

Araştırma Makalesi

## Investigating Responsibility in the Driving Context: Associations with Driving Anger Expressions and Driver Behaviors

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### Abstract

The aim of this study is to explore the predicting role of responsibility (behavioral responsibility and feeling of responsibility) on driving anger expressions (verbal, personal physical, use of vehicle, and adaptive/constructive) and driver behaviors (ordinary and aggressive violations, errors, and lapses). A sample of 279 drivers (188 female and 91 male) completed an online survey which included Driver Behavior Questionnaire, Driving Anger Expression Inventory, and Feelings of Responsibility and Behavioral Responsibility Scale. Hierarchical regression analyses partially supported the expectations. Accordingly, behavioral responsibility, but not feelings of responsibility, was found as a predictor for driver behaviors. In detail, behavioral responsibility was a significant predictor for ordinary violations, errors and lapses, but not for aggressive violations. Additionally, behavioral responsibility negatively predicted verbal anger expression, feeling of responsibility negatively predicted use of the vehicle to express anger and lastly, behavioral responsibility positively predicted adaptive/constructive anger expression. Lastly, mediation analyses were conducted to investigate the indirect relationships between variables. The difference between patterns of results of the analyses with behavioral responsibility and feelings of responsibility highlights the difference between feeling and behavior, that is two concepts based on different psychological backgrounds do not necessarily lead to one another. The results were discussed in the framework of the related literature.

*Keywords:* driver behavior, driving anger expression, responsibility

## Sorumluluğun Sürücülük Bağlamında İncelenmesi: Sürücü Öfke İfadesi ve Sürücü Davranışları

### Öz

Bu çalışmanın amacı, sorumluluğun (davranışsal sorumluluk ve sorumluluk duygusu) sürücülük öfke ifadeleri (sözel, kişisel fiziksel, araç kullanımı ve uyarlanabilir/yapıcı) ve sürücü davranışları (sıradan ve saldırgan ihlaller, hatalar) üzerindeki yordayıcı rolünü araştırmaktır. 279 sürücüden oluşan bir örneklem (188 kadın ve 91 erkek), Sürücü Davranışı Anketi, Sürücü Öfke İfadesi Envanteri ve Sorumluluk Duygusu ve Davranışı Ölçeğini içeren çevrimiçi bir anketi tamamlamıştır. Hiyerarşik regresyon analizleri sonuçları araştırmanın beklentilerini kısmen desteklemektedir. Buna göre, davranışsal sorumluluğun sürücü davranışlarının bir yordayıcısı olduğu, sorumluluk duygusunun ise olmadığı bulunmuştur. Ayrıntılı olarak, davranışsal sorumluluğun, sıradan ihlaller, hatalar ve ihmaller ile ilişkili olduğu, ancak saldırgan ihlaller için ilişkili olmadığı desteklenmiştir. Bunun dışında, davranışsal sorumluluk sözel öfke ifadesini olumsuz yönde, sorumluluk duygusu öfkeyi ifade etmek için araç kullanımını yine olumsuz yönde yordamış ve son olarak davranışsal sorumluluk uyum sağlayıcı/yapıcı öfke ifadesini olumlu yönde yordamıştır. Son olarak, değişkenler arasındaki dolaylı ilişkileri test etmek için aracılık analizlerine de başvurulmuştur. Davranışsal sorumluluk ve sorumluluk duyguları ile yapılan analizlerin sonuçlarının arasındaki fark, duygu ve davranış arasındaki farkı, yani farklı psikolojik arka planlara dayanan iki kavramın mutlaka birbirine yol açmadığını vurgulamaktadır. Sonuçlar ilgili literatür çerçevesinde tartışılmıştır.

*Anahtar kelimeler:* sürücü davranışları, sürücü öfke ifadesi, sorumluluk

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## **Investigating Responsibility in the Driving Context: Associations with Driving Anger Expressions and Driver Behaviors**

Just like the rest of the world, human factors are considered as a prominent contributor to traffic accidents in Turkey. One component of human factors is driver behavior which can be considered as a habitual driving style that drivers generally prefer to engage in (Elander et al., 1993). Driver behavior is affected by many factors such as beliefs (Fhaner & Hane, 1975), intentions (Chliaoutakis et al., 2000), driver's personality characteristics such as aggressiveness (Dukes et al., 2001), impulsiveness (Bıçaksız & Ozkan, 2016; Dahlen et al., 2005), demographic characteristics such as driving experience (Li et al., 2015), young age (Abdel-Aty & Abdelwahab, 2000). In the present study, we investigated the links between another individual difference variable, namely responsibility, with driver behavior after controlling for age, gender, and mileage.

