

## **ANGRY COLLEGE STUDENT DRIVERS: CHARACTERISTICS AND A TEST OF STATE-TRAIT THEORY**

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### **Abstract**

This study mapped the characteristics of angry college student drivers and provided a test of state-trait anger theory applied to anger while driving. Compared to low anger drivers, high anger drivers reported: (1) more frequent and intense anger in daily driving and more intense anger in response to commonly occurring (e.g., normal traffic and stuck in rush hour traffic) and their personally most provocative situations; (2) more aggressive and less constructive forms of expressing their anger while driving; (3) more state anger, more verbal and physical aggressive tendencies, and less positive coping following visualization of a frustrating event (i.e., another driver stealing the parking space for which the person has been waiting); (4) more aggressive and risky behavior in driving diaries and three-month surveys; (5) more of three crash-related outcomes (i.e., moving violations, losses of concentration while driving, and close calls); and (6) greater general anger, outward negative expression and suppression of anger and less controlled anger expression. Results showed that angry drivers were angrier and more aggressive and risky drivers and supported predictions derived from the state-trait model of anger.

### **Resumen**

El presente estudio describe las características de conductores universitarios encolerizados y plantea una comprobación de la teoría de la ira estado-rasgo aplicada a la cólera mientras se conduce. Comparados con los conductores con baja ira, los conductores de elevada ira informaban: (1) una irritabilidad más frecuente e intensa en la conducción diaria y una irritabilidad más intensa en respuesta a situaciones habituales (p.ej., tráfico normal y atascos en las horas punta) y a las situaciones más provocadoras a nivel personal; (2) maneras más agresivas y menos constructivas de expresar su irritación mientras conducen; (3)

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más cólera estado, más tendencias agresivas verbales y físicas y menos afrontamiento positivo después de visualizar un acontecimiento frustrante (p.ej., otro conductor se cuele en el espacio de aparcamiento por el que ha estado esperando): (4) comportamientos más arriesgados y agresivos reflejados en los diarios de conducción y en las evaluaciones a los tres meses; (5) más de tres consecuencias relacionadas con colisiones (p.ej., infracciones mientras conduce, pérdidas de concentración mientras conduce y huidas del lugar del incidente), y (6) una mayor irritabilidad general, mayor supresión y expresión negativas de la ira hacia el exterior y un menor control en la expresión de la ira. Los resultados muestran que los conductores encolerizados eran conductores más irritados, arriesgados y agresivos y apoyan las predicciones que se derivan del modelo estado-rasgo de la ira.

### Introduction

Over the last several years, the media has drawn attention to angry drivers and «road rage.» Media descriptions are familiar to most drivers, because they have been exposed to the erratic, impulsive behavior of angry drivers. Additionally, most drivers know otherwise reasonable people until they encounter frustration on the road. Such drivers perceive some offense and turn into enraged, swearing, yelling, gesturing, menacing drivers who upset themselves, the people who ride with them, and potentially other drivers with whom they are upset. Although it generally does not, such anger can escalate and precipitate retaliation, assault, crashes, and potentially serious injury or death.

The nature of situations encountered and other social-environmental factors such as anonymity and the presence of hostile messages certainly influence whether anger is triggered at all and the amount of anger experienced (Deffenbacher, Deffenbacher, Lynch, & Richards, in press; Deffenbacher, Huff, Lynch, Oetting, & Salvatore, 2000; Doob & Gross, 1968; Ellison-Potter, Bell, & Deffenbacher, 2001; Lajunen & Parker, 2001; Shinar, 1998). Other research, however, suggests that person factors such as the individual's propensity to anger while driving may contribute to the level of anger and aggression (Arnett, Offer, & Fine, 1997; Deffenbacher, Deffenbacher, *et al.*, in press; Deffenbacher, Lynch, Oetting, & Yingling, 2001; Lajunen, Parker, & Stradling, 1998; Underwood, Chapman, Wright, & Crundall, 1999).

