From trait anger to aggressive violations in road traffic

Pantilimon-Alexandru Găianu [a], Cezar Giosan [a,*], Paul Sârbescu [b]

[a] Department of Psychology, University of Bucharest, Romania
[b] Department of Psychology, West University of Timişoara, Romania

ABSTRACT

Drivers' beliefs and attitudes are known to be precursors of driving behavior, mediating the relationship between it and personality traits. However, the mediation effect of these beliefs on the relationship between trait anger and aggressive driving is not fully understood. The present study examined how the variance in the total numbers of violations, ordinary violations, and aggressive violations was explained by anger and behavioral, normative and control beliefs, and how much of this variation was explained by a linear combination of anger and any of these beliefs. A sample of 224 participants completed a series of instruments tapping into trait anger, attitude, subjective norms, descriptive norms, perceived behavioral control, intention, total number of violations, aggressive violations, and ordinary violations. The results showed that trait anger controlled approximately 9% of the variation in the total number of violations and aggressive violations and 6.5% of ordinary violations, while behavioral beliefs (through attitude) added a further 9.2–11.6%. The intention, which prior research linked to the manifestation of the behavior, explained a further 21.6% in aggressive violations in our study. Attitude mediated the relationship between trait anger and behavioral outcomes, the linear combination of trait anger and attitude accounting for 40.7% in intention, 17.6% in aggressive violations, 22.5% in the total number of violations and 25% in ordinary violations. The role of behavioral beliefs was greater when the level of aggressive violation decreased. Aggressive violations are less intentional than other behaviors that lead to violations, making it very important to consider both attitude toward behavior and trait anger to reduce them. Limitations and directions for further research are also discussed.

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1. Introduction

Driver behavior, particularly the so called "specific behaviors of problematic driving", represents one of the main factors that contributes to car accidents (Deffenbacher, Deffenbacher, Lynch, & Richards, 2003; Demir, Demir, & Özkan, 2016; Galovski & Blanchard, 2004; Harris et al., 2014; Kovácsová, Rošková, & Lajunen, 2014; Lajunen, Parker, & Summala, 2004; Precht, Keinath, & Krems, 2017a; Dula & Geller, 2003; Hayley, Ridder, Stough, Ford, & Downey, 2017). Of the entire palette of problematic driving behaviors, aggressive driving, defined as driving behaviors intended to hurt (physically or psychologically) or cause damage to other road users (Dula & Geller, 2003; Ellison-Potter, Bell, & Deffenbacher, 2001), is one of the most important variables associated with road accidents (DePasquale, Geller, Clarke, & Littleton, 2001; Dula & Geller, 2003; Galovski, Blanchard, Malta, & Freidenberg, 2003; Kovácsová et al., 2014; Malta, Blanchard, & Freidenberg, 2005;

Suhr & Nesbit, 2013), contributing for example to 3% of all reported traffic crashes and 8% in all fatalities in the UK ("Reported road casualties Great Britain, annual report," 2015).

The literature describes aggressive driving as a particular form of general aggression, which has two components: (1) emotional-impulsive, based on negative emotions such as anger, and (2) instrumental-cognitive, as a means to an end (Precht et al., 2017a; Stangor, 2011; Suhr & Nesbit, 2013). But, in reality, aggressive driving is both emotional-impulsive and instrumental-cognitive, and it is unclear if it is triggered by anger and if it is used as a means to an end (Precht et al., 2017a).

The trait-state theory (Cattell & Sheier, 1961) can explain the emotional-impulsive component of aggressive driving. It states that anger can be experienced in two different modalities: (1) as a transient state (state anger) or (2) as a personality dimension (trait anger). Trait anger is the disposition to perceive various situations as being frustrating (Spielberger, 2006), and drivers who have more of this trait have a greater tendency to interpret events as being provoking and react in an angry manner to them (Deffenbacher, Stephens, & Sullman, 2016).

Personality theories, such as such as the Five Factor Model (FFM) (Costa & McCrae, 2008), have been at the basis of many studies explaining some problematic driving behaviors through personality traits (Demir et al., 2016; Pease & Lewis, 2015; Suhr & Nesbit, 2013), with some addressing the emotional-impulsive component of the relationship between trait anger and aggression (Bogdan, Măirean, & Havârneanu, 2016; Dahlen & White, 2006; Deffenbacher et al., 2003; Nesbit, Conger, & Conger, 2007).