Reason et al. (1990) examined driver behaviors under two different main headings which are errors and violations. Errors are not being able to practice the planned actions and consequences whereas violations are deliberate changes in actions that are known to depart from safety (Reason et al., 1990). The main difference between these two categories is based on behavioral intention. This distinction was outstanding in the sense that it is claimed there are different psychological mechanisms for violations and errors. In addition, lapses are when the intention does not match with the driver's behavior and are mostly memory-related failures (Özkan & Lajunen, 2005).

Previous literature emphasizes the relation between driver behavior and emotions mostly from the perspective of risky driving. Reichardt (2008) claimed a model that driver behavior is affected by emotions that are related to risk assessment. This finding was taken further by Hu and colleagues (2013) who argued negative emotions are associated with a higher probability of risky driver behavior. In this sense, it is not surprising that anger was found to be related to driver behavior in the way that it leads to risky driving actions such as high speed (Wickens et al., 2011) and lower lane control (Cai et al., 2007). Yagil (2001) claimed that aggression and evaluation of the driver's own violations in traffic are related. It is important to mention that this relation is formed regardless of state anger or trait anger (Deffenbacher et al., 2002). Meaning that not only aggression in traffic leads to risky driver behaviors and violations, but also more aggressive drivers do not perceive violations as dangerous as they are. Drivers think and evaluate before violating unless it becomes a habit, and if this evaluation leads to perceiving more negative consequences such that getting a ticket or disapproval by others, then drivers are less likely to violate (Parker et al., 1996). Therefore, it is possible to say that drivers' characteristics such as feeling of responsibility and behavioral responsibility can be reflected in their driver behaviors.

### **1.1. Responsibility**

The definition of responsibility is accepting and owning any kind of outcome when making a decision (Botti & McGill, 2006). Perceived responsibility in situations may influence how people behave. This reflection of perceived responsibility on behavior was shown in various ways such as on consumer behavior (Becker-Olsen et al., 2006) and social motivation (Weiner, 1993), in addition to self-regulatory behavior (Autry, 1982).

Schlenker and colleagues' (1994) The Triangle Model of Responsibility (TMR) yields a deeper understanding of the concept by investigating perceived responsibility under three main elements. The event, as the first element refers to the action which corresponds to the driver behavior in traffic context. Prescriptions as the second element refers to rules that are referrals for the behaviors which correspond to traffic rules and regulations. The identity as the third

element refers to the characteristics of the individual which correspond to driver characteristics (e.g. age, driving experience). The model suggests that strong association between prescriptions and identity is an indicator for high perception of responsibility (DeZoort & Harrison, 2018). In other words, drivers with higher perceived responsibility are more likely to embrace the traffic rules and regulations. As a result, it can be expected that such drivers will have a lower tendency to violate the rules.

Additionally, sense of control was linked to perceived responsibility in several studies (e.g., Jörling et al., 2019; Schlenker et al., 1994; Weiner, 1993). This link of higher control and higher perceived responsibility may indicate that the drivers who have a higher sense of control over their behavior in traffic are the ones that have higher perception of responsibility as well as the ones that are less likely to error.

Perceived responsibility can be investigated through responsibility feelings of responsibility and behavioral responsibility which are correlated with one another (Conrad & Hedin, 1981). The difference between feelings of responsibility and behavioral responsibility can be generalized to any other kind of feeling-behavior difference. In other words, the feeling is not a direct reason of a specific behavior. Theory of Planned Behavior (TPB) suggested that behavior is affected by attitude, norm, perceived behavioral control and intention (Ajzen, 1985). Although feelings of responsibility and behavioral responsibility are highly correlated, it would be wrong to assume that they always coexist. It was suggested that one's perceived responsibility is associated with evaluation of the decision on an emotional level (Botti & McGill, 2006). In fact, perceptions of responsibility on a given topic leads to more self-conscious and prosocial behavior (De Groot & Steg, 2009). Therefore, drivers who perceive themselves as responsible can be expected to engage in behaviors considering others in traffic.

Furthermore, Gosling and colleagues (2006) claimed that denial of responsibility is a way to reduce dissonance such that people unconsciously perceive little or no responsibility in order to solve the conflict between thoughts and behavior. Previous research indicates that having the reluctance to take responsibility is positively correlated with anger (Arslan, 2010) and there is a significant association between experiencing anger and aggressive driving behavior (Nesbit et al., 2007). Feeling negative emotions are considered normal; however, what makes a difference is the expression of them. Since aggressive driver behavior is a way of anger expression in traffic, it is possible to claim that responsibility feelings and responsible behaviors might be related to anger expression in traffic.

## 1.2. Driving Anger Expression

Anger is defined not only as an emotion but also as an experience that a person undergoes when sensing a threat (Novaco, 2011) and its consequence is very likely to be aggression (Berkowitz, 1990). Having experienced the same level of anger in equal situations may lead to different expressions of anger in different people. Therefore, what is more important than the anger itself is how anger is expressed. In addition, anger expressions can be situation-specific which means daily life's anger expression can be different from anger expression in traffic (Deffenbacher et al., 2002).

People express anger in numerous ways and these can be differentiated in terms of adaptiveness. Driving Anger Expression Inventory (DAX; (Deffenbacher et al., 2002), investigated anger expression four subheadings: Verbal Aggressive Expression, Personal Physical Aggressive Expression, Use of Vehicle to Express Anger, and Adaptive/Constructive Expression. The first three of these expressions are considered maladaptive, whereas the fourth expression is adaptive. Verbal Aggressive Expression refers to expressing anger with words such as yelling and cursing. Personal Physical Aggressive Expression refers to expressing anger through using

one's own body nonverbally. For instance, hostile gestures or physical fights. Use of Vehicle to Express Anger refers to using the vehicle itself instead of verbal or personal physical expression such as cutting in front of the other driver and flashing the lights at other drivers. Adaptive/Constructive Expression refers to the driver's intention to solve the problem in expressing anger such as taking a deep breath to calm down and using distractions to distance themselves from frustrations in traffic. Although these terms are situation-based, in traffic, adaptive/constructive anger expression is considered adaptive and related to safe driver behavior, whereas expressing anger through engaging in the physical assault is considered non-adaptive and related to risky driver behavior (Deffenbacher et al., 2002). Individual differences in problem-solving methods and anger expression also show their reflections on driver behavior. The way of expressing anger in a maladaptive way was found to be correlated with risky driving (Deffenbacher et al., 2002) and sensation seeking (Dahlen et al., 2006). In short, the emotion of anger in traffic-related behavior has been an important topic for researchers because it has been thought that it leads to many undesirable yet drastic consequences such as deaths or irreversible injuries.

### 1.3. Aim of the Study

The aim of the study was to examine responsibility in the driving context. Specifically, we investigated the associations of feeling of responsibility and behavioral responsibility with driver behaviors and driving anger expressions. Considering the well-established links between driving anger expression and driver behaviors (Deffenbacher et al., 2002), it can be also expected that responsibility predicts driver behaviors through driving anger expression. As an exploratory analysis, we also tested the mediating role of driving anger expression in the relationship between responsibility and driver behaviors.

## 2. Method

### 2.1. Participants

The data is collected from 279 (188 females, 67%; 91 males, 33%) adult participants who have reached the age of 18 and are native Turkish speakers. All participants had driving licenses and identified themselves as active drivers. Participants had a mean age of 34 years with the range from 18 to 69 years ( $SD = 10.9$ ). The mean annual mileage the participants had was 15867 km (range 500-200000).

### 2.2. Measures

#### 2.2.1. Driver Behavior Questionnaire (DBQ).

To measure lapses, errors, and violations in the traffic, Driver Behavior Questionnaire (DBQ) were used in the study. DBQ was developed by Reason and colleagues (1990) and adapted to Turkish by Sümer and colleagues (2002) and Sümer and Özkan (2002). DBQ has 28 items that were formed of lapses ( $n=8$ ), errors ( $n=8$ ), aggressive violation ( $n=3$ ) and ordinary violations ( $n=9$ ). This scale is a 6-point Likert-type scale from 0 (Never) to 5 (Nearly All the Time) which asks how often drivers committed each behavior when driving. Higher scores indicate higher levels of violations, errors, and lapses in traffic. After deleting item 13 from the error subscale, the internal consistency coefficient (Cronbach's Alpha) of the subscales for the Driver Behavior Questionnaire was found as follows: .61 for lapses, .65 for errors, .73 for ordinary violations, and .73 for aggressive violations.

### **2.2.2. Responsibility Feeling and Behaviors Scale (RFBS).**

Responsibility Feeling and Behaviors Scale (RFBS) was used to measure the degree to which an individual's sense of responsibility affects one's life and how it is reflected in behavior. The scale is developed by Özen (2013) for the Turkish population. There are 18 items in the scale that ask the frequency of experienced responsibility feelings in social situations and the responsible behaviors along with such feelings. Each item was rated for both feeling and behavior on a 4-point Likert-type scale from 1 (Never) to 4 (Always). Higher scores indicate higher feelings of responsibility and higher behavioral responsibility. The Cronbach's Alpha internal consistency coefficient of the feeling of responsibility subscale is .83 and the behavioral responsibility subscale is .85.

### **2.2.3. Driving Anger Expression Inventory (DAX).**

The Driving Anger Expression Inventory (DAX) was used to measure drivers' anger expressions in traffic. This scale was developed by Deffenbacher and colleagues (2002) and adapted to Turkish by Eşiyok and colleagues (2007). In total, the scale has 49 items which includes four different subscales: Verbal Aggressive Expression ( $n=12$ ), Personal Physical Aggressive Expression ( $n=11$ ), Use of the Vehicle to Express Anger ( $n=11$ ), and Adaptive/Constructive Expression ( $n=15$ ). Drivers were asked to indicate their frequency of possible anger expressions in different situations in traffic on a 4 Point-Likert scale from 1 (Almost Never) to 5 (Almost always). Higher scores indicate higher levels of anger expression in each subscale. The Cronbach's alpha internal consistency coefficient of Verbal Aggressive Expression is .86, Personal Physical Aggressive Expression is .82, Use of the Vehicle to Express Anger is .86, and Adaptive/Constructive Expression is .89.

## **2.3. Procedure**

Ethical approval was received from the Scientific Research and Publication Ethics Committee of Başkent University (62310886-604.99). All the data were collected through Qualtrics, an online survey website. The participants were assured of anonymity and confidentiality via informed consent form. Then, the participants answered three different scales (DBQ, RFBS, DAX) which were counterbalanced. A demographic form was given after the questionnaires. After participants answered the questions, a debriefing form was presented to give the participants detailed information about the main purpose of the study.

## **2.4. Data Analysis**

Prior to analysis, the data were examined in terms of the major assumptions of multivariate analysis and no assumption violation was detected. Then, bivariate correlations between the study variables were calculated. After that, a series of hierarchical multiple regression analyses were carried out with each of the driving anger expression dimensions and driver behavior dimensions as the DV, behavioral responsibility and feeling of responsibility as the predictors, and age, gender, and annual mileage as the control variables. Finally, a series of mediation analyses were conducted to examine the mediating role of driving anger expression in the relationship between responsibility and driver behaviors, after controlling for age, gender and annual mileage.

### 3. Results

#### 3.1. Correlations between Demographic Variables, Responsibility, Driving Anger Expression, and Driver Behaviors.

In Table 1, the correlations among study variables (i.e., age, gender, annual mileage, responsibility subscales, and driving anger expression subscales) and their means and standard deviations are presented. Accordingly, age had significant positive correlations with responsibility feeling and behavior, and negative correlations with verbal anger expression and use of the vehicle to express anger, ordinary and aggressive violations, and lapses. Being female had significant negative correlations with annual mileage, personal physical and vehicle anger expressions, ordinary violations, and errors, and a significant positive correlation with constructive anger expression. Annual mileage had significant positive correlations with personal physical anger expression and ordinary violations.

Responsibility feelings and behaviors had significant negative correlations with verbal and personal physical anger expression, and use of the vehicle to express anger, on the other hand, they both have positive correlations with constructive anger expression. Additionally, responsibility feelings and behaviors negatively correlated with ordinary and aggressive violations and lapses. Responsibility behaviors have significant negative correlations with errors, but responsibility feelings do not relate to errors.

Ordinary and aggressive violations, errors, and lapses have significant positive correlations with all of the driver's anger expressions, except constructive driving anger expression. Constructive driving anger expression is negatively correlated to the aforementioned driver behaviors. Lapses, on the other hand, was not related to constructive anger expression.

#### 3.2. Hierarchical Regression Analysis: Predicting Driver Behaviors

Separate hierarchical regression analyses were conducted to investigate the relationship between responsibility (feeling of responsibility and behavioral responsibility) and driver behaviors after controlling for age, gender, and annual mileage. Considering the related literature, being young and male has a significant role on risky driver behaviors (Rhodes et al., 2015), thus age and gender was statistically controlled. Additionally, the statistical control of the mileage is a common practice in traffic studies, since the experience of the driver can have a great influence on the driver behaviors (Summala et al., 2014). For each subscale of the driver behavior questionnaire (ordinary and aggressive violations, lapses and errors), demographic variables as age, gender, and annual mileage were entered as control variables in the first step. In the second step, feeling of responsibility and behavioral responsibility were entered.

In the first analysis, the first model to predict **ordinary violations**, which included age, gender, and annual mileage, was statistically significant and explained 13 % of the variance ( $R^2_{change} = .13, p < .001$ ). Age ( $\beta = -.30, SE = .00, p < .001$ ) and being female ( $\beta = -.23, SE = .08, p < .001$ ) were negatively related to this dimension. Annual mileage was not found as related. Model 2, which included behavioral responsibility and feeling of responsibility, significantly explained 11 % of the extra variance, ( $R^2_{change} = .11, p < .001$ ). The only significant and negative predictor in this model was behavioral responsibility ( $\beta = -.35, SE = .15, p < .001$ ). All in all, the model explained 23 % of the variances ( $Adj. R^2 = .23$ ).

In the second analysis, the first model to predict **aggressive violations**, which included age, gender, and annual mileage, was statistically significant and explained 6 % of the variance, ( $R^2_{change} = .06, p = .002$ ). Age ( $\beta = -.23, SE = .00, p < .001$ ) was negatively related to this dimension, while being female and annual mileage were not related. Model 2, which included

**Table 1.** Correlations among investigated variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13
Age (1)	1												
Gender (2)	<b>-.20**</b>	1											
Annual km (3)	.12	<b>-.21**</b>	1										
Responsibility: Feeling (4)	<b>.17**</b>	.11	.02	1									
Responsibility: Behavior (5)	<b>.33**</b>	.01	.06	<b>.74**</b>	1								
DAX: Verbal (6)	<b>-.17**</b>	-.01	.01	<b>-.15**</b>	<b>-.28**</b>	1							
DAX: Personal Physical (7)	-.03	<b>-.30**</b>	<b>.13*</b>	<b>-.15*</b>	<b>-.12*</b>	<b>.39**</b>	1						
DAX: Vehicle (8)	<b>-.14*</b>	<b>-.29**</b>	.08	<b>-.27**</b>	<b>-.22**</b>	<b>.53**</b>	<b>.68**</b>	1					
DAX: Constructive (9)	.12	.13*	-.12	<b>.26**</b>	<b>.31**</b>	<b>-.24**</b>	<b>-.27**</b>	<b>-.38**</b>	1				
Ordinary Violations (10)	<b>-.21**</b>	<b>-.22**</b>	<b>.13*</b>	<b>-.31**</b>	<b>-.39**</b>	<b>.42**</b>	<b>.46**</b>	<b>.62**</b>	<b>-.35**</b>	1			
Aggressive Violations (11)	<b>-.22**</b>	-.03	.09	<b>-.15*</b>	<b>-.21**</b>	<b>.61**</b>	<b>.49**</b>	<b>.54**</b>	<b>-.30**</b>	<b>.48**</b>	1		
Errors (12)	-.02	<b>-.14*</b>	.05	-.12	<b>-.19**</b>	<b>.17**</b>	<b>.14*</b>	<b>.21**</b>	<b>-.20**</b>	<b>.42**</b>	<b>.25**</b>	1	
Lapses (13)	<b>-.14*</b>	.01	-.08	<b>-.23**</b>	<b>-.34**</b>	<b>.26**</b>	<b>.13*</b>	<b>.23**</b>	-.11	<b>.39**</b>	<b>.29**</b>	<b>.48**</b>	1

Note. Gender is coded as 0= Male, 1= Female, \*  $p < .05$ ; \*\*  $p < .01$

behavioral responsibility and feeling of responsibility was not significant. All in all, the model explained 6 % of the variance ( $Adj. R^2 = .06$ ).

Lastly, the first model to predict **errors** was not significant. In other words, demographic variables were not related to errors. In the second model, 3% of the variances explained ( $R^2_{change} = .07, p < .001$ ). The only significant and negative predictor in this model was behavioral responsibility ( $\beta = -.34, SE = .11, p < .001$ ). All in all, the whole model explained 7 % of the variance ( $Adj. R^2 = .07$ )

The following analysis which investigates the relationship between study variables and **lapses**, revealed non-significant results for the first model. In the second model, 9% of the variance was explained by responsibility scale ( $R^2_{change} = .09, p < .001$ ). In detail, behavioral responsibility was found to be negatively related to lapses ( $\beta = -.36, SE = .12, p < .001$ ), while feeling responsibility was not related. All in all, the model explained 10 % of the variance ( $Adj. R^2 = .10$ ).

### 3.3. Hierarchical Regression Analysis: Predicting Driving Anger Expression

Separate hierarchical regression analyses were conducted to investigate the relationship between responsibility, driving anger expression, and driver behaviors after controlling for age, gender, and annual mileage. For each subscale of the driving anger expression questionnaire (verbal aggressive expression, personal physical aggressive expression, use of vehicle to express anger, and adaptive/constructive expression), demographic variables such as age, gender, and annual mileage were entered as control variables in the first step. In the second step, feeling of responsibility and behavioral responsibility were entered.

In the first analysis, the first model to predict **verbal aggressive expression**, which included age, gender, and annual mileage, was not statistically significant. Model 2, which included behavioral responsibility and feeling of responsibility, significantly explained 7 % of the extra variance, ( $R^2_{change} = .07, p < .001$ ). The only significant and negative predictor in this model was behavioral responsibility ( $\beta = -.34, SE = .16, p = .001$ ). All in all, the model explained 8 % of the variances ( $Adj. R^2 = .08$ ).

In the second analysis, the first model to predict **personal physical aggressive expression**, which included age, gender, and annual mileage, was statistically significant and explained 9 % of the variance, ( $R^2_{change} = .09, p < .001$ ). Only being female was related to personal physical aggressive expression ( $\beta = .28, SE = .03, p < .001$ ). Model 2, which included behavioral responsibility and feeling of responsibility was not significant. All in all, the model explained 8% of the variance ( $Adj. R^2 = .08$ ).

In the third analysis, the first model to predict **use of vehicle to express anger** was statistically significant which included age, gender, and annual mileage, was statistically significant and explained 11 % of the variance, ( $R^2_{change} = .11, p < .001$ ). Age ( $\beta = -.20, SE = .00, p = .002$ ) was negatively and being female ( $\beta = .31, SE = .06, p < .001$ ) was positively associated with this dimension. In the second model, 4 % of the variances explained ( $R^2_{change} = .04, p = .004$ ). The only significant and negative predictor in this model was feeling of responsibility ( $\beta = -.20, SE = .13, p = .030$ ). All in all, the whole model explained 14 % of the variance ( $Adj. R^2 = .14$ )

In the last analysis, the first model to predict **adaptive/constructive expression** which included age, gender, and annual mileage, was statistically significant and explained 4 % of the variance, ( $R^2_{change} = .04, p = .014$ ). Age ( $\beta = .14, SE = .00, p = .028$ ) was positively and being female ( $\beta = -.13, SE = .08, p = .049$ ) was negatively associated with this dimension. In the second model, 8% of the variance was explained by responsibility scale ( $R^2_{change} = .08, p < .001$ ). In detail, behavioral responsibility was found to be positively related to adaptive/constructive expression



**Table 2.** Results of Hierarchical Regression Analyses Examining the Associations of Responsibility with Driver Behaviors

	Ordinary Violations			Aggressive Violations			Errors			Lapses		
	$\beta$	SE	$\Delta R^2$	$\beta$	SE	$\Delta R^2$	$\beta$	SE	$\Delta R^2$	$\beta$	SE	$\Delta R^2$
<b>Step 1</b>			<b>.13**</b>			<b>.06**</b>			<b>.03</b>			<b>.03</b>
Age	<b>-.30**</b>	.00		<b>-.23**</b>	.00		-.03	.00		-.15	.00	
Gender	<b>-.23**</b>	.08		-.03	.12		<b>-.16*</b>	.06		-.05	.06	
Annual Mileage	.12	.00		.11	.00		.01	.00		-.08	.00	
<b>Step 2</b>			<b>.11**</b>			<b>.02**</b>			<b>.03*</b>			<b>.09**</b>
Feeling of Responsibility	-.00	.16		-.00	.25		.08	.14		.07	.13	
Behavioral Responsibility	<b>-.35**</b>	.15		-.13	.23		<b>-.22*</b>	.13		<b>-.36**</b>	.12	

Note: Gender was coded as 0=men, 1=women; N = 279; \*p < .05; \*\*p < .01.

**Table 3.** Results of Hierarchical Regression Analyses Examining the Associations of Responsibility with Driving Anger Expression

	Verbal Aggressive Expression			Personal Physical Aggressive Expression			Use of Vehicle to Express Anger			Adaptive/Constructive Expression		
	$\beta$	SE	$\Delta R^2$	$\beta$	SE	$\Delta R^2$	$\beta$	SE	$\Delta R^2$	$\beta$	SE	$\Delta R^2$
<b>Step 1</b>			.03			<b>.09**</b>			<b>.11**</b>			<b>.04*</b>
Age	<b>-.18**</b>	.00		-.08	.00		<b>-.20**</b>	.00		<b>.14*</b>	.00	
Gender	-.03	.08		<b>.28**</b>	.03		<b>.31**</b>	.06		<b>-.13*</b>	.08	
Annual Mileage	.03	.00		.08	.00		.03	.00		-.11	.00	
<b>Step 2</b>			<b>.07**</b>			.01			<b>.04**</b>			<b>.08**</b>
Feeling of Responsibility	.11	.17		-.09	.07		<b>-.20*</b>	.13		.03	.16	
Behavioral Responsibility	<b>-.34**</b>	.16		-.02	.06		-.01	.12		<b>.28**</b>	.15	

Note: Gender was coded as 0=men, 1=women; N = 279; \*p < .05; \*\*p < .01.

( $\beta = .28$ ,  $SE = .15$ ,  $p = .003$ ), while feeling responsibility was not significantly related. All in all, the model explained 11% of the variance ( $Adj. R^2 = .11$ ).

### 3.4. Mediation Analyses

To examine the mediating role of driving anger expression in the relationship between responsibility and driver behaviors, a series of mediation models were tested via model 4 of Hayes Process Macro V.3. In these analyses, the four factors of the DAX were entered as the mediators, and either feeling of responsibility or behavioral responsibility as the IV (see Figure 1). In each analysis, age, gender and annual mileage were entered as control variables. These analyses were carried out for each of the four factors of the DBQ as the DV. Therefore, a total of eight mediation models were tested. Three of these models yielded significant total indirect effects.

First, driving anger expression significantly mediated the relationship between behavioral responsibility and ordinary violations. The bootstrapped total indirect effect was  $-.17$  ( $SE = .09$ , 95 %  $CI = [-.37, -.01]$ ). When the indirect effects of the driving anger expression dimensions were examined individually, it was found that none of them reached significance.

Second, the indirect effect of driving anger expression in the relationship between behavioral responsibility and aggressive violations was significant. The bootstrapped total indirect effect was  $-.43$  ( $SE = .15$ , 95 %  $CI = [-.73, -.14]$ ). Among the indirect effects of each driving anger expression dimension, the indirect effect of verbal aggressive expression was significant. The bootstrapped indirect effect was  $-.25$  ( $SE = .08$ , 95 %  $CI = [-.41, -.11]$ ). Behavioral responsibility was negatively associated with verbal aggressive expression ( $B = -.42$ ,  $SE = .11$ , 95 %  $CI = [-.62, -.21]$ ), and verbal aggressive expression in turn predicted aggressive violations positively ( $B = .62$ ,  $SE = .09$ , 95 %  $CI = [.45, .79]$ ).

Finally, driving anger expression significantly mediated the relationship between feeling of responsibility and ordinary violations. The bootstrapped total indirect effect was  $-.23$  ( $SE = .11$ , 95 %  $CI = [-.45, -.03]$ ). The indirect effect of none of the driving anger expression dimensions was significant.

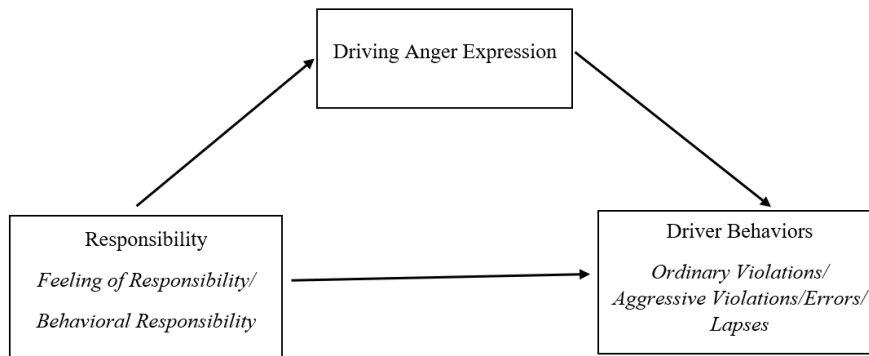


Figure 1. The conceptual framework of the mediation models tested

## 4. Discussion

The aim of the present study was to examine responsibility in the driving concept. More specifically, the associations of responsibility with driving anger expression and driver behaviors were tested after controlling age, gender and mileage. The results showed partially supporting evidence for the expectations regarding these relationships. In the first analysis, it was found that being young and being male were related to ordinary violations. Young driver's

tendency to commit ordinary violations is consistent with the literature that was shown in several studies (e.g., Reason et., 1990; Zhao et al., 2012). The finding related to gender is consistent with the related literature such that Golias and Karlaftis (2002) claimed females drive more safely and Kontogiannis and colleagues (2002) claimed that male drivers are more likely to violate traffic. Moreover, behavioral responsibility was associated with ordinary violations whereas feelings of responsibility was not. Taken into account the association between responsibility and prosocial behavior (De Groot & Steg, 2009), it can be claimed that responsible drivers tend to act according to the rules and violate less, because they perceive it as positive social behaviors. Also, the insignificant relationship between feelings of responsibility and ordinary violations suggests that feeling responsible is not necessarily linked to such driver behavior and action is necessary. Another possible explanation might be that responsibility might predict driver behaviors indirectly, rather than directly. We tested this alternative explanation via a series of mediation analyses in which the indirect associations of responsibility with driver behaviors through driving anger expression were tested. The results showed a significant indirect relationship between responsibility (both feeling of responsibility and behavioral responsibility) and ordinary violations through driving anger expression dimensions (combined). Therefore, these findings support the alternative explanation of an indirect relationship. It should also be noted that in both of these analyses, the total indirect effect of the four driving anger expression dimensions combined was found to be significant, and none of the individual indirect effects of each dimension of driving anger expression reached significance. As Hayes (2018) explains, the total indirect effect in a multiple parallel mediator model represents the indirect effect of the IV on DV summed across all the individual mediators, and it is possible to observe a significant total indirect effect although each of the individual indirect effects corresponding to each mediator in the model are nonsignificant. One of the reasons of this issue, according to Hayes (2018), is that if the mediators in the model are highly correlated, it might be difficult to detect their weak effects, and their effect can be strong enough to reach significance when added together. This problem of high correlations between the mediators is the case in the current study since the mediators in the models tested were four dimensions of a given construct (i.e., the four factors of the DAX scale).

Secondly, being young was found to be significantly associated with aggressive violations. Results supported that younger drivers have a higher tendency to engage in aggressive violations in traffic (Zhao et al., 2012). However, although negatively correlated, neither feeling of responsibility nor behavioral responsibility predicted aggressive violations in the regression analysis. Again, there was a possibility that responsibility might predict aggressive violations indirectly, rather than directly. The results showed a significant indirect relationship between behavioral responsibility and aggressive violations through driving anger expression dimensions (combined). Specifically, among the four dimensions of driving anger expression, the indirect effect of verbal aggressive expression between behavioral responsibility and aggressive violations was significant.

Third, being male and behavioral responsibility were related to errors. In this study, being male predicted errors. The relationship between gender and errors in the literature is controversial such that some studies found females as more likely to make errors (Reason et al., 1990), some studies found no relationship between these two factors (Bener & Crundall, 2008), and some found males as being more likely to make one subtype of errors, namely, inattention errors (Rimmö & Åberg, 1999). This suggests that to be able to understand errors, investigating different factors is necessary such as stress (Matthews et al., 1998), perceptual distraction (Storie, 1977), being more engaged by vehicle (Reason et al., 1990).

Based on the analyses, both errors and lapses were significantly predicted by behavioral responsibility indicates the role of responsible behavior in diminishing errors and lapses. Taken

into account the association between responsibility and self-conscious behavior (De Groot & Steg, 2009), it is possible to say that responsible drivers tend to be more careful and less likely to get distracted. In addition, this finding highlighted the difference of feelings of responsibility and behavioral responsibility such that feeling responsible was not related to errors and lapses, and engaging in responsible behavior was found necessary. However, although driving anger expression dimensions and errors and lapses were correlated, the mediating roles of driving anger expression between responsibility and errors and lapses were not significant. In the literature, anger expression is found to be significantly positively associated with anger as a trait (Allan & Gilbert, 2002). In addition, previous findings suggest a strong correlation between anger as a trait and driving errors (Zhang & Chan, 2016). One possible explanation for that is the cognitive load of participants when they are in the traffic. Different variables which cause cognitive load such as anxiety (Briggs et al., 2011; Shahar, 2009), stress (Kontogiannis, 2006) or anger (Demir et al., 2016) can predict errors while anger also can predict anger expression (Deffenbacher et al., 2003; Precht et al., 2017). In this study, bivariate correlation results are supporting the literature; however, further analysis can provide strong evidence for this relationship. Since this study does not control participants' cognitive load, the results may not indicate anger expression as a predictor for errors and lapses. In future studies, behavioral responsibility can be investigated to understand how it may have an impact on such behaviors. Since both errors and lapses have a high possibility to be the result of an attention shift (Stephens & Groeger, 2009), behavioral responsibility could be related to strong ability to maintain attention.

There are some limitations of the study. First, an online survey was used to collect the data. However, it is noteworthy to consider that driver behavior is a performative act. In future studies, driving stimulation might be used to obtain stronger results. Second, the self-report nature of data collection may have an effect on the reliability of the results considering participants' objectivity for the answers and issues such as socially desirable responding tendency. Finally, the majority of the participants were female drivers. Although there is not a major difference between male and female participants, this finding should be considered while generalizing the present findings.

In the present study, we investigated the associations of responsibility with driving anger expression and driver behaviors were tested. The results showed partially supporting evidence for the expectations regarding these relationships. As far as our knowledge, the present study was the first attempt to investigate the role of responsibility in driving context. Thus, we believe that it will have significant contributions to the related literature. Additionally, the practical implications of these findings might pave the way for developing intervention programs targeting responsibility in the driving context.

### **Ethics Committee Approval Statement**

Ethics committee approval of the study was obtained from the Scientific Research and Publication Ethics Committee of Başkent University (62310886-604.99).

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