The present research explores the person factor of trait driving anger or the person's general propensity to become angry when driving and tests an adaptation of the state-trait model (Spielberger, 1988) to driving anger. Four hypotheses were derived from the state-trait model. If trait driving anger reflects the person's tendency to become angry when frustration and provocation are encountered, then, compared to low trait angry drivers, high trait anger drivers should: (1) experience more frequent (frequency hypothesis) and (2) intense (intensity hypothesis) anger when operating a vehicle. Because elevated anger may prompt and motivate aggression, high trait anger drivers should also (3) engage in more aggressive behavior while driving (aggression hypothesis). Since aggressive

responding and positive, constructive handling of anger are minimally correlated (Deffenbacher, Lynch, Oetting, & Swaim, 2002), high trait anger drivers are predicted to (4) cope with provocative/frustrating events in less positive ways (reduced positive coping hypothesis). Two other predictions were developed, although they did not stem directly from the state-trait model, because conditions included in them are not necessarily mediated by anger. Because anger and aggression may elicit behaviors or be correlated with behaviors such as impulsiveness that interfere with the cognitive, perceptual, and behavioral processes involved in safe driving, it was predicted that high anger drivers would (5) engage in more risky behaviors when driving (risky behavior hypothesis) and (6) experience more crashes and crash-related conditions (negative outcome hypothesis).

Several studies support for these predictions. For example, state anger increased with the degree of driving frustration (Deffenbacher *et al.*, 2000; Deffenbacher, Lynch, Oetting, *et al.*, 2001), and state anger correlated with aggression and risky behavior such as reckless driving (Arnett *et al.*, 1997; Deffenbacher, Lynch, Oetting, *et al.*, 2001). Trait driving anger was associated with increased frequency and intensity of anger while driving, the frequency of risky and aggressive behavior, and some crash-related outcomes (Deffenbacher, Deffenbacher, *et al.*, in press; Deffenbacher, Filetti, Richards, Lynch, & Oetting, 2003; Deffenbacher, Lynch, Filetti, Dahlen, & Oetting, in press; Deffenbacher, Lynch, Filetti, Dahlen, & Oetting, 2003; Deffenbacher, Lynch, Oetting, *et al.*, 2001). Further, the study by Deffenbacher, Deffenbacher, *et al.* (in press) showed that in high impedance simulations, high anger drivers engaged in more erratic driving, had shorter times and distances to a crash, and experienced double the crash rates of low anger drivers. Studies in England have also shown that elements of trait driving anger correlate with both aggressive and non-aggressive traffic violations (Lajunen *et al.*, 1998; Underwood *et al.*, 1999).

Although these initial tests of the state-trait model are promising, the research has at least three problems. First, three of these studies (Deffenbacher, *et al.*, 2000; Deffenbacher, Filetti, *et al.*, 2003; Deffenbacher, Lynch, *et al.*, 2003) employed treatment samples of high anger drivers. Since the high anger drivers were seeking assistance for driving anger reduction, their anger status is confounded with the help seeking. That is, an unknown portion of the findings may be attributable to being a problem admitting, high anger driver, rather than being high anger per se. These studies, therefore, do not provide a clean test of hypotheses. Second, few studies provide tests of all or most of the hypotheses in the same study. Third, few studies employ multiple methodologies for testing hypotheses to see if findings converge across different methodologies.

The present study addresses these issues by partially replicating and extending the Deffenbacher, Deffenbacher, *et al.* (in press) study. First, the Deffenbacher, Deffenbacher, *et al.* (in press) study assessed state anger and aggression following high impedance driving simulations. Although impedance is an important type of frustration encountered on the road, there are other sources of frustration that are much more interpersonal in nature (e.g., another driver yelling or gesturing at you). The present study assessed one of these interpersonal events, namely another driver

stealing the parking space for which the person has been waiting. Replication of findings in such interpersonal situations will increase generalizability and strength of findings. Second, the reduced coping hypothesis was tested in this new class of provocation by adding a measure of positive coping to assessment of state anger and aggression. Third, two individual-specific measures of anger intensity were added. Prior research has shown that high anger drivers experience more intense anger in frequently occurring situations such as being stuck in rush hour traffic; however, low anger drivers reported considerable anger on some of these measures. This raises the possibility that low anger individuals become just as angry as high anger drivers when they confront the situations that anger them the most. Such a finding would qualify the intensity hypothesis to less provocative events. The present research addressed this issue by including two idiographic measures of anger response to the person's most angering situations. Fourth, measures of general trait anger and general anger expression were included not only to continue to map these characteristics in high anger drivers, but also to assess whether high anger drivers are more generally angry and aggressive as found by Lajunen and Parker (2001).