Problematic driving behaviors include errors (cognitive components, unintentional) and violations (social component, intentional) (Reason, Manstead, Stephen, Baxter, & Campbell, 1990). Violations are behavioral outcomes of driving and they can be (1) aggressive or (2) ordinary (deliberate, non-aggressive) (Lawton, Parker, Manstead, & Stradling, 1997; Sârbescu, 2013). There are gender and age differences in violations, with studies generally showing that younger people are responsible for more violations than older people, and men for more violations than women (Parker, West, Stradling, & Manstead, 1995; Reason, 1994). There are also gender differences in certain types of aggression, with women experiencing anger in traffic more frequently than men (Deffenbacher et al., 2016; Sullman, 2006, 2015).

It is believed that attitudes and beliefs, rather than personality traits, are the proximal antecedents to intentions and behaviors (Fishbein, 2009), which mediate the relationship between personality traits and behaviors (Ajzen, 2018; Fishbein & Cappella, 2006), such as violations. Violations are closely linked with road accidents (de Winter & Dodou, 2016; Parker et al., 1995; Precht, Keinath, & Krems, 2017b) and can be reduced by changing attitudes, behavioral results-related beliefs, social norms, or the culture that tacitly accepts their non-compliance (Reason, 1994).

The relationship between one's beliefs about a particular behavior and their real behavior (Batool & Carsten, 2018) can be explained by the Theory of Planned Behavior (TPB) (Åberg & Wallén Warner, 2008; Atombo, Wu, Zhong, & Zhang, 2016; Castanier, Deroche, & Woodman, 2013; Chen, Donmez, Hoekstra-Atwood, & Marulanda, 2016; Forward, 2009; Walsh, White, Hyde, & Watson, 2008), which argues that behavioral attitudes, subjective norms and perceived behavioral control (PBC) explain intentions to perform different types of behaviors. These intentions, together with PBC, account for considerable variation in one's real behavior (Ajzen, 1991), which can be acceptably ascertained by self-reported behavior used as proxy (Atombo et al., 2016; De Pelsmacker & Janssens, 2007). By examining the mediation effect of drivers' behavioral, normative, and control beliefs in the relationship between trait anger and violations (both aggressive and ordinary) we can better understand the mechanisms by which behaviors based on aggressive driving are generated.

The present study investigates a behavioral outcome of a driving situation ("If a vehicle encumbers you in traffic, you do everything you can to display outrage to the other driver") that involves aggressive driving and is linked to violations, such as illegal passing, going above speed limit, excessive honking, etcetera. Thus, the first objective of the present study was to investigate the ways in which personality traits (especially trait anger) and TPB's behavioral, normative and control beliefs explain variance in violations (especially aggressive violations).

Because aggressive violations are less intentional, studies of reducing aggression in traffic have focused primarily on anger as a predictor of aggressive behaviors (Deffenbacher, 2016) and less on attitude toward behavior. Thus, aggressive violations are likely primarily caused by stable personality characteristics (the distal causes), such as trait anger; therefore, our first hypothesis is:

Hypothesis 1.a.: Trait anger accounts for more of the variance in aggressive violations than TPB constructs.

Furthermore, trait anger should be less involved in violations that are carried out regularly or are relatively common; therefore, our second hypothesis is:

Hypothesis 1.b.: TPB constructs account for more variance in ordinary violations than trait anger.

The second objective of this study was to investigate whether behavioral, normative and control beliefs mediate the relationship between trait anger and intention, total number of violations, aggressive violations or ordinary violations. The variation in the intention to manifest the behavior, total number of violations, aggressive violations, and ordinary violations is likely to be explained by the linear combination of trait anger and TPB constructs. Since anger is a distal predictor of aggressive driving, and behavioral, normative and control beliefs are proximal predictors of it, their combination should explain substantial variance in intention to engage in such behaviors. Therefore, our third hypothesis is:

Hypothesis 2.a.: The linear combination of trait anger and behavioral, normative or control beliefs explains substantial variance in intention.

Since ordinary violations are primarily based on beliefs, rather than anger, it follows that they should be more easily influenced by these beliefs than by anger. Therefore, our fourth hypothesis is:

Hypothesis 2.b.: In the linear combination between trait anger and behavioral, normative or control beliefs, the latter explain more of the variance in ordinary violations than the variance in aggressive violations.

2. Method

2.1. Participants and procedure

This was a cross-sectional study, with data collected through several online survey campaigns made on social media networks, in Romania. The campaigns reached 47,628 people, out of which 1,127 accessed a Google form, and 224 of them, aged between 18 and 64 years (M = 39.18, SD = 11.15) completed all measures. The gender ratio was 45.1% / 54.9% male/female. The distribution of the sample according to age groups was: 14.3% (32), 18–25 y.o.; 21.9% (49), 26–35 y.o.; 33.5% (75), 36–45 y.o.; and 30.4% (68), 46–64 y.o. The distribution according to education was: 4.9% (11), middle school or less; 17.4% (39), high school; 34.8% (78), undergraduate; and 42.9% (96), graduate studies. The distribution according to the driving setting was: 54.9% (123) for personal use; and 45.1% (101) for work purposes. The subjects were told that their participation helps researchers to better understand the predictors of road accidents and received no financial compensation for their effort. In order to be eligible to participate in the study, participants had to own a valid driving license and regularly drive a vehicle. The study received Institutional Review Board approval from the Research Ethics Committee of the University of Bucharest.

2.2. Measures

In addition to demographic data, the following measures were also administered:

Personality traits and trait anger. Personality traits were assessed with the Romanian adaptation of 300-item NEO IPIP questionnaire (Goldberg et al., 2006; Iliescu, Popa, & Dimache, 2015), a measure based on FFM. The trait anger cluster of this instrument, which contributes to the measurement of Neuroticism, consisted of 10 items (e.g., "Get angry easily") and had a Cronbach's alpha = 0.90 in this study.

Behavioral, normative and control beliefs (TPB). To examine the TPB constructs, a behavioral situation was created including the four elements necessary to ensure specificity: target, action, context, time (TACT) (Ajzen, 2006). The behavioral situation was: "*If a vehicle encumbers you in traffic, you do everything you can to display your outrage to the other driver*" and the participants had to answer to all possibilities listed in the TPB measure. In order to measure these beliefs, a questionnaire was built in compliance with the guide developed by Ajzen (2006), and tested in a pilot test. For each question, bipolar adjectives scale responses were expected with values ranging from 1 to 7, where 1 reflects *the desirable meaning*, and 7 *the undesirable meaning* (see all questions and behavioral scenario in Appendix A). The measured constructs were: (1) Intention (INT), referring to the situation of manifesting that behavior (3 items, Cronbach's alpha = 0.89), (2) Attitude (ATT), reflecting one's personal beliefs about whether or not that behavior was right (13 bipolar adjectives, Cronbach's alpha = 0.94); (3) Subjective norms (SN), referring to the belief of necessity, expectation and acceptance of behavior from the other (3 items, Cronbach's alpha = 0.81); (4) Descriptive norms (DN), referring to the belief that other people perform this behavior as well (3 items, Cronbach's alpha = 0.72); and (5) Perceived behavioral control (PBC), which refers to the respondent's belief that they could control that behavior so that it would not lead to negative behavioral outcomes (4 items, Cronbach's alpha = 0.88).

Behavioral outcomes. We measured behavioral outcomes using the Driver Behavior Questionnaire (DBQ), which is based on the aberrant behaviors taxonomy (Reason et al., 1990) and distinguishes between violations and errors. The Romanian adaptation of the DBQ puts first the two-factor model, where aggressive violations and ordinary violations form one factor, namely Total Number of Violations (TNVIO) (11 items, example of item: "Sound your horn to indicate your annoyance to another road user", Cronbach's alpha = 0.82) and errors and lapses form another factor, namely Errors (Sârbescu, 2013). In our analyses, we used both the first-order dimensions (i.e., ordinary and aggressive violations) and the higher-order factor TNVIO. This procedure is consistent with previous research examining the study of aberrant driving behavior using this version of the DBQ (Lawton et al., 1997). Thus, besides violations from the two-factor model, we also used aggressive violations (AV) (3 items, example of item: "Become angered by a certain type of a driver and indicate your hostility by whatever means you can", Cronbach's alpha = 0.68) and ordinary violations (OV) (8 items, example of item: "Disregard the speed limit on a motorway", Cronbach's alpha = 0.77), from the four-factor model. We considered that the order of the three factors we used (aggressive violations, total number of violations, and ordinary violations) is hierarchically related to the expression of aggressiveness.

2.3. Statistical approach

For the first objective, bivariate correlation and hierarchical regression analyses were conducted. The targeted variables and estimation errors were compliant with the statistic assumptions of the OLS regression (normality, independence and homoscedasticity). For the second objective, mediation analysis was used, which can reveal if changes in behavioral, normative or control beliefs lead to changes in behavioral outcomes (Deffenbacher, 2016). The theoretical requirements for running the mediation analysis were that the independent variables *(IV)*, - in this case trait anger -, be linked to the dependent variables *(DV)*, namely the behavioral outcomes (Sümer, 2003; Scott-Parker, 2017; Riendeau, Stinchcombe, Weaver, & Bédard, 2018; Rhodes, Courneya, & Jones, 2005), and to the TPB mediating variables *(MV)*. These conditions were met (see the correlation matrix, Table 1). For the mediation analysis, model 4 from Process (Hayes, 2012), with one mediating variable (Fig. 1) was used.

In order to analyze the statistical significance of the indirect effect, a 95% confidence interval was derived using bootstrapping techniques for a recommended number of 5000 iterations. The null hypothesis would be rejected if the indirect effect confidence interval (CI) excluded zero.

Table 1
Descriptive statistics and correlation matrix.

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Demographic data											
1. Age	1										
2. Education	0.26[***]	1									
Personality traits											
3. TA[a]	−0.24[***]	−0.09	1								
Behavioral, normative and control beliefs											
4. ATT[b]	0.05	−0.01	−0.19[**]	1							
5. SN[c]	0.02	−0.02	−0.13[*]	0.59[***]	1						
6. DN[d]	0.20[**]	0.00	−0.15[*]	0.41[***]	0.59[***]	1					
7. PBC[e]	0.11	0.01	0.03	0.12	0.17[*]	0.22[**]	1				
8. Intention	−0.05	−0.02	0.24[***]	−0.58[***]	−0.46[***]	−0.42[***]	−0.04	1			
Behavioral outcomes											
9. TNVIO[f]	−0.20[**]	−0.05	0.28[***]	−0.41[***]	−0.28[***]	−0.21[**]	0.04	0.49[***]	1		
10. AV[g]	−0.09	−0.01	0.29[***]	−0.40[***]	−0.21[**]	−0.16[*]	0.04	0.62[***]	0.75[***]	1	
11. OV[h]	−0.22[**]	−0.06	0.24[***]	−0.33[***]	−0.20[**]	−0.20[**]	0.02	0.35[***]	0.95[***]	0.52[***]	1
M	39.18	4.94	25.09	77.04	17.67	13.96	10.00	7.29	22.04	5.62	16.43
SD	11.15	1.26	6.62	14.51	4.13	4.50	6.24	5.65	1.97	4.35	
Cronbach's alpha	–	–	0.90	0.94	0.81	0.72	0.88	0.89	0.82	0.68	0.77
Range	49	5	34	59	18	18	24	18	30	12	23
Mean of means	–	–	2.51	5.93	5.89	4.65	2.50	2.43	2.00	1.87	2.05

Note. Total number of violations (TNVIO) sum up aggressive violations (AV) and ordinary violations (OV).
$N = 224$.
[*] $p < .05$ [***] $p < .01$ [***] $p < .001$.
[a] Trait anger.
[b] Attitude.
[c] Subjective norms.
[d] Descriptive norms.
[e] Perceived behavioral control.
[f] Total number of violations.
[g] Aggressive violations.
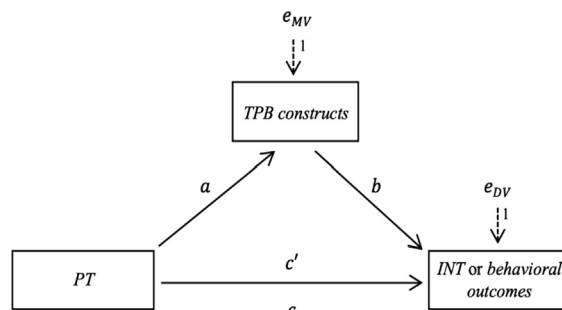[h] Ordinary violations.

Fig. 1. Graphic representation of the mediation model (Model 4 Process). Note: PT (personality traits) = independent variable (IV), TPB constructs = mediator variable (MV), INT or behavioral outcomes (TNVIO, AV, OV) = dependent variable (DV); the total effect (weight c) is composed of the direct effect (weight c') and indirect effect (a*b).

3. Results

3.1. Descriptives and correlations

Table 1 presents the main descriptive statistics for the variables examined (M, SD, range, mean of means), along with Cronbach's alpha and the correlation coefficients. Trait anger had a statistically significant correlation with ATT, SN and DN from the TPB constructs, as well as with INT and the behavioral outcomes TNVIO, AV and OV. Moreover, TPB constructs ATT, SN and DN had a statistically significant correlation with INT and with the behavioral outcomes TNVIO, AV and OV. Trait anger did not correlate with PBC and, furthermore, PBC showed no correlation with the behavioral outcomes TNVIO, AV and OV.

3.2. The first objective

Table 2 contains the hierarchical regression analysis, which explains a large part of the variance in TNVIO, AV and OV. In Step 1, age, gender and education explained around 8% of the variance in TNVIO ($R^2 = 0.088$, $F(3, 133) = 4.27$, $p < .01$) and OV ($R^2 = 0.083$, $F(3, 133) = 3.99$, $p < .01$) and 5.8% of the variance in AV ($R^2 = 0.058$, $F(3, 133) = 2.73$, $p < .05$). There were no gender differences in behavioral outcomes: TNVIO ($F(1, 222) = 3.07$, $p = .081$), AV ($F(1, 222) = 2.41$, $p = .122$), and OV ($F(1, 222) = 2.46$, $p = .118$). In Step 2, trait anger held approximately equal weight in explaining the variance in TNVIO (9%, $R^2 = 0.178$, $F(4, 132) = 7.14$, $p < .01$) and AV (8.5%, $R^2 = 0.144$, $F(4, 132) = 5.53$, $p < .001$), and less so (6.5%) in explaining variance in OV ($R^2 = 0.148$, $F(4, 132) = 5.71$, $p < .001$). TPB constructs had a different contribution to explaining the three behavioral outcomes (Step 3), that is, 11.6% of the variance in TNVIO ($R^2 = 0.294$, $F(8, 128) = 6.66$, $p < .001$), 10.1% of the variance in AV ($R^2 = 0.245$, $F(8, 128) = 5.17$, $p < .001$) and 9.2% of the variance in OV ($R^2 = 0.240$, $F(8, 128) = 5.05$, $p < .001$).

Since the variation in AV was explained more by TPB (via ATT) than by anger, Hypothesis 1.a. was not confirmed. Although the difference in the variance between trait anger and TPB constructs was fairly small (1.6–2.7%), this disconfirms the hypothesized greater influence of the emotional-impulsive aspect of aggression versus the instrumental-cognitive aspect.

Table 2
Summary of hierarchical regressions of trait anger, TPB constructs, and intention on behavioral.

Variables	R^2	Adj. R^2	ΔR^2	β	R^2	Adj. R^2	ΔR^2	β	R^2	Adj. R^2	ΔR^2	β
	Total number of violations (TNVIO)				Aggressive violations (AV)				Ordinary violations (OV)			
Step 1												
Age				−0.250**				−0.133				−0.263**
Gender				−0.174				−0.217*				−0.126
Education	0.088	0.067	0.088	0.024	0.058	0.037	0.058	0.031	0.083	0.062	0.083	0.017
Step 2												
Age				−0.206*				−0.090				−0.213*
Gender				−0.201*				−0.243*				−0.149
Education				0.801				0.086				0.065
Trait anger	0.178	0.153	0.090	0.310***	0.144	0.118	0.085	0.302***	0.148	0.122	0.065	0.26**
Step 3												
Age				−0.182*				−0.053				−0.213*
Gender				−0.151				−0.216*				−0.096
Education				0.038				0.047				0.027
Trait anger				0.253**				0.251**				0.213**
ATT[a]				−0.337***				−0.307**				−0.296**
SN[b]				0.061				0.163				0.004
DN[c]				−0.088				−0.175				−0.034
PBC[d]	0.294	0.250	0.116	0.105	0.245	0.197	0.101	0.090	0.240	0.192	0.092	0.094
Step 4												
Age				−0.200*				−0.083				−0.222**
Gender				−80.114				−0.153				−0.077
Education				0.039				0.050				0.028
Trait anger				0.201**				0.162*				0.187*
ATT[a]				−0.225*				−0.115				−0.240*
SN[b]				0.066				0.172				0.006
DN[c]				−0.010				−0.006				0.016
PBC[d]				0.084				0.055				0.084
INT[e]	0.367	0.322	0.073	0.333***	0.461	0.422	0.216	0.573***	0.258	0.206	0.018	0.167

N = 220.
* $p < .05$ *** $p < .01$ *** $p < .001$.
[a] Attitude.
[b] Subjective norms.
[c] Descriptive norms.
[d] Perceived behavioral control.
[e] Intention.

ATT from the TPB explained more of the variation in OV than trait anger, therefore Hypothesis 1.b. was confirmed. INT had a different contribution in explaining the variance in each of the three dependent variables (Step 4), contributing with 7.3% of the variance in TNVIO ($R^2 = 0.367$, $F (9, 127) = 8.17$, $p < .001$), 21.6% of the variance in AV ($R^2 = 0.461$, $F (9, 127) = 12.05$, $p < .001$) and only 1.8% of the variance in OV ($R^2 = 0.258$, $F (9, 127) = 4.91$, $p < .001$).

Of all the TPB constructs, in Step 3 only ATT accounted for statistically significant variance in AV and OV. However, in Step 4 (when INT was included in the analysis), ATT did reach statistical significance. SN had a marginal contribution to the variance in AV ($\beta = 0.172$, $p = .066$, see Table 2).

3.3. The second objective

Because only ATT and SN explained the variance in behavioral outcomes (TNVIO, AV, or OV), only these variables were used in the mediation analysis as mediators. The mediation analysis was ran using INT as an independent variable, its close ties with behavioral outcomes being well-known (Armitage & Conner, 2001; Castanier et al., 2013) (see Table 3, standardized coefficients).

INT, TNVIO, AV and OV were significantly linked to a linear combination of trait anger and ATT ($F (2,216) = 62.92$, $p < .001$, $R^2 = 0.36$; $F (2,217) = 28.03$, $p < .001$, $R^2 = 0.20$; $F (2,217) = 28.89$, $p < .001$, $R^2 = 0.21$; $F (2,217) = 18.65$, $p < .001$, $R^2 = 0.14$). ATT mediated the relationship between trait anger, INT and the three behavioral outcomes, because the direct effect (weight c') was less than the total effect (weight c) in all conditions (Table 3). However, when AV was linked to a linear combination between trait anger and SN ($F (2,217) = 17.90$, $p < .001$, $R^2 = 0.14$), the indirect effect was not statistically significant, as the CI includes zero. The mediation effect of ATT was not high in all the examined conditions either, because the direct effect remained statistically significant. However, as a mediator variable, ATT explained between 17.64% and 40.74% of the variance in INT, TNVIO, AV or OV (see Table 3).

Hypothesis 2.a. was confirmed, because the linear combination of the trait anger and ATT explained 40.74% of the INT variation (see Table 3). With regard to Hypothesis 2.b., the null hypothesis was also rejected because OV was significantly associated with a linear combination of trait anger and ATT, followed by TNVIO and AV (see Table 3). In other words, the more behavioral outcomes have a more aggressive component, the more the mediating effect of ATT decreases.

4. Discussion

The present study examined the ways in which the variance in total number of violations, ordinary violations, or aggressive violations is explained by trait anger and behavioral, normative and control beliefs. Not all TPB constructs explained the variance in behavioral outcomes, which is in line with Ajzen (2018) claims that no element of the initial theory suggests that all TPB constructs must significantly explain one's behavior. In our study, descriptive norms and perceived behavioral control did not significantly contribute to the variance in behavioral outcomes.

Age and gender were significant predictors of violations. Age explained the variance in ordinary violations better, while gender better explained the variance in aggressive violations. Our results showed that age and gender are more strongly associated with total number of violations, younger people have more ordinary violations, while men display more aggressive violations. This is in line with prior studies showing that younger drivers, and men, are responsible for more violations (Parker et al., 1995; Reason, 1994). Unlike other studies, however (e.g., Deffenbacher et al., 2016; Sullman, 2006, 2015) we have not found that women were more aggressive than men in our sample.

The results obtained at the Driver Behavior Questionnaire scales are similar to those of the 2013 adaptation study (Sârbescu, 2013). In terms of errors, our results are almost the same as in that study, but, in terms of ordinary violations,

Table 3
The indirect effects of Att (TPB constructs) on the associations between TA (trait anger) and intention (INT), violations (TNVIO), aggressive violations (AV) or ordinary violations (OV) (Model 4 Process).

PT	TPB constructs	BR[a]	a	b	c	c'	Bootstrap for indirect effect		
							a*b	95% CI	Variance explained
TA[b]	ATT[c]	INT[d]	−0.21**	−0.55***	0.27***	0.15**	0.11	[0.04, 0.19]	40.74%
TA[b]	ATT[c]	TNVIO[e]	−0.21***	−0.33***	0.31***	0.24***	0.07	[0.02, 0.12]	22.58%
TA[b]	SN[f]	AV[g]	−0.13	−0.15*	−0.34***	−0.32***	0.01	[−0.00, 0.04]	2.94%
TA[b]	ATT[c]	AV[g]	−0.21**	−0.31***	−0.34***	−0.28***	0.06	[0.02, 0.11]	17.64%
TA[b]	ATT[c]	OV[h]	−0.21**	−0.30***	0.24***	0.18**	0.06	[0.02, 0.11]	25.00%

N = 224.
* $p < .05$ *** $p < .01$ *** $p < .001$.
[a] Behavioral result.
[b] Trait anger.
[c] Attitude.
[d] Intention.
[e] Total number of violations.
[f] Subjective norms.
[g] Aggressive violations.
[h] Ordinary violations.

aggressive violations, and total number of violations, our values are lower. This aspect was due to the difference between the two samples used, the level of social desirability being higher in the elderly population (from 18 to 64 years, M = 39.18, SD = 11.15), than in the younger one on which the adaptation study was based (19–33 y.o., M = 25.80, SD = 3.65). The number of errors decreases less than the number of violations does with age (de Winter & Dodou, 2016; Parker, Lajunen, & Stradling, 1998; Precht et al., 2017b). Therefore, due to the age difference between the two samples, the number of violations decreased. As the number of violations is higher in younger drivers, this aspect (along with the level of concealment given by social desirability) could be a possible explanation for the difference in the violations increase.

Contrary to the first hypothesis, our results showed that trait anger did not explain more of the variance in aggressive violations than behavioral beliefs did, suggesting that TPB factors can substantially contribute to such violations and should be further examined in future studies. Interventions on both anger management and changing of behavioral beliefs should be included in the reduction of aggressive driving.

As predicted, TPB constructs explained the variance in ordinary violations better than trait anger did, illustrating their importance in the mechanisms responsible for the violation of road norms and rules.

Attitude explained more of the variance in total number of violations than the variance in aggressive violations, although the difference was small. On the other hand, intention explained more of the variance in aggressive violations than of the variance in total number of violations and it did not explain at all the variance in ordinary violations. This suggests that the behavioral situation is critical for aggressive driving but has a weak influence on ordinary violations, which we expected.

The significant link between intentions and aggressive violations (INT accounts for 21.6% of the variance in AV) makes the two variables of the model overlap to such an extent that it diminishes much of the intentional nature of aggressive violations, thus emphasizing their emotional-impulsive component. This suggests that anger, even though it is a distal predictor of behavior, should be targeted when trying to reduce aggressive driving.

Our results also showed that only attitude mediates the relationship between trait anger and behavioral outcomes (total number of violations, aggressive violations, or ordinary violations). Subjective norms did not mediate the relationship between trait anger and aggressive violations, and thus were not strong enough to interfere with the relationship between trait anger and behavioral outcomes. Attitude plays an important role in this mediation and influences the relationship between trait anger and intention, total number of violations, or aggressive violations. This suggests that if we changed the behavioral beliefs, we could also change intention. Attitude also plays an important role in influencing the link between trait anger and ordinary violations, although its importance tends to decrease once the aggression associated with the behavior increases. This suggests that aggressive violations are a less intentional behavioral outcome compared to ordinary violations, and thus behavioral beliefs cannot fully mediate the relationship between trait anger and aggressive violations.

Despite these promising results, the present study also comes with a number of important limitations.

First, being a cross-sectional study, it makes causal inferences impossible, although an argument can be made that personality traits (e.g., trait anger), being distal factors and stable personal characteristics (Sümer, Lajunen, & Özkan, 2005), causally influence the behavioral outcomes examined in this study.

Second, self-reported data was used to run the analysis, which introduces the issue of socially desirable answers, especially when the questions address behaviors that are not socially acceptable or encouraged. This raises the possibility that the indirect effect of behavioral beliefs on the relationship between trait anger and aggressive behavior might actually be greater than what we found with our instruments.

Third, the association between aggressive driving using a scenario in which a driver encumbered in traffic by another driver does everything in their power to display their outrage to the other is somewhat contrived. Further, more ecologically valid studies should be conducted to better shed light on these complex relationships.

Fourth, this paper investigated the way in which trait anger explains the variance in behavioral outcomes based on aggression and the way in which this relationship is mediated by TPB constructs, leaving state anger out. Further studies should include state anger amongst the variables examined to better understand these associations.

Fifth, our sample was self-selected from online ads, which may raise questions about the generalizability of the results to other categories of people (e.g., those who do not use Social media). Further studies, on larger and more representative samples are needed to clarify these aspects. However, unlike many other studies on this topic, which were primarily made on students, our research was done on a sample that is likely to better resemble the general population. Although no employment data were collected (and we list this as another limitation of our study), besides age and education we have also collected the driving setting (personal or work purposes, 54.9%, 45.1% respectively). Since the vast majority (75%) of Romanian students do not work ("Doar un sfert dintre studenții români lucrează part-time sau full-time. Majoritatea sunt întreținuți de părinți", 2013), and their mean age (21.20 y.o.) ("Articole - Românii, printre cei mai tineri studenți din Europa - Munca. ro.," 2005) is substantially lower than that of our sample (39.18 y.o.), as well as the fact that the data were collected through social networks and not through students subject pools, it can be inferred that our sample did not come mainly from a student population.

Last but not least, our dependent variable was past driving behavior, which we predicted from intention. Since intention precedes a future behavior, not a past one, a legitimate question arises about the merits of this method. In this regard, our approach has followed Ajzen's, who argued that, as long as the key behavior is temporally stable, intention has predictive validity (Ajzen, 2018). Further longitudinal studies, where intention precedes future behaviors, should be conducted to shed more light on these important aspects.

Despite these caveats, the present study presents compelling evidence that behavioral beliefs explain a substantial part of the variance in aggressive violations and that the role of the behavioral beliefs in the explanations of behavior is inversely related to the aggression level of the violations. These promising findings may lead to better interventions for reducing aggressive driving, and, ultimately, such accidents.

CRediT authorship contribution statement

Pantilimon-Alexandru Găianu: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing. **Cezar Giosan:** Methodology, Validation, Writing - review & editing, Visualization, Supervision. **Paul Sârbescu:** Methodology, Validation, Resources, Writing - review & editing.

Declaration of Competing Interest

The authors declare they have no conflict of interest.

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Appendix A

The Theory of Planned Behavior (TPB) Questionnaire:

Behavioral scenario: "*If a vehicle encumbers you in traffic, you do everything you can to display your outrage to the other driver.*"

Intent
1. I do not exclude performing this behavior.
                                        very unlikely- very likely
2. If I get the chance, I will try to perform this behavior.
                                        certainly false – certainly true
3. I plan to perform this behavior.
                                        I do not agree – I agree
Behavioral beliefs
4. For me, performing this behavior is...
                                        good – bad
                                        thoughtful – thoughtless
                                        conformism – non-conformism
                                        brave – not brave
                                        fun – not fun
                                        efficient – inefficient
                                        happy – unhappy
                                        ingenious – unimaginative
                                        pleasant – unpleasant
                                        cautious – reckless
                                        precious – not precious
                                        rational – irrational
                                        responsible - irresponsible
Subjective norm
5. Most people who are important to me believe that ...
                                        I should– I shouldn't
                                        ... perform this behavior.
6. Most people expect me to perform this behavior
                                        very likely – very unlikely
7. The people in my life whose opinions I value...
                                        approve – disapprove

... of me performing this behavior.

Descriptive norm

8. The people most important to me are performing this behavior.

completely true – completely false

9. The people in my life whose opinions I value...

perform – don't perform

… this behavior.

10. Most drivers perform this behavior.

very likely – very unlikely

Check-point question

11. I completely exclude performing this behavior.

entirely true* – entirely false

* If you answered with 1 to Q11, please finish the questionnaire here, as the next questions do not apply to you.

Control of perceived behavior

12. For me, having control while performing this behavior is...

possible – impossible

13. If I want to maintain control when performing this behavior, I can do so.

certainly true – certainly false

14. The likelihood of having control when performing this kind of behavior is...

very high – very low

15. In most cases it is only up to me to control myself when I perform this behavior.

completely agree – completely disagree

Appendix B. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.trf.2020.02.006.

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