situational and environmental factors that motivate, stimulate, or elicit aggressive driving (Anderson & Anderson, 1998; Ellison-Potter et al., 2001; Hennessy & Wiesenthal, 1997; Kenrick & MacFarlane, 1986; Krahé, 2001; Lajunen, Parker, & Summala, 1999; McGarva & Steiner, 2000; Parker, Lajunen, & Summala, 2002; Shinar, 1998, etc.). These studies have revealed the following findings:

- There are situations on the road that provoke drivers frustration and lead to aggressive behaviour.
- Driving in congested traffic is a source of irritation that has a negative impact upon the driver.
- The constant exposure to daily problems (e.g., job-related concerns, commuting and financial concerns) can exacerbate one's stress level and result in more aggressive driving.
- Anonymity of driving may result in a reduced respect for others, less decency and more aggressive behaviour.
- Noise, heat, and the presence of others in the vehicle may be related with occurrence of aggressive behaviour.

Individual properties of aggressive behaviour. Not everyone becomes aggressive on the road when exposed to provocative situations. As such, it is important to investigate individual difference variables that are potentially related to driver aggression. The media has suggested that some peoples' behaviour changes when they find themselves behind the steering wheel. In other words, some people act aggressively when driving but are not aggressive during other daily life activities. Based on this theory, we could conclude that driving represents a catalyst for aggression for some people. However, according to a specialised bibliography on aggression, the tendency (i.e., the trait or the adopted behaviour pattern) toward aggression is a stable characteristic and, as such, an individuals' aggressive behaviour should be consistent across time and situations (Baron & Richardson, 1994; Berkowitz, 1993; Scheier, Buss, & Buss, 1978, according to Lajunen & Parker, 2001). Therefore, it is reasonable to expect that one's inclination towards aggression will be reflected in their behaviour in traffic (Lajunen & Parker, 2001). Research on the causality of aggressive driving has revealed the existence of the following individual differences: younger drivers resort to aggressive driving more often than older drivers (Hauber, 1980; Krahé & Fenske, 2002; Lawton, Parker, Manstead, & Stradling, 1997; Parry, 1968), and one's driving experience may affect one's probability of aggressive behaviour in traffic. Some research has shown that more experienced drivers (i.e., those with more mileage travelled and more years spent in traffic) are less prone to quickly attack others or to act aggressively in relation to younger, less experienced drivers (Wells-Parker et al., 2002); men are more prone to aggressive driving than women (Blanchard, Barton, & Malta, 2000; Wells-Parker et al., 2002; Wiesenthal, Hennessy, & Gibson, 2000); personality traits are related to aggressive driving (Benfield, Szlemko, & Bell, 2007; Bone & Mowen, 2006; Dahlen & White, 2006); traits of anger and aggression are connected with aggressive behaviour while driving (Arnett, Offer, & Fine, 1997; Deffenbacher, Huff, Lynch, Oetting, & Salvatore, 2000; Deffenbacher, Richards, Filetti, & Lynch, 2005; Lajunen & Parker, 2001); and people with a type A personality (i.e., those with a chronic sense of being in a hurry, easily angered, hostile, competitive, impatient, aggressive and discourteous verbal and psycho-motor manners) are prone to aggressive driving (Perry & Baldwin, 2000).

Behaviour is always the product of individual tendencies combined with environment-related stimuli. The role of a driver's personality and predisposition is illustrated by the finding that those who more frequently violate the red light rule have three times as many previous driving violations than those who respect the red light rule (Retting & Williams, 1996, as cited in Shinar, 1998).

1.1. The relationship between personality traits, driving-related anger, and aggressive driving

Personality traits can be defined as dimensions of individual differences that have a consistent pattern of thoughts, feelings, and behaviour (McCrae & Costa, 1990). In some earlier studies using the 'individual differences' approach, "human factors" were analysed in relation to the theory on 'accidents proneness' (Farmer & Chambers, 1929), which emphasises the role of an accident-prone personality. However, this theory has been criticised based for a number of reasons and replaced with new theories, such as the 'differential accident involvement' (McKenna, 1983). Nevertheless, some recent research confirmed

that accident-proneness is indeed a personality dimension (Neeleman, 2001; Neeleman, Wessely, & Wadsworth, 1998). Visser, Pijl, Stolk, Neeleman, and Rosmalen (2007) conducted a meta-analysis of the distribution of accidents in the general population and found that the number of persons who have been in multiple accidents was higher than expected. They concluded that there individuals can be accident-prone, but its study is severely hampered by the variation in operationalisations of the concept. Recent traffic studies have also confirmed the connection between personality traits and traffic accidents (Hilakivi et al., 1989; Jonah, 1997; West & Hall, 1997).

The personality traits included in the five-factor model (FFM) (i.e., neuroticism, extraversion, openness, agreeableness, conscientiousness) (Costa & McCrae, 1992) may provide insight into aggressive driving behaviour. Aggressive drivers are characterised by impatience, disrespect for other drivers, inconsiderateness and hostility. These characteristics are associated with consistent behaviour patterns and personality traits. However, the results from research that included the five-factor personality model dimensions and aggressive behaviour of drivers are not consistent. Some studies confirmed the relation of certain dimensions with aggressive behaviour, whereas others studies confirmed the relations of other personality dimensions.

Neuroticism is a personality trait that is defined as an inclination to experience negative emotions and difficulty in dealing with problems. Neurotic individuals are inefficient in their attempts to overcome stress and are prone to irrational thinking. People with a high score on the neuroticism scale are often impatient, anxious, tense and irritated (Carver & Scheier, 1999). Previous research has shown that neuroticism was positively correlated with risky driving (Booth-Kewley & Vickers, 1994; Matthews, Dorn, & Glendon, 1991; White & Dahlen, 2001), aggressive driving (Bone & Mowen, 2006; Dahlen & White, 2006), the number of car accidents, mortality and a dislike of driving (Kirkcaldy & Furnham, 2000; Matthews et al., 1991). Bettencourt, Talley, Benjamin, and Valentine (2006) believe that neuroticism is a factor of a specific type of aggression called "reactive aggression" and arises in provocative situations. Reactive aggression corresponds to the notion of neurotic hostility that is expressed with a constant and strong experience of anger (Costa, McCrae, & Dembroski, 1989).

Extraversion is a personality trait that reflects social relations, the need for stimulation and the capacity to experience positive emotions. People with a high score on the extraversion scale are active, talkative, optimistic, cheerful, enjoy excitement and stimulation, and are full of energy. Researches have shown that extraversion is positively correlated with risky driving (Renner & Anderle, 2000; Smith & Kirkham, 1981; White & Dahlen, 2001). Lev, Hershkovitz, and Yechiam (2008) found that those who violated traffic regulations were much more extraverted than were those in a control group. Extraversion has also been shown to be connected with motor vehicle accidents, traffic mortalities, violation of traffic regulations, driving under the influence of various substances (Eysenck, 1970; Fine, 1963; Lajunen, 2001; Martin & Boomsma, 1989; Renner & Anderle, 2000; Smith & Kirkham, 1981) and the use of physical aggression toward other drivers (Benfield et al., 2007).

Openness towards an experience is defined as an active need for a novel experience and a tolerance of things that are unknown and novel. People who have the personality trait of openness are curious, non-traditional, unconventional, and prone to seek out novel experiences and reconsideration of authorities, although not necessarily unprincipled or lacking a system of values. When openness towards an experience was examined in the context of drivers' behaviour, only a few studies found a connection between the dimension of openness toward experiences and aggressive driving. Fernandes, Job, and Hatfield (2007) surveyed a sample of students and found that openness and specific attitudes towards aggressive driving were the best predictors of aggressive driving. Arthur and Graziano (1996) found that openness was positively connected with accidents caused by the aggressive driver. Benfield et al. (2007) concluded that the majority of aggressive behaviours exhibited while driving were associated with a low score on the openness scale and low scores on the scales measuring agreeableness and conscientiousness.

Agreeableness is a personality trait that reflects an individual's relationships with and attitudes about other people. Individuals with a high score on the agreeableness scale tend to be altruistic, empathetic and willing to help others, believing that they will receive same treatment from others in return. Low scores on this trait tend to reflect an antagonistic, egocentric, manipulative and competitive individual. According to Costa et al. (1989), antagonistic people tend to be hostile and irritating and have the need to confront, attack or punish others. Although this dimension can be connected with aggressive behaviour in general, and with driving-related aggression specifically, based solely on its definition, there are few studies that have confirmed this relationship empirically. Agreeableness was negatively correlated with highly risky driving, the number of traffic regulation violations (Booth-Kewley & Vickers, 1994; Cellar, Nelson, & Yorke, 2000) and the expression of aggression while driving (Benfield et al., 2007). In their paper, Bettencourt et al. (2006) hypothesised that people who have an aggressive personality and a low score on the agreeableness scale are likely to express aggression in both provoking and neutral situations.

Conscientiousness is the personality trait that has been studied most often in relation to drivers' behaviour in traffic. It is defined as the extent of organisation, persistence, and motivation of a behaviour directed towards a goal. People with high scores on the conscientiousness scale are precise, punctual, reliable, scrupulous, and thoughtful and have strong feelings of order, duty and self-discipline. Such persons could be expected to observe traffic regulations and laws and to act thoughtfully in traffic. The results of previous studies have shown that conscientiousness was negatively correlated with risky driving (Booth-Kewley & Vickers, 1994; White & Dahlen, 2001), aggressive driving (Bone & Mowen, 2006), and the number of self-reported accidents within a 3 year period (Arthur & Doverspike, 2001). In a larger study, Arthur and Graziano (1996) found that conscientiousness was the only one of the 'big five' personality traits that predicted a lack of participation in traffic accidents.

Driving-related anger and aggressive driving. More recent data show that driving-related anger and aggressive driving are common (Neighbors, Vietor, & Knee, 2002). A number of studies support the usefulness of the driving anger scale (DAS) for the prediction of anger towards other drivers, impatience in traffic, aggressive and risky driving, and the violation of traffic regulations (Blanchard et al., 2000; Deffenbacher et al., 2000; Knee, Neighbors, & Vietor, 2001; Lajunen & Parker, 2001; Underwood et al., 1999). There are many things that make people angry and deliberate them to drive aggressively, including the fact that driving is a potentially dangerous activity involving the interaction with unknown persons in an environment that does not allow for communication (Joint, 1995, as cited in King & Parker, 2008). A large number of studies have connected drivers' anger and aggressive behaviour while driving. An individual's inclination to get angry while driving is usually measured with the driving anger scale (Deffenbacher, Lynch, & Oetting, 1994). Deffenbacher et al. (1994) have shown that very angry drivers are almost three and a half to four times more prone to aggressive behaviour while driving and about one and a half to two times more prone to non-aggressive, risky behaviour while driving compared to drivers with a low level of anger (Deffenbacher, Lynch, Oetting, & Yingling, 2001; Deffenbacher et al., 2000, 2005). A study conducted by Lawton and Nutter (2002) showed that individuals with a high anger score would likely show aggression while driving than they would in another situation. Using the variables of gender, age, mileage travelled and different types of aggression traits in a regression model, King and Parker (2008) found that only physical aggression and anger were significant predictors of aggressive traffic rules violations, accounting for 31% of the variance in the model. In a sample of more than 2500 Norwegian drivers, Iversen and Rundmo (2002) found a significant correlation between risky driving and an individual's score on an abbreviated driving anger scale (Deffenbacher et al., 1994). Schwebel, Severson, Ball, and Rizzo (2006) found that anger/hostility was a significant predictor of traffic rules violations reported on Driving Behaviour Questionnaire (DBQ). Several studies have found that a high score on an anger scale correlated with a greater number of motor vehicle accidents, aggressive driving, traffic rules violations, intensity of driving-related anger, and less frequent use of safety belts (Blanchard et al., 2000; Deffenbacher, Lynch, Filetti, Dahlen, & Oetting, 2003; Deffenbacher et al., 1994, 2000; Lajunen & Parker, 2001; Underwood et al., 1999). Driving-related anger predicts risky driving, aggressive driving, and loss of control over one's vehicle (Dahlen & White, 2006). The personality traits of the five-factor model have rarely been connected with driving-related anger. In Dahlen and White's (2006) research, only the neuroticism dimension was connected with driving anger, whereas the study of Benfield et al. (2007) found the correlation with agreeableness, conscientiousness, and openness.

1.2. Research project

From the review of the literature presented above, we can see that all of the FFM (Costa & McCrae, 1992) dimensions have been connected with risky driving in general or aggressive driving, and with other driving outcomes. Our intention is to determine the following:

- Which dimensions of a five-factor personality traits model are connected with aggressive driving?
- Is driving-related anger a mediator between personality traits and aggressive behaviour while driving?
- Using the model presented in Fig. 1 and modifying it based on the data obtained from this study, we will construct a structural model that will use personality traits as predictors, aggressive driving as a criterion, and driving-related anger as a mediator between personality traits and aggressive driving.

In addition to the above-mentioned main objectives of the study, we will also test for a connection between the demographic characteristics of drivers (e.g., gender, age) and driving experience (e.g., the number of years one has possessed a driver's license) with driving-related anger and aggressive driving. Also, we will to examine the data to see whether a connection exists between aggressive behaviour in driving and traffic accidents, traffic rules violations and involvement in risky situations on driving.

Explanation of the model. A review of the literature revealed that the five-factor model dimensions were linked with aggressive driving, although there are conflicting findings in terms of what personality traits are predictors of aggressive driving. We began with the assumption that all of the five-factor model dimensions are linked with aggressive driving, either directly or indirectly through experience of driving-related anger. However, we hypothesised that the dimension of

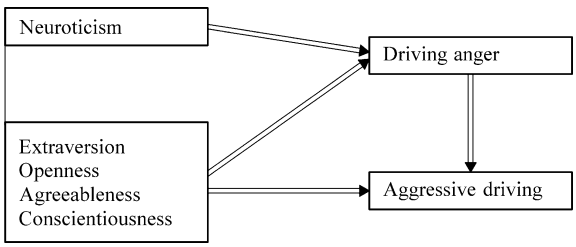

Fig. 1. A model predicting aggressive driving.

neuroticism would be linked only indirectly with aggressive driving via driving-related anger. We theorised that neurotic hostility (i.e., aggression) is expressed through a constant and strong feeling of anger (Costa et al., 1989). Thus, we predicted that the trait neuroticism would only be an indirect predictor (via anger) of aggressive driving, whereas the remaining four personality traits would be linked with aggressive driving both directly and indirectly.

2. Method

2.1. Sample

The data for this study were collected by mail. The names and addresses of 400 individuals with valid driving licenses were obtained from the register of owners of motor vehicles. The questionnaires were sent to the above-mentioned sample group, along with a cover letter explaining the purpose and objective of the research. We included a prepaid envelope to be used to return the completed questionnaires. We received 260 completed questionnaires. The final sample consisted of 137 men and 123 women from the Serbia. The mean age of the subjects was 32.5 years (range = 18–60 years, SD = 10.9) and the mean annual mileage was 12,622 km (SD = 19,826). The female drivers in this sample were younger (M = 31.9 years, SD = 10.6) than the male drivers (M = 32.9 years, SD = 11.1). The women also had less annual mileage (M = 4377, SD = 4956) than the men (M = 20,024, SD = 24,696).

The subjects were instructed to carefully read all of the questions and to reply honestly without spending too much time on each item. The participants were also ensured that their answers would be treated as anonymous and confidential and that their data would be used exclusively for scientific purposes. The participants were not asked to write their names on their questionnaires to reduce the possibility of giving socially desirable answers. The study received ethical approval by the University of Novi Sad.

2.2. Measures

The alpha values for the reliability of each measure are derived from the data collected in this study.

2.2.1. UK driving anger scale (UKDAS)

The UKDAS (Lajunen et al., 1998) consists of 21 items describing driving situations that may potentially provoke a driver's anger. The items are divided into three subscales:

1. *Progress impeded* (α = 0.80) consisted of nine items
2. *Reckless driving* (α = 0.83) consisted of nine items
3. *Direct hostility* (α = 0.83) consisted of three items

We also compiled a *total driving anger* score by adding up the three subscale scores. The reliability of the total anger scale in our sample was α = 0.89. The UKDAS uses a five-point Likert scale to assess the degree to which a situation provokes anger (1 = not at all to 5 = very much).

2.2.2. Driving anger expression inventory (DAX)

The DAX is a scale consisting of 49 items that asks individuals to rank how often they express anger in the described manner, using a four point response option (1 = almost never to 4 = almost always) (Deffenbacher, Lynch, Oetting, & Swaim, 2002). The DAX provides four ways of measuring of driving-related anger expression:

1. A 12-item *verbal aggressive expression* subscale (α = 0.88) (e.g., swearing or yelling at another driver).
2. An 11-item *personal physical aggressive expression* subscale (α = 0.85) (e.g., giving another driver the finger or trying to have a physical fight with another driver).
3. An 11-item *use of the vehicle to express anger* subscale (α = 0.77) (e.g., speeding up to frustrate another driver or flashing lights at another driver).
4. A 15-item *adaptive/constructive expression* subscale (α = 0.82) (e.g., relaxing or thinking about things to distract oneself from frustration).

We also measured the *total expression of aggressive responds* (α = .85) by totalling the scores on the verbal aggressiveness, personal physical aggressiveness and use of vehicles for anger expression subscales. The verbal and physical aggressiveness and use of vehicle as means for anger expression subscales are positively inter-correlated and are each negatively correlated with adaptive/constructive expression.

2.2.3. Personality inventory (NEO–PI-R)

We used the abbreviated version of the personality inventory NEO–PI-R (Djurić-Jočić, Džamonja-Ignjatović, & Knežević, 2004) that consists of 60 items. This scale has been standardised for the Serbian population. The responses were marked on a

five-point Likert scale (1 = completely wrong to 5 = completely true). This scale is used to assess five personality domains: *neuroticism*, *extraversion*, *openness*, *agreeableness*, and *conscientiousness*.

2.2.4. The socio-demographic questionnaire and additional questions related to driving experience and driver behaviour

This questionnaire consists of six items and is divided into the following three parts:

1. Socio-demographic data (e.g., gender, age).
2. Data on one's driving experience (e.g., amount of time one has possessed a driving license).
3. Data on driver behaviour (e.g., How many risky situations (almost accidents) have you participated in as a driver within the last 3 months? How many times have you been stopped because of violations of traffic regulations within the last 3 months? How many accidents have you participated in as a driver within the last 3 years?).

2.3. Statistical analysis

To analyse the date, we used descriptive statistics measures (i.e., the mean and standard deviation), linear correlation measures, regression analyses, and procedures for determining the significance of the differences between the means (i.e., *t*-test). The reliability coefficients were expressed using Cronbach's Alpha. The relationship between personality traits, driving anger and expression of aggression while driving was determined using a structural equation model. We analysed the covariance matrix using the Amos 6.0 programme (Arbuckle, 2005). Various fit indices were used to assess the fit of the model: The goodness-of-fit index (GFI), adjusted goodness-of-fit (AGFI), comparative fit index (CFI) and root-mean-square error of approximation (RMSEA). The GFI, AGFI, and CFI values exceeding 0.90 provide evidence that the model is a very good fit for the data (Hu & Bentler, 1995; Kline, 2005). The RMSEA values below 0.06 are taken as representing a good fit (Hu & Bentler, 1999; Miles & Shevlin, 2007).

3. Results

The associations among the personality traits (measured by the NEO–PI-R scale), the driving-related anger (measured by UKDAS scale) and the expression of aggressive driving (measured by DAX scale) were analysed using Pearson's linear correlation analyses. The results are presented in Table 1.

As displayed in the table above, the traits of neuroticism, agreeableness, and conscientiousness were significantly correlated with driving anger and the expression of aggression while driving. The trait of openness was not correlated with experiencing anger or with the expression of aggressiveness while driving. Extraversion was correlated with certain expressions of aggression, but the correlation was very small, although significant.

As expected, the correlation between experiencing anger and the expression of aggressiveness while driving was quite strong. All of the forms of driving anger were statistically significantly correlated with all of the forms of the expression of aggressiveness, with the exception of adaptive/constructive expression. The strongest correlations were noted between anger provoked by impeded progress and all forms of aggression: verbal ($r = 0.518$, $p < .01$), physical ($r = 0.471$, $p < .01$),

Table 1
The correlations among personality traits, driving-related anger, and aggressive driving.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Neuroticism	–													
2. Extraversion	−.17**	–												
3. Openness	−.05	.11	–											
4. Agreeableness	−.29**	.14*	.02	–										
5. Conscientiousness	−.36**	.26**	.12	.35**	–									
6. UKDAS–PI	.36**	−.07	−.05	−.32**	−.13*	–								
7. UKDAS–RD	.24**	.08	−.04	.01	.11	.59**	–							
8. UKDAS–DH	.17**	−.01	−.04	−.20**	−.10	.52**	.41**	–						
9. UKDAS–TA	.33**	.01	−.05	−.19**	−.03	.88**	.87**	.68**	–					
10. DAX–VA	.29**	−.09	.11	−.38**	−.26**	.52**	.19**	.34**	.42**	–				
11. DAX–PA	.24**	−.13*	−.04	−.32**	−.40**	.47**	.13*	.22**	.33**	.57**	–			
12. DAX–UV	.30**	−.12	−.08	−.30**	−.36**	.53**	.14*	.32**	.39**	.56**	.74**	–		
13. DAX–A/C	−.22**	.13*	.05	.19**	.29**	−.11	.10	−.04	−.01	.02	−.30**	−.16*	–	
14. DAX–TA	.33**	−.13*	.01	−.41**	−.39**	.56**	.17**	.35**	.43**	.87**	.84**	.85**	−.13*	–

Note: UKDAS–PI = UK driving anger scale–progress impeded; UKDAS–RD = UK driving anger scale–reckless driving; UKDAS–DH = UK driving anger scale – direct hostility; UKDAS–TA = UK driving anger scale–total driving anger; DAX–PA = driving anger expression inventory–physically aggressive expression; DAX–VA = driving anger expression inventory–verbally aggressive expression; DAX–UV = driving anger expression inventory–use of the vehicle; DAX–A/C = driving anger expression inventory–adaptive/constructive expression; DAX–TA = driving anger expression inventory–total expression of aggressive replies.

* $p < .05$.

** $p < .01$.

use of the vehicle for anger expressing ($r = 0.534$, $p < .01$), and with the total score for the expression of aggression ($r = 0.562$, $p < .01$).

3.1. Hierarchical regression analyses

To test the relationship between personality traits, driving anger, and the expression of aggression while driving, we conducted two hierarchical regression analyses, controlling for the effect of age and driving experience. In the first analysis, the dependent variable was the total score for the driving anger. The variables for age and driving experience were entered as independent variables in the first block and the personality traits were entered in the second block. In the second analysis, the dependent variable was the total score for the expression of aggression while driving. Age and driving experience were entered as independent variables in the first block, personality traits in the second block and total driving anger in the third block. The first purpose of these analyses was to determine the predictive value of the personality variables and driving anger on aggressive behaviour expressed while driving, controlling for age and driving experience. The second purpose was to determine what variables should be included in the analysis of the indirect effects to refine the structural equation model. The variables of age and driving experience were controlled because they are statistically significantly correlated with anger and the expression of aggressiveness while driving (see Table 2).

In the first regression analysis, the variables for age and driving experience were entered in the first step and explained 3% of the variance of driving anger ($F(2, 257) = 4.11$, $p < .05$). After the introduction of the personality traits in the second step, the model explained 17% of the total variance ($F(7, 252) = 7.16$, $p < .001$). The personality traits explained the additional 14% of variance in the driving anger (r^2 change = 0.14, F change $(5, 252) = 8.15$, $p < .001$). In the final model, the largest unique contribution was made by neuroticism ($\beta = .34$, $p < .001$), whereas a statistically significant contribution was made by agreeableness ($\beta = -.13$, $p < .05$) and conscientiousness ($\beta = .17$, $p < .05$).

In the second regression analysis, the variables for age and driving experience were introduced in the first step and explained 6% of the variance of the expression of aggression in traffic ($F(2, 257) = 7.68$, $p < .001$). After the introduction of the personality traits in the second stage, the model explained 29% of the total variance ($F(7, 252) = 14.46$, $p < .001$). The personality traits explained the additional 23% of the variance in the expression of aggression (r^2 change = 0.23, F change $(5, 252) = 16.26$, $p < .001$). The largest unique contribution was made by agreeableness ($\beta = -.26$, $p < .001$), followed by conscientiousness ($\beta = -.20$, $p < .001$), and neuroticism ($\beta = .17$, $p < .01$). The total driving anger score was introduced in the third step, and the model as a whole explained 40% of the total variance ($F(8, 251) = 20.58$, $p < .001$). Driving-related anger explained the additional 11% of variance in the expression of aggression (r^2 change = 0.11, F change $(1, 251) = 45.56$, $p < .001$). The personality traits and the driving anger explained 34% of the variance in the expression of aggression in traffic. In the final model, the largest contribution was made by the driving anger ($\beta = .36$, $p < .001$). In addition to the total driving anger, a statistically significant contribution was made by conscientiousness ($\beta = -.26$, $p < .001$) and agreeableness ($\beta = -.21$, $p < .001$).

The results of the regression analyses revealed that among all of the personality traits assessed, the driving anger and the expression of aggressiveness can be predicted by an individual's level of neuroticism, conscientiousness, and agreeableness. Furthermore, when we included the personality traits and the total driving anger score in the regression equation, we found that the traits of conscientiousness and agreeableness and the total driving anger score are sufficient for predicting the total expression of aggression score. We concluded that the traits of agreeableness and conscientiousness are connected with driving anger and the expression of aggression. The trait of neuroticism was primarily connected with anger while driving, and the anger mediated the expression of aggression while driving.

3.2. Structural equation model

The structural equation model used to test the association between the personality traits, driving anger, and aggression while driving was constructed using the results of the regression analyses.

Table 2
The correlations between the demographic characteristics, risky behaviour while driving, driving-related anger, and aggressive driving.

Variables	1	2	3	4	5	6	7
1. Age	–						
2.Driving experience	.88**	–					
3. Involvement in accidents	−.18**	−.13*	–				
4. Involvement in risky situations	−.05	−.05	.22**	–			
5. Violations of traffic rules	−.10	−.02	.15*	.21**	–		
6. UKDAS–TA	−.15*	−.18**	.01	.02	.02	–	
7. DAX–TA	−.23**	−.17**	.06	.13*	.18**	.43**	–

Note: UKDAS–TA = UK driving anger scale–total driving anger; DAX–TA = driving anger expression inventory–total expression of aggressive replies.
* $p < .05$.
** $p < .01$.

The relevant model statistics revealed that the proposed model fit the data $\chi^2(1, n = 260) = 0.46$, $p = 0.50$, GFI = 0.99, AGFI = 0.99, CFI = 1.00, RMSEA = 0.00. The results for this model are represented in Fig. 2. This figure provides the standardised regression coefficients for all the pathways. The path model confirmed the results we obtained in regression analyses. The traits of agreeableness and conscientiousness correlate directly with aggressive driving, but they are also indirectly related to aggressive driving through driving-related anger. The trait of neuroticism was associated with the expression of aggressiveness while driving indirectly through anger.

We hypothesised at the beginning that trait of neuroticism is associated with aggression while driving through driving anger. Regression analyses and structural equation model supported our hypothesis. However, to make sure our model is appropriate we tested alternative model, too. This alternative model differs because it has direct path between neuroticism and outcome variables (driving anger and aggression). Tested model does not fit the data $\chi^2(1, n = 260) = 4.71$, GFI = 0.99, AGFI = 0.89, CFI = 0.98, RMSEA = 0.12, and relationship between neuroticism and aggression was not significant. We can take these results as additional support to our assumption that neuroticism correlates with aggression while driving through driving anger.

3.3. Additional results

In Introduction, we mentioned findings about relations between sex, age and driving experience and driving anger and aggression. Furthermore, some researches showed existence of correlation between driving anger and aggression and traffic accidents (Hemenway & Solnick, 1993; Parry, 1968; Tillman & Hobbes, 1949; Underwood et al., 1999; Whitlock, 1971). Aiming to check these results once more, we conduct some additional analyses.

There was a statistically significant difference in anger provoked by the reckless driving of other drivers ($t(258) = -4.05$, $p < .001$) and in the total driving anger score between men and women (woman reported more anger), ($t(258) = -3.20$, $p < .01$). As for the expression of aggression, the only significant difference found was for the expression of adaptive/constructive aggression ($t(258) = -2.00$, $p < .05$), also woman reported more adaptive responses. The correlation between the variables for age, driving experience, involvement in risky situations, violations of traffic rules and traffic accidents and the variables for driving anger (measured by the UKDAS) and aggressive behaviour in traffic (measured by the DAX) was tested using Pearson's linear correlation coefficients. The results of these analyses are presented in Table 2. This table shows that older and more experienced drivers reported experiencing less anger and expressing less aggression while driving compared to their counterparts.

The correlation between driving aggression and risky behaviour (i.e., involvement in risky situations and violation of traffic rules) was small, although statistically significant. To test this relationship more thoroughly, we divided risky behaviours into two groups: those who reported risky behaviours and those who did not. A t-test analysis was used to determine the difference between these two groups in terms of driving aggression. There was a significant difference between those who were involved in risky behaviours and those who were not (involvement in risky situations $t(258) = -3.53$, $p < .001$; violations of traffic rules $t(258) = -3.79$, $p < .001$).

4. Discussion

The primary aim of this study was to explore the relations of personality traits with anger and aggressive behaviour while driving. We hypothesised that neuroticism would be correlated with expression of aggression while driving only indirectly, mediated by driving-related anger, whereas the other four dimensions of the five-factor personality model would be related both directly and indirectly through driving anger. However, the results of the study only partially supported our hypothesis. As we expected, the results of the regression analyses and structural equation models showed that neuroticism was correlated with expression of aggression while driving only through the driving anger. This result is consistent with the definition of neurotic hostility/aggression as 'experiencing constant and strong anger' (Costa et al., 1989). Our results are also consistent with Bettencourt et al.'s (2006) assertion that neuroticism is a special kind of aggression termed "reactive aggression" that arises in provocative circumstances.

Although we expected the remaining four dimensions of the five-factor personality model to be correlated with aggressive driving both directly and indirectly through anger, the results of this study showed that this was only the case for agreeableness and conscientiousness. Namely, these two personality dimensions were correlated with the expression of

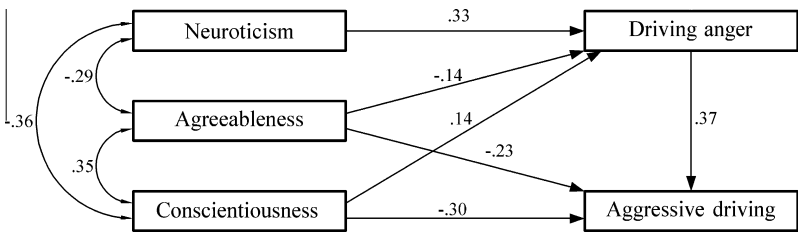

Fig. 2. The path diagram for neuroticism, conscientiousness, agreeableness, driving-related anger, and aggressive driving.

aggressiveness while driving both directly and indirectly through driving-related anger. As stated in the introduction, only one study has linked the trait of agreeableness directly with aggressive behaviour while driving (Benfield et al., 2007). The theoretical interpretation of the five-factor personality model (Costa et al., 1989) suggested a link between agreeableness (i.e., the opposite of antagonism) and the expression of aggression both in provocative circumstances, in which anger results, and in relatively neutral circumstances.

Thus, our results were consistent with the above-mentioned theoretical implications of Costa et al. (1989) and the results of Bettencourt et al. (2006) that did not refer directly to agreeableness but to other personality variables. Conscientiousness was also associated with the expression of aggression while driving, as was found in previous research (Arthur & Doverspike, 2001; Arthur & Graziano, 1996; Bone & Mowen, 2006; Booth-Kewley & Vickers, 1994; White & Dahlen, 2001). Because its contribution to anger while driving is very small, we believe that conscientiousness influences aggressive driving in relatively neutral circumstances, meaning that less conscientious drivers show more aggressive behaviour while driving in non-provocative situations.

However, the results of this study did not confirm the hypothesis that extraversion and openness would be correlated with anger and aggression while driving. Although the correlation between extraversion (Benfield et al., 2007) and openness towards new experiences (Benfield et al., 2007; Fernandes et al., 2007) and the aggressive behaviour of drivers have been reported previously, these findings were not confirmed in this study. More precisely, although there is a correlation between extraversion and aggression while driving, it is small not statistically significant in the prediction of aggressive driving. One possible reason for the differences across the studies may be the specific characteristics of the sample of students used in the above-mentioned research. Indeed, Fernandes et al. (2007) asserted that it is difficult to generalise the results from a student population to the general population because of the differences in age range and socio-economic status.

We found that the personality traits that predicted aggressive behaviour while driving were neuroticism, agreeableness, and conscientiousness. The structural equation model for the direct and indirect paths between personality traits and aggressive behaviour while driving was consistent with the results from the regression analyses. This model suggests that personality variables can be used as predictors for aggressive driving. Although personality variables used to be neglected as predictors of risky behaviour while driving, the results of this study suggest that individual personality characteristics will be correlated to one's behaviour in traffic (Lajunen & Parker, 2001). Partially, this study supports the concept of 'differential accident involvement' (McKenna, 1983) such that individuals with certain personality characteristics (neuroticism, agreeableness and conscientiousness, i.e. their negative pole) express more aggressive behaviour while driving. Other research has found that aggressive behaviour while driving is highly correlated with the number of traffic accidents experienced (Hemenway & Solnick, 1993; Parry, 1968; Tillman & Hobbes, 1949; Underwood et al., 1999; Whitlock, 1971). There are several possible reasons for the difference between our results and those of previous studies, and they are primarily related to under-reporting of the number of traffic accidents in self-report studies (Harano, Peck, & McBride, 1975). It is possible that some drivers purposely failed to report an accident. Second, their opinion as to which accident they should report in study may differ. Third, drivers often simply forget to report an accident (Maycock, Lockwood, & Lester, 1991).

Study has few interesting results we should discuss a little more. First, the zero order correlation between conscientiousness and driving-related anger was around 0.0. However, in hierarchical regression analyses and structural equitation model this personality dimension showed to be significant predictor of driving anger. These results could be explained in few ways. It is possible that conscientiousness acts like suppressor variable in final model. Or, it is possible that if we control other variables in model some important part of conscientiousness comes to surface. In original model, that part of conscientiousness could be cluttered by other facets of conscientiousness. Second result we are concerning here is also about conscientiousness. Beta coefficients of conscientiousness, both in regression analyses and path model, were positively correlated with driving anger but negatively correlated with aggression while driving. Perhaps those who are high in conscientiousness get angry while driving because the behaviour of other drivers violates their sense of appropriateness and scruples. However, this same sense of discipline prevents them from acting on their anger.

This study did replicate the results of some previous studies that did not examine the five-factor personality traits. For example, to a small extent, older and more experienced drivers reported anger and aggression while driving. Similar results were obtained by other researchers (Hauber, 1980; Krahé & Fenske, 2002; Lawton et al., 1997; Parry, 1968; Wells-Parker et al., 2002). We found that female drivers experienced greater anger in general while driving and greater anger provoked primarily by the reckless driving of others. These results are consistent with the results of other studies that documented that women report higher levels of anger than do men (Lajunen & Parker, 2001; Lajunen et al., 1998; Sullman, 2006). However, previous studies that have found that male drivers are more likely to drive aggressively than are females (Blanchard et al., 2000; Parker et al., 2002; Wiesenthal et al., 2000) were not confirmed in our study. Our female participants reported more adaptive responses, but there were no differences in other forms of aggressive driving. This does not mean, however, that gender differences do not exist. Even when there are no differences in aggression scores, the difference in the form of aggression expressed by men and women can be distinguished (Lajunen & Parker, 2001). In contrast, because female drivers showed more anger while driving, and because the structural model confirmed that anger leads to aggressive behaviour while driving, the reader could expect that we would have found more aggressive acts among women than among men. This was not the case in our study, presumably because anger does not necessarily have to be expressed through aggressive responses to others.

This study has several practical implications. First, because aggressive behaviour behind the wheel was associated with risky traffic situations and more violations of traffic rules, anger management and learning how to control one's tendency to

react aggressively while driving should be integral parts of corrective courses aggressive drivers. Moreover, the knowledge of personality variables that are related to the expression of aggression while driving (i.e., neuroticism, agreeableness, and conscientiousness) could facilitate the development of corrective programmes for safe driving. Such knowledge could help in the creation of population-specific public campaigns and promotional messages on safety in traffic.

Despite the attempt to conduct methodologically accurate research, this study has certain limitations. The main limitation is the sample because it was not stratified according to the percentage of the population for the various categories of drivers (e.g., according to gender and age), which limits the generalisability of the results to the whole population of drivers in Serbia. In addition, the participants were not asked to identify themselves by their ethnic affiliation, which means we had no data on whether the sample was stratified by ethnicity. Furthermore, the data presented in this study were based on self-descriptive techniques alone. Such a method of data collecting can lead to distortions in the data because of socially desirable responding. Although the subjects were ensured of the anonymity and confidentiality of their data, they may still have been wary to fully disclose personal information.

In conclusion, this study used global personality traits as predictors, and it indicates that it would be beneficial for future research to include more levels of mediating variables. It would be useful to test this model using attitudes towards driving, driving styles and driving habits as potential mediators for global personality dimensions and aggressive driving.

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