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The Big Five factors, sensation seeking, and driving anger in the prediction of unsafe driving ☆

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Abstract

Despite a wealth of literature supporting the utility of trait driving anger, sensation seeking, and the Big Five personality factors in predicting unsafe driving behavior and crash-related outcomes, these predictors have been studied in isolation. The present study investigated the utility of combining these variables in the prediction of self-reported driving anger expression and the frequency of aggressive and risky driving behaviors. Three hundred and fifteen college students completed measures of driving anger, sensation seeking, Big Five personality factors, unsafe driving behavior, and driving anger expression. Hierarchical regressions controlling respondent age, gender, and average weekly miles driven supported the predictive utility of driving anger, sensation seeking, emotional stability, agreeableness, and openness to experience. Results supported the use of multiple predictors in the study of unsafe driving and demonstrated that different combinations of predictors are needed to explain different aspects of driving behavior.

Keywords: Aggressive driving; Personality; Anger; Sensation seeking

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1. Introduction

Automobile accidents and traffic fatalities represent a serious social and public health problems in the United States. According to the National Highway Traffic Safety Administration (NHTSA, 2004), there were 42,643 fatalities among the 6,328,000 vehicular accidents reported by police in 2003. Based on 2000 data, such accidents are the leading cause of death for people between 2 and 33 and have an estimated economic cost (i.e., travel delay, productivity losses, cost to employers, legal and court costs, property damage, emergency services, medical costs, rehabilitation costs, and insurance administration) of $230.6 billion (NHTSA, 2002).

Given that human factors explain significantly more variability in accident rates than vehicular or roadway factors (Evans, 1991; United States General Accounting Office, 2003), it is not surprising that social science research has focused on the relationships among various human factors and unsafe driving. Of the many personality constructs that have been studied as potential predictors of unsafe driving, the Big Five personality factors, sensation seeking, and trait driving anger have received the most support to date.

Research on the Five Factor Model (FFM) supports the utility of extraversion, neuroticism, and conscientiousness in predicting driving-related outcomes and behavior. First, extraversion has been associated with motor vehicle accidents, traffic fatalities, traffic violations, and driving under the influence (Eysenck, 1970; Fine, 1963; Lajunen, 2001; Renner & Anderle, 2000; Smith & Kirkham, 1981; Martin & Boomsma, 1989). Next, neuroticism is related to vehicular accidents, fatalities, aggression while driving, and dislike of driving (Kirkcaldy & Furnham, 2000; Matthews, Dorn, & Glendon, 1991). In addition, conscientiousness is inversely related to at-fault crashes, total crashes, and moving violation tickets (Arthur & Doverspike, 2001; Arthur & Graziano, 1996). The predictive utility of agreeableness and openness is less clear, as many studies have failed to find relationships with driving outcomes or behavior (e.g., Miles & Johnson, 2003). Exceptions include a study by Cellar, Nelson, and Yorke (2000) which found that agreeableness was inversely related to traffic citations and Arthur and Graziano's (1996) finding that openness was related to at-fault accidents.

In addition to the broader constructs that comprise the FFM, several studies have focused on the role of sensation seeking in driving outcomes and behavior. According to Zuckerman (1994), sensation seeking is "a trait defined by the seeking of varied, novel, complex, and intense sensations and experiences and the willingness to take physical, social, legal, and financial risks for the sake of such experiences" (p. 27). As a result, those high in sensation seeking are assumed to engage in reckless driving to provide the type of stimulation that they find pleasurable. High sensation seeking is related to traffic accidents, moving citations, driving while intoxicated, speeding, not wearing seatbelts, passing in no-passing zones, and a variety of other unsafe driving behaviors (Arnett, 1990; Arnett, Offer, & Fine, 1997; Donovan, Queisser, Salzberg, & Umlauf, 1985; Jonah, 1997; Jonah, Thiessen, & Au-Yeung, 2001; Trimpop & Kirkcaldy, 1997).

Another construct that has emerged as a viable predictor of unsafe driving is trait driving anger. Defined as the propensity to become angry while driving (i.e., a context-specific version of trait anger), driving anger is generally measured with the Driving Anger Scale (DAS; Deffenbacher, Oetting, & Lynch, 1994). Several studies have found that high DAS scores are associated with motor vehicle accidents, aggressive driving, traffic violations, intensity of state anger while driving, anger-related damage to vehicles, and less frequent use of seatbelts (Blanchard, Barton,

& Malta, 2000; Deffenbacher et al., 1994; Deffenbacher, Huff, Lynch, Oetting, & Salvatore, 2000; Deffenbacher, Lynch, Filetti, Dahlen, & Oetting, 2003; Lajunen & Parker, 2001; Underwood, Chapman, Wright, & Crundall, 1999).

Despite support for the predictive utility of the FFM (especially extraversion, neuroticism, and conscientiousness), sensation seeking, and driving anger, these variables have been studied independently. In fact, we are aware of only two prior studies that have combined the aforementioned variables, both conducted by our research team. In the first, we found that extraversion, conscientiousness, and neuroticism predicted risky driving and certain accident-related outcomes (i.e., losing concentration while driving, loss of vehicular control, and close calls) beyond driving anger (White & Dahlen, 2001). Thus, we suggested studies of driving anger may benefit from the addition of these factors. In the second study, we found that sensation seeking added significantly to the prediction of risky and aggressive driving, independent of driving anger (Dahlen, Martin, Ragan, & Kuhlman, 2005). Given the complexity of driving behavior and the myriad of factors contributing to vehicular accidents, it is likely that multivariate models are needed to predict unsafe driving behavior. The present study was conducted to examine the utility of combining the FFM, sensation seeking, and driving anger in predicting aggressive driving, risky driving, and various crash-related outcomes.

2. Methods

2.1. Participants

Participants were 312 (222 women and 90 men) undergraduate psychology students at the University of Southern Mississippi (Mdn age = 19). Approximately 54% identified themselves as White, 42% as African American, 1% as Asian/Pacific Islander, 1% Hispanic, and 1% other. Participants reported driving a median of 60 miles/week. Students were tested in small groups and received research credit for their participation.

2.2. Instruments

2.2.1. The Driving Survey

The 35-item Driving Survey (Deffenbacher et al., 2000) was used to assess the frequency of aggressive driving (e.g., cut another driver off in anger, made an angry gesture at another driver or pedestrian, etc.), risky driving (e.g., driven without using a seatbelt, passed unsafely, etc.), and six crash-related conditions (losses of concentration, minor losses of vehicular control, and close calls over the past 3 months and lifetime traffic citations, minor accidents, and major accidents). Prompts were included to clarify the meaning of questions and facilitate recall for minor events. For example, ''minor accidents'' included ''such as a fender bender,'' and ''lost concentration'' included ''daydreaming, thinking of something else, etc.'' Items were rated from 0 to 5+ referring to how many times each event occurred over a particular time frame. The 13-item aggressive driving and 16-item risky driving subscales are internally consistent (αs = .88 and .86, respectively) while the crash-related condition items were not designed to form a reliable scale and

are analyzed individually. Test–retest reliabilities over a 3-month period were acceptable for aggressive driving (.85–.89) and risky driving (.83–.86) in an undergraduate population (Deffenbacher et al., 2003).

2.2.2. International Personality Item Pool (IPIP)

FFM personality traits were assessed with the 50-item IPIP (Goldberg, 1999). Items, directions for administration, and directions for scoring can be obtained from the author. Each factor is assessed by 10-items rated from 1 (very inaccurate) to 5 (very accurate) as to how accurately it describes the respondent. The first factor, extraversion ($\alpha = .87$), is designed to assess one's sociable and active traits (e.g., am the life of the party, start conversations, keep in the background, etc.). Agreeableness ($\alpha = .82$) consists of items that address one's interest in and warmth toward others (e.g., am interested in people, have a soft heart, feel little concern for others, etc.). Conscientiousness ($\alpha = .79$) consists of items designed to assess one's traits of conscientiousness and dependability (am always prepared, like order, leave my belongings around, etc.). Emotional stability ($\alpha = .86$) is assessed by items that ask about one's sensitivity to stress and fluctuations in emotional experience (e.g., get stressed out easily, get upset easily, seldom feel blue, etc.). Finally, openness ($\alpha = .84$) assesses for the traits of creativity and sophistication (e.g., have a rich vocabulary, have a vivid imagination, am not interested in abstract ideas, etc.). The IPIP scales are correlated with the equivalent scales of the NEO inventory, with most correlations being higher than .90 after correction for attenuation.

2.2.3. Sensation Seeking Scale (SSS)

Sensation seeking was assessed with a modified version of the 40-item Form V of the SSS (Zuckerman, 1994). Each item requires respondents to choose between one of two choices, one statement related to the desire for sensation (e.g., "I like wild and uninhibited parties") and another related to a more cautious preference (e.g., "I prefer quiet parties with good conversation"). Respondents select the choice that more accurately describes their preferences. Based on criticism of the dated wording used in some SSS items (e.g., Arnett, 1994), phrases such as "far-out" and "jet set" were followed with updated terms. The SSS yields a total score and four subscales: Thrill and Adventure Seeking (TAS), Experience Seeking (ES), Boredom Susceptibility (BS), and Disinhibition (DIS). Zuckerman (1994) found that the total score was internally consistent (αs = .83–.86) and stable over 3 weeks ($r_{xx} = .94$). However, not all of the subscale scores are acceptably reliable (Deditius-Island & Caruso, 2002). In the present study, only TAS and DIS were sufficiently reliable (αs > .70). The SSS has been validated through comparisons with many different traits and behaviors, including cigarette smoking, driving practices, impulsivity, and use of drugs and alcohol (Zuckerman, 1994).

2.2.4. Driving Anger Scale (DAS)

Participants' propensity to experience anger while driving was assessed by the 14-item short form of the DAS (Deffenbacher et al., 1994). Items are rated on a five-point scale (1 = not at all to 5 = very much) with regard to the level of anger each scenario elicits. The short form ($\alpha = .80$) was constructed from the best single-cluster structure of the 33-item version, with the

requirement that it include at least one item from each of the six subscales contained in the long form. The short form is highly correlated ($r = .95$) with the long form and has a 10-week test–retest reliability of .84 (Deffenbacher et al., 1994). DAS scores are positively related to general trait anger, impulsiveness, and trait anxiety, and participants who score high on the DAS report more aggressive and risky driving and some crash-related outcomes than those who score low (Deffenbacher et al., 2000; Deffenbacher et al., 2003).

2.3. Procedure

Questionnaire packets containing each of the measures described above were administered to groups of participants in counterbalanced order. The entire process took approximately 40 min to complete.

Table 1
Alphas, means, and standard deviations for all variables by gender ($N = 312$)

Variable	α	Male		Female		F
		M	SD	*M*	SD	
IPIP						
E	.86	32.77	7.30	33.56	7.98	1.92
A	.74	37.99	5.24	41.38	4.98	22.98**
C	.77	35.76	6.09	36.63	5.87	1.73
ES	.86	34.35	7.28	29.15	7.62	26.28**
O	.75	37.24	5.78	36.61	5.00	.13
SSS						
Total	.84	19.08	6.75	15.83	6.85	13.73**
TAS	.86	5.06	.16	5.37	.10	2.75
DIS	.76	4.02	.17	3.72	.11	2.27
DAS	.88	47.72	11.31	49.21	10.35	2.94
Driving Survey						
MV	–	1.97	1.88	1.25	1.49	11.91**
Min. A	–	1.23	1.25	1.13	1.24	.36
Maj. A	–	.63	1.02	.42	.88	3.13
CC						
LC	–	3.03	1.71	3.24	1.71	1.05
LoC	–	1.54	1.53	2.15	1.60	8.88**
CC	–	1.54	1.42	1.73	1.48	.90
AD	.84	12.37	10.81	14.82	11.19	4.52*
RD	.86	34.88	17.74	29.96	14.45	4.42*

Note. IPIP = International Personality Item Pool, E = extraversion, A = agreeableness, C = conscientiousness, ES = emotional stability, O = openness, SSS = Sensation Seeking Scale, TAS = Thrill and Adventure Seeking, DIS = Disinhibition, DAS = Driving Anger Scale, MV = moving violation, Min. A = minor accident, Maj. A = major accident, LC = lost concentration, LoC = loss of control, CC = close calls, AD = aggressive driving, and RD = risky driving.

* $p < .05$.

** $p < .01$.

Table 2
Intercorrelations among all variables ($N = 312$)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
(1) MV	–															
(2) Min. A	.36*	–														
(3) Maj. A	.34*	.42*	–													
(4) LC	.17*	.15*	.04	–												
(5) LoC	.12	.12	.03	.35*	–											
(6) CC	.09	.20*	.10	.25*		–										
(7) AD	.10	.11	.09	.22*	.33*	.40*	–									
(8) RD	.19*	.17*	.06	.31*	.41*	.49*	.57*	–								
(9) DAS	.03	.02	.03	.13	.12	.18*	.38*	.31*	–							
(10) SSS	.26*	.19*	.19*	.15*	.12	.04	.13	.26*	−.01	–						
(11) TAS	−.04	−.01	.04	−.03	.12	.03	.05	.12	.15*	−.26*	–					
(12) DIS	.12	.06	.04	.02	.02	.09	.21*	.28*	.07	.40*	.11	–				
(13) E	.05	−.01	.07	−.00	.05	−.01	−.00	.06	−.01	.31*	−.05	.23*	–			
(14) A	−.12	−.09	−.04	−.02	−.13	−.04	−.18*	−.22*	−.05	−.18*	−.05	−.20*	.24*	–		
(15) C	−.04	.01	−.01	−.12	−.16*	−.08	−.10	−.15*	.00	−.12	−.02	−.12	−.00	.23*	–	
(16) ES	.13	−.06	.02	−.14	−.03	−.17*	−.31*	−.13	−.39*	.15	−.14	−.01	.25*	.03	.14	–
(17) O	−.01	−.01	.05	.04	−.06	.00	−.03	−.14	−.04	.20*	−.13	.01	.20*	.19*	.25*	.14

Note. MV = moving violation; Min. A = minor accident; Maj. A = major accident; LC = lost concentration; LoC = loss of control; CC = close calls; AD = aggressive driving; RD = risky driving; DAS = Driving Anger Scale; SSS = Sensation Seeking Scale Total; TAS = Thrill and Adventure Seeking; DIS = Disinhibition; E = extraversion, A = agreeableness; C = conscientiousness; ES = emotional stability; and O = openness.

* $p < .01$.

Table 3
Summary of hierarchical regressions on the Driving Survey

Variable	R^2	ΔR^2	β
Risky driving			
Step 1	.06		
Gender			−.14*
Age			−.16*
Miles/week			.09
Step 2	.15	.09**	
ES			−.12
E			.01
O			−.17*
A			−.05
C			−.02
Step 3	.26	.10**	
DAS			.26**
SSS			.26**
Aggressive driving			
Step 1	.05		
Gender			.09
Age			−.13*
Miles/week			.06
Step 2	.17	.13**	
ES			−.21**
E			.01
O			.02
A			−.10
C			−.01
Step 3	.26	.09**	
DAS			.31**
SSS			.14*
Losses of concentration			
Step 1	.04		
Gender			.08
Age			.00
Miles/week			.21**
Step 2	.09	.05*	
ES			−.13
E			−.06
O			.06
A			.04
C			−.11
Step 3	.13	.04**	
DAS			.09
SSS			.20**
Losses of vehicular control			
Step 1	.03		
Gender			.24**
Age			−.01
Miles/week			.07

(*continued on next page*)

Table 3 (*continued*)

Variable	R^2	ΔR^2	β
Step 2	.08	.05*	
ES			
E			−.02
O			.05
A			−.16*
C			−.12
Step 3	.10	.03*	
DAS			.16*
SSS			.09
Close calls			
Step 1	.01		
Gender			.03
Age			−.06
Miles/week			.02
Step 2	.05	.04	
ES			−.13
E			−.06
O			.04
A			−.06
C			−.07
Step 3	.06	.01	
DAS			.12
SSS			.03
Moving citations			
Step 1	.12		
Gender			−.14*
Age			.21**
Miles/week			.09
Step 2	.16	.04	
ES			.07
E			.08
O			−.06
A			−.08
C			−.00
Step 3	.20	.04**	
DAS			.11
SSS			.19**
Minor accidents			
Step 1	.03		
Gender			−.00
Age			.14*
Miles/week			.07
Step 2	.06	.03	
ES			−.13
E			−.00
O			−.04

Table 3 (*continued*)

Variable	R^2	ΔR^2	β
A			−.10
C			.06
Step 3	.08	.02	
DAS			−.02
SSS			.16*

Note. ES = emotional stability; E = extraversion; O = openness; A = agreeableness; C = conscientiousness; DAS = Driving Anger Scale; and SSS = Sensation Seeking Scale.
* $p < .05$.
** $p < .01$.

3. Results

Means and standard deviations for all variables are presented in Table 1 by gender. A one-way (gender) MANOVA conducted on all variables except the six crash-related conditions and the two SSS subscales used in the present study revealed a moderate multivariate gender effect, $F(9, 245) = 9.50$, $p < .01$ ($\eta^2 = .26$). Significant univariate gender differences were found for agreeableness, emotional stability, SSS, aggressive driving, and risky driving. A separate one-way (gender) MANOVA on the six crash-related conditions item also produced a small multivariate gender effect, $F(6, 305) = 4.26$, $p < .01$ ($\eta^2 = .08$). Significant univariate gender differences were found on losses of vehicular control and moving tickets. A final one-way (gender) MANOVA on the two reliable SSS subscales (TAS and DIS) was not significant, $F(2, 305) = .98$, $p = .06$.

Potential gender differences in correlations were investigated by tests for differences in independent correlations (Bruning & Kintz, 1997). Out of all comparisons, only two showed gender differences significant at a $p < .01$ level. Thus, bivariate correlations are presented in Table 2 for the full sample. Hierarchical multiple regressions were conducted on the aggressive and risky driving subscales of the Driving Survey and five of the six crash-related condition items (see Table 3).

Table 4
Logistic regression predicting major accidents

Predictor	*B*	SE	Odds ratio
Gender	−.72*	.03	.49
Age	.06	.35	1.06
Miles/week	−.00	.00	1.00
ES	−.01	.02	.99
E	.03	.02	1.03
O	−.04	.03	.97
A	.04	.03	1.04
C	−.02	.03	.98
DAS	.02	.02	1.02
SSS	.05*	.03	1.05

Note. ES = emotional stability; E = extraversion; O = openness; A = agreeableness; C = conscientiousness; DAS = Driving Anger Scale; and SSS = Sensation Seeking Scale.
* $p < .05$.

A logistic regression was conducted for major accidents after dichotomizing this variable because the low base rate resulted in significant skewness (see Table 4). In all regressions, gender, age, and miles driven/week were entered on Step 1 to control for their effects. The five IPIP scales were entered on Step 2, and the DAS and SSS total score were entered on Step 3. This order of entry was based on the more global nature of the FFM in comparison to driving anger and sensation seeking. Total SSS score was used instead of the subscales because it was more highly correlated with all criterion variables than were the subscales. Simultaneous entry was used on all steps.

Beyond gender, age, and miles driven, risky driving was predicted by reduced openness and increased DAS and SSS scores. Aggressive driving was predicted by reduced emotional stability and increased DAS and SSS scores. Losses of concentration were associated with SSS, and losses of vehicular control were predicted by reduced agreeableness and the DAS. Moving citations, minor accidents, and major accidents were predicted SSS scores. None of the variables under study predicted close calls.

4. Discussion

The present study combined three separate lines of research on the prediction of unsafe driving: the FFM, sensation seeking, and driving anger. Openness, emotional stability, agreeableness, trait driving anger, and sensation seeking predicted driving behavior and outcomes independent of gender, age, and miles/week. Findings provide additional support for the predictive utility of driving anger and sensation seeking. However, the FFM results were mixed, as extraversion and conscientiousness did not appear useful in understanding driving behavior/outcomes.

The finding that trait driving anger predicted unsafe driving was consistent with previous literature (e.g., Deffenbacher et al., 2000; Deffenbacher et al., 2003; Underwood et al., 1999). Driving anger predicted risky driving, aggressive driving, and minor losses of vehicular control. Thus, individual differences in the propensity to experience anger while driving appear to be an important predictor of driving behavior and accident-related outcomes. Continued study of this construct is warranted in the context of driving behavior. Moreover, the brevity and empirical support for the DAS suggest that it may be a viable tool for screening high-risk drivers or as part of a more comprehensive assessment of personality traits associated with unsafe driving.

Support for the utility of sensation seeking in predicting risky, non-aggressive driving was also consistent with previous research (e.g., Arnett et al., 1997; Dahlen et al., 2005; Donovan et al., 1985; Jonah et al., 2001; Trimpop & Kirkcaldy, 1997). However, the present findings suggest that its utility may be broader than previously recognized. Specifically, sensation seeking also predicted aggressive driving, losses of concentration while driving, moving citations, minor accidents, and major accidents. These findings were consistent with our prior research in which a different measure of sensation seeking was used (Dahlen et al., 2005). Additional research is needed to determine the pathway through which sensation seeking impacts driving behavior. For example, it may be that individuals high in sensation seeking perceive less risk in unsafe driving behaviors (Arnett, 1990). Alternatively, they may be more willing to take risks in order to experience the thrill associated with such driving behaviors (Jonah, 1997). Finally, further separating the subcomponents of sensation seeking (e.g., Thrill and Adventure Seeking and Disinhibition) may be beneficial for understanding the construct.

Regarding the FFM, the present findings that openness predicted risky driving and agreeableness predicted losses of vehicular control were consistent with previous studies supporting the utility of these constructs in predicting driving outcomes (e.g., Arthur & Graziano, 1996; Cellar et al., 2000). However, our expectation that extraversion, emotional stability, and conscientiousness would be useful predictors was only partially supported. Consistent with previous research (e.g., Kirkcaldy & Furnham, 2000; Matthews et al., 1991; White & Dahlen, 2001), emotional stability predicted aggressive driving, however, extraversion and conscientiousness did not predict any of the dependent variables (although conscientiousness was inversely related to losses of vehicular control and risky driving). While this was consistent with Cellar et al. (2000), it differed from previously reported relationships between conscientiousness and accidents/violations (e.g., Arthur & Doverspike, 2001; Arthur & Graziano, 1996). Similarly, whereas extraversion had previously been associated with accidents and moving violations (e.g., Lajunen, 2001; Renner & Anderle, 2000; Smith & Kirkham, 1981; Martin & Boomsma, 1989), it was not related to any of the driving behaviors or outcomes measured in our study.

In understanding these divergent findings, it is worth noting that the instruments used to assess the FFM have not been entirely consistent. In addition, many of the previous studies had considerably broader age ranges (e.g., Martin & Boomsma, 1989; Renner & Anderle, 2000). Moreover, several of the prior studies supporting extraversion used exclusively male respondents (e.g., Eysenck, 1970; Fine, 1963; Smith & Kirkham, 1981). Finally, most of the previous studies did not control for factors such as age, gender, or miles driven. Additional research is needed to determine whether the present results were anomalous or whether these differences explain the divergent findings. Until then, conclusions about the utility of the FFM in driving behavior seem premature.

An important limitation is the restricted age range of the college student sample. Although there is no *a priori* reason to believe that college student drivers would systematically differ from non-college drivers of the same age, this has not been sufficiently investigated. It is also clear that the restricted age range has important implications for many of the variables studied (e.g., sensation seeking). Thus, it is important for future research to include a wider age range. In addition, the retrospective correlational design limits conclusions about the predictive utility of the variables under study. Prospective designs in which personality factors are assessed and driving behaviors are subsequently tracked over time may be helpful in this regard.

Moreover, although self-report data are generally preferred in research on driving behavior (Ball & Owsley, 1991) because they include many behaviors that would otherwise go unreported (e.g., close calls), findings would be strengthened by supplementing self-report measures with other methods (e.g., driving simulators, naturalistic observation, etc.).

In summary, the present study adds to the literature by demonstrating the combined utility of driving anger, sensation seeking, and certain components of the FFM of personality (i.e., openness, agreeableness, and emotional stability) in the prediction of unsafe driving.

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