## Method

### *Participants*

Participants (*Mdn* age = 18) were 160 students enrolled in introductory psychology students in a state university of approximately 25,000 in the western U. S. The *ns* were equal with 40 male and 40 female high and low anger drivers who, respectively, scored in the upper (DAS > 52) and lower (DAS < 42) quartiles on the 14-item Driving Anger Scale (DAS, Deffenbacher *et al.*, 1994). Of these, 70.0% were freshmen, 18.8% sophomores, 5.6% juniors, and 5.6% seniors. Regarding the rural characteristics of their driving backgrounds, 8.1% had been living in towns of less than 2000, 13.1% in towns from 2000 to 5000, 8.8% in towns from 5000 to 10,000, and 70.0% in cities of over 10,000. Students received one of three research credits for participation.

### *Instruments*

*Driving Anger Scale (DAS)*. On the 14-item DAS, participants rate the degree of anger experienced when they encounter the situation described in the item (e.g., Someone backs right in front of you without looking) (Deffenbacher *et al.*, 1994). Ratings are a 5-point scale (1 = not at all; 5 = very much). Prior  $\alpha$  reliabilities range from .80 to .93 (current  $\alpha$  = .93) with 10-week test-retest reliability of .84 (Deffenbacher, 2000). The DAS correlates positively with intensity of anger and frequency of anger, aggression, and risky behavior while driving, aggressive expression of driving anger, and general trait anger (Deffenbacher *et al.*, 2002; Deffenbacher, Lynch, Oetting, *et al.*, 2001).

*Driving Scenarios.* The three Driving Scenarios (Ordinary Traffic, Stuck in Rush Hour Traffic, and Being Yelled at by Another Driver) involve reports of anger on seven, 5-point semantic differentials (e.g., hotheaded—coolheaded) (Deffenbacher *et al.*, 2000). Alpha reliabilities range from .92 to .94. High anger drivers reported greater anger on the Scenarios than low anger drivers (Deffenbacher *et al.*, 2000).

*Personal Driving Situations.* Two Personal Driving Situations (Deffenbacher, Lynch *et al.*, 2003) assessed intense anger by having the person describe his/her two most angering situations on the road and rate intensity of anger on a 0-100 scale (0 = little or no anger; 100 = maximum level of anger you could ever experience). Alpha reliability is not applicable, but this measure is an adaptation of the Anger Situation measure, which had 10-week test-retest reliability of .81 (Deffenbacher, Story, Brandon, Hogg, & Hazaleus, 1988). Clinical samples of high anger drivers report greater anger on Personal Situations than low anger drivers (Deffenbacher, Lynch, *et al.*, 2003).

*Driving Anger Expression Inventory (DAX).* The 49-item DAX assesses how people express their anger while driving. Respondents rate on a 4-point scale (1 = almost never, 4 = almost always) how often they express their anger in the manner described (Deffenbacher *et al.*, 2002). The four forms of expressing anger while driving derived from the DAX are: (1) a 12-item Verbal Aggressive Expression ( $\alpha$  = .88 to .90, current  $\alpha$  = .90) involving behaviors such as swearing or yelling at another driver; (2) an 11-item Personal Physical Aggressive Expression ( $\alpha$  = .80 to .84, current  $\alpha$  = .76) including behaviors such as giving another driver the finger or trying to engage in a physical altercation with another driver; (3) an 11-item Use of the Vehicle to Express Anger ( $\alpha$  = .86 to .89, current  $\alpha$  = .90) involving behavior such as speeding up to frustrate another driver or flashing lights at another driver; and (4) a 15-item Adaptive/Constructive Expression ( $\alpha$  = .89 to .90, current  $\alpha$  = .91) assessing positive handling of anger through things such as relaxing or listening to the radio to distract one's self from frustration. Verbal, physical, and vehicular forms of anger expression correlate positively with each other and negatively with Adaptive/Constructive Expression. Aggressive forms of expression correlate positively with anger, aggression, and risky behavior and correlate stronger with these than Adaptive/Constructive Expression (Deffenbacher *et al.*, 2002; Deffenbacher, Lynch, Deffenbacher, *et al.*, 2001).

*Driving Survey.* The Driving Survey (Deffenbacher *et al.*, 2000) assesses the frequency of aggressive and risky behaviors and four crash-related outcomes (i.e., moving violations, losses of concentration, minor loss of vehicular control, and close calls) over the past three months and two crash-related outcomes (i.e., minor and major accidents) over the last year. Students reported the number of times (0 to 5+) that they engaged in the behavior or experienced the condition described. The 13-item Aggression (e.g., yelling at another driver or having a physical fight with another driver) and the 15-item Risky Behavior (e.g., drinking alcohol and driving or speeding 10-20 mph over the speed limit) formed reliable scales with current  $\alpha$ s of .88 and .85, respectively, and prior  $\alpha$ s of .85 to .89 and of .83 to .86, respectively. Crash-related conditions did not form a reliable scale with a current  $\alpha$  of .36 (prior  $\alpha$ s = .41 to .51). Since measures of Aggression and Risky Behavior formed reliable

scales, frequencies were summed into single scores of aggressive and risky behavior. Since crash-related outcomes did not yield a reliable index, items were analyzed individually. Clinical samples of high anger drivers engage in more aggressive and risky behavior on the road and experience more of some crash-related outcomes (Deffenbacher et al., 2000; Deffenbacher, Filetti, et al., 2003; Deffenbacher, Lynch, et al., 2003).

*Driving Logs.* For three days, students completed Driving Logs (Deffenbacher et al., 2000), on which they reported the number of times and miles driven, the frequency of anger while driving that day, a 0-100 rating of most intense anger experienced while driving that day, and frequencies of 6 aggressive and 14 risky behaviors. Frequency and intensity of state anger correlate positively with each other, trait driving anger and risky and aggressive behavior (Deffenbacher, Lynch, Oetting, et al., 2001), and high anger drivers report greater frequency and intensity of anger and frequency of aggressive and risky behavior (Deffenbacher, Deffenbacher, et al., in press).

*State Anger Scale (SAS) and Positive Coping.* Following visualization of another driver stealing the parking space for which the participant had been waiting, participants completed the 15-item SAS (Spielberger, 1999) and the 2-item Positive Coping Scale (Novaco, 1975). On the SAS participants rated on a 4-point scale (1 = not at all, 4 = very much) the degree to which they felt or experienced the item at the moment. The SAS provides 5-item measures of State Anger (e.g., feeling angry or annoyed) (current  $\alpha = .93$ , prior  $\alpha$ s = .92 to .94), of Verbal Aggression (e.g., feeling like yelling at or swearing at someone) (current  $\alpha = .93$ , prior  $\alpha$ s = .93 to .94), and of Physical Aggression (e.g., feeling like pounding someone or breaking things) (current  $\alpha = .90$ , prior  $\alpha$ s = .89 and .91). The Positive Coping Scale (current  $\alpha = .85$ , prior  $\alpha$ s = .84 and .88) assesses positive, state coping by having participants rate the likelihood of engaging in the positive behavior described. High trait anger individuals report elevated state anger and reduced coping following visualization of anger-provoking situations, and high anger drivers report more state anger and verbal and physical aggressive tendencies and lowered positive coping following high impedance simulations (Deffenbacher, Deffenbacher, et al., in press).

*Trait anger and general anger expression.* General anger was measured by the 10-item Trait Anger Scale (TAS, Spielberger, 1999), on which participants rate items on a 4-point scale (1 = almost never, 4 = almost always) according to how they generally feel or react with regard to anger. Reported  $\alpha$  reliabilities are in the high .80 range, and two-week test-retest reliabilities range from .70 to .77 (Jacobs, Latham, & Brown, 1988), and two-month retest reliability was .75 (Morris et al., 1996). The TAS correlates positively with measures of anger, aggression, hostility and anger consequences (Deffenbacher, Oetting, Lynch & Morris, 1996; Deffenbacher, Oetting, Thwaites, et al., 1996; Spielberger, 1999). General anger expression was measured by the 24-item Anger Expression Inventory (AX; Spielberger, 1988), on which respondents indicate on a 4-point (1 = almost never, 4 = almost always) scale how often they express their anger in the manner described in the item. The AX provides three 8-item scales of anger expression:

Anger-In, Anger-Out, and Anger-Control ( $\alpha$ s = .73 to .84 based on previous research). Anger-In assesses suppressing anger, being critical, and harboring grudges (e.g., boiling on the inside but not showing anger). Anger-out addresses outward, negative expression through verbal and physical aggression (e.g., striking out at whatever infuriates the person). Anger-Control measures a person's attempt to manage anger and calm down (e.g., calming down faster than others). Anger-Out and Anger-Control correlate negatively with each other, but Anger-In correlates minimally with the other two. Anger-In and Anger-Out correlate positively with general trait anger, whereas Anger-Control correlates negatively with trait anger. Anger-In, however, correlates less strongly with trait anger than does Anger-Out or Anger-Control (Deffenbacher, Oetting, Thwaites, et al., 1996). Validity for the AX is found in the different patterns of correlations of forms of anger expression with anger, personality, and physiological measures (Deffenbacher, Oetting, Thwaites, et al., 1996; Spielberger, 1999).

### *Procedure*

In five large, introductory psychology classes, students voluntarily completed the DAS and left their name and phone number if they were interested in participating in a study involving driving and emotion.

Research assistants called and scheduled interested students in the upper or lower quartile on the DAS. Undergraduate research assistants conducted assessments in groups of 10-15 in small university classrooms. Upon arriving, research assistants gave students two informed consent forms and provided a brief verbal description of the study. Students read, signed, and returned one consent form, keeping the other for their records. Participants then completed, in order, the Driving Scenarios, Personal Situations I and II, DAX, Driving Survey, TAS, and AX. Pilot studies showed that this order created less confusion as measures moved from asking about anger and anger expression when driving to more general, non-driving characteristics. When questionnaires were completed, research assistants instructed students to listen to an audio tape, which instructed them to close their eyes and visualize the situation described as if it were happening to them right then. The scene involved the participant being late for an important meeting and driving around in a parking lot for some time looking for a place to park. The participant arrives first behind a driver who is backing out. However, another driver coming from the other direction cuts in and steals the parking spot for which the participant had been waiting. Following 90 seconds of visualizing this situation, the tape recorder was shut off, and students completed the SAS and Positive Coping Scale regarding their feelings and reactions to this situation. Research assistants then distributed three Driving Logs with instructions to complete them on three days on which students drove in the coming week. Participants who did not turn in their Logs in 10 days were called and reminded.

## Results

Two-way (Gender x Anger Status) MANOVAs, employing the Wilks  $\lambda$  statistic, were run on measures assessed by a common methodology. Since there was but one significant multivariate interaction and a small number of gender effects, anger main effects are summarized in Table 1 and other effects in the text. Effect sizes are presented in terms of  $\eta^2$  with qualitative interpretation of effects sizes made according to Cohen's (1988) criteria wherein  $\eta^2$  of .01-.04 is considered a small effect, .05-.14 a moderate effect, and greater than .14 a large effect.

### *Anger in Response to Specific Situations*

Driving Scenarios (Table 1) revealed a significant multivariate effect for anger,  $F(3, 151) = 40.52, p < .001, \eta^2 = 0.45$ , and the interaction,  $F(3, 151) = 2.95, p < .05, \eta^2 = 0.06$ , but not for gender,  $F(3, 151) = 1.59$ . Univariate analyses revealed a significant interaction only for the Scenario involving another driver yelling at the participant about his/her driving,  $F(1, 157) = 4.35, p < .05, \eta^2 = 0.03$ . This interaction was due to the fact that low anger males and females did not differ significantly from one another ( $M_s = 19.68$  and  $19.71$ ), but high anger male drivers ( $M = 29.30$ ) reported significantly greater anger in this situation than did high anger female drivers ( $M = 25.82$ ). All Scenarios demonstrated large univariate anger effects (Table 1) due to high anger drivers reporting significantly more anger in ordinary traffic, when stuck in rush hour traffic, and when yelled at by another driver.

The individual's two most angering situations revealed a significant multivariate effect for anger,  $F(2, 155) = 28.43, p < .001, \eta^2 = 0.27$ , but not for gender or the interaction,  $F_s(2, 155) = 1.39$  and  $0.30$ . Both personal anger situations showed large univariate anger effects (Table 1) due to high anger drivers reporting greater anger in response to their most provocative situations than low anger drivers.

### *Driving Anger Expression*

Patterns of expressing anger while driving demonstrated a significant multivariate effects for anger and gender,  $F_s(4, 153) = 30.59$  and  $4.20, p_s < .001$  and  $.01, \eta^2_s = 0.44$  and  $0.10$ , but not for the interaction,  $F(4, 153) = 0.62$ . Univariate gender effects were found on physical, vehicular, and adaptive/constructive forms of anger expression,  $F_s(1, 156) = 5.05, 4.85,$  and  $10.50, p_s < .05, \eta^2_s = 0.03, 0.03,$  and  $0.06$ , but not on verbally aggressive expression,  $F(1, 156) = 0.18$ . Males reported significantly more physical and vehicular aggressive expression and less adaptive/constructive expression ( $M_s = 13.79, 21.71,$  and  $30.05$ ) than did women ( $M_s = 12.80, 19.68,$  and  $34.11$ ). Men and women did not differ on verbally aggressive expression ( $M_s = 27.81$  and  $28.30$ ). All forms of anger expression demonstrated large univariate anger effects (Table 1). High anger drivers reported expressing their anger more through verbal, personal physical and vehicular aggressive expression and less through adaptive/constructive means than did low anger drivers.



**Table 1**  
 Driving Anger, Anger Expression, Aggression, Risky Behavior, Crash-Related Outcomes, General Anger, and General Anger Expression as a Function of Gender and Anger Level

Measure	Group				Univariate Anger	Anger Effect
	Low Anger		High Anger			
	M	SD	M	SD	F (1,156)	Size ( $\eta^2$ )
<i>Anger in Response to Specific Situations</i>						
Ordinary Traffic	10.90	3.90	14.85	5.23	29.09**	0.160
Rush Hour Traffic	17.94	7.07	26.33	5.70	66.67**	0.303
Yelled at by Other Driver	19.69	5.63	27.58	5.14	80.20***	0.363
Personal Situation I	64.21	20.46	82.31	12.37	45.64***	0.226
Personal Situation II	56.76	20.68	76.66	13.55	52.36***	0.251
<i>Driving Anger Expression</i>						
Verbally Aggressive	23.09	6.60	33.03	7.72	75.73***	0.327
Physically Aggressive	11.67	1.37	14.91	3.75	54.26***	0.258
Use of Vehicle	16.41	4.21	26.10	7.58	85.71***	0.355
Adaptive/Constructive	35.68	7.90	28.49	8.38	32.86***	0.174
<i>State Reaction to Someone Steals the Parking Spot for which you Have Been Waiting</i>						
Anger	13.18	4.25	17.28	3.45	48.35***	0.237
Verbal Aggression	10.11	3.95	15.50	4.69	62.23***	0.288
Physical Aggression	5.89	2.05	8.29	4.09	23.39***	0.130
Positive Coping	7.56	2.91	4.99	2.29	32.56***	0.173
<i>Driving Log</i>						
Times Driven/day	2.48	1.51	3.12	2.15	2.62	0.025
Miles Driven/day	42.58	44.85	34.92	28.19	1.11	0.011
Frequency of Anger/day	0.88	0.78	1.99	1.81	17.79***	0.150
Intensity of Anger	29.95	23.90	50.83	22.44	20.06***	0.166
Aggressive Behavior/day	0.55	0.59	1.57	1.33	24.92***	0.198
Risky Behavior/day	1.81	1.37	3.15	1.85	16.84***	0.143
<i>Driving Survey</i>						
Aggressive Behavior/3 mo.	6.26	6.27	20.53	11.326	98.23***	0.386
Risky Behavior/3 mo.	15.58	7.86	27.41	13.61	24.03***	0.133
Lost Concentration/3 mo.	2.24	1.59	2.97	1.75	7.86**	0.048
Loss of Control/3 mo.	0.94	1.18	1.30	1.34	3.33	0.021
Close Call/3 mo.	0.99	1.16	1.40	1.23	4.79*	0.030
Moving Violations/3 mo.	0.20	0.46	0.41	0.85	3.84*	0.024
Minor Accidents/yr.	0.25	0.54	0.39	0.65	2.17	0.014
Major Accidents/yr.	0.06	0.24	0.11	0.32	1.23	0.008
<i>General Anger and General Anger Expression</i>						
Trait Anger	16.79	3.29	24.39	5.95	102.77***	0.397
Anger-In	16.14	3.60	17.65	4.38	5.62*	0.035
Anger-Out	14.78	3.06	18.49	5.07	31.94***	0.170
Anger-Control	25.03	4.64	21.19	4.97	25.58***	0.141

\*  $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

Note. The univariate  $df$  for all analyses is 1, 156, except for the Scenarios where  $df$  is 1, 153 due to three unusable questionnaires and for the Driving Log where  $df$  is 1, 101 due to several students not driving and therefore not completing Logs.

### *State Anger, Aggression, and Coping Following Visualized Provocation*

Responses to visualizing someone stealing the parking spot for which the driver had been waiting revealed a significant multivariate effect for anger,  $F(4, 153) = 17.80$ ,  $p < .001$ ,  $\eta^2 = 0.32$ , but not for gender or the interaction,  $F_s(4, 153) = 2.28$  and 1.48. Measures showed large anger effects, except for the moderate anger effect on physical aggressive tendencies (Table 1). High anger drivers reported more state anger and verbal and physical aggressive tendencies and less positive coping than low anger drivers.

### *Driving Logs*

Driving Logs were averaged over three days and yielded a multivariate effect for anger,  $F(6, 96) = 7.99$ ,  $p < .001$ ,  $\eta^2 = 0.33$ , but not for gender or the interaction,  $F_s(6, 96) = 1.41$  and 1.09. No differences were found between groups on number of times or miles driven per day (Table 1), but large anger effects were found for the frequency and intensity of anger and the frequency of aggression and risky behavior while driving. High anger drivers were more frequently and intensely angered and engaged in more aggressive and risky behavior in day-to-day driving than low anger drivers. In fact, high anger drivers became angry 2.3 times more often than low anger drivers, aggressed 2.9 times more often, and engaged in 1.7 times more risky behavior. Moreover, it should be remembered that these are only daily averages. Over time, they take on added meaning. Extrapolated over a 300 driving day year, low anger drivers would be angered 264 times and engage in 165 acts of aggression and 543 risky behaviors, whereas high anger drivers would be angered 597 times and engage in 471 acts of aggression and 945 risky behaviors.

### *Aggression, Risky Behavior, and Crash-related Events on the Driving Survey*

Aggressive and risky behavior over the last three months demonstrated a multivariate effect for anger,  $F(2, 155) = 49.99$ ,  $p < .001$ ,  $\eta^2 = 0.37$ , but not for gender or the interaction,  $F_s(2, 155) = 2.66$  and 1.09. Univariate effect sizes were large and moderate, respectively, (Table 1). High anger drivers engaged in more aggressive and risky behavior than low anger drivers, approximately 3.3 times more aggression and 1.8 times more risky behavior. Crash-related measures showed a multivariate effect for anger,  $F(6, 151) = 2.85$ ,  $p < .05$ ,  $\eta^2 = 0.10$ , but not for gender or the interaction,  $F_s(6, 151) = 1.38$  and 1.09. High anger drivers reported more moving violations, losses of concentration while driving and close calls in the last three months than did low anger drivers (Table 1). No differences were found for minor losses of vehicular control in the last three months or minor and major accidents in the last year, although differences in losses of vehicular control approached significance ( $p < .08$ ).

### *Trait Anger and General Anger Expression*

Trait anger and forms of expressing anger generally revealed a significant multivariate effect for anger,  $F(4, 153) = 26.68$ ,  $p < .001$ ,  $\eta^2 = 0.41$ , but not for gender or the interaction,  $F_s(4, 153) = 0.81$  and  $0.90$ . All measures showed large anger effects (Table 1), except for Anger-In where a small anger effect was found. High anger drivers reported more general, trait anger, Anger-In, and Anger-Out and less Anger-Control than low anger drivers.

## **Discussion**

Relatively few gender differences were found. No gender effects were found for the Driving Logs, Surveys, Personal Situations, the state assessment following visualization of a provocation, or two of the Scenarios. Only the Scenario of being yelled at by another driver revealed a gender effect, and then it was only for high anger male drivers; high anger male drivers reported more anger in this situation than high anger female drivers, whereas low anger drivers did not differ. Gender differences were found on the expression of driving anger. High anger drivers reported that they expressed their anger more via using their personal physical presence and their vehicles as the means of expressing anger and that they were less likely to employ constructive means of expressing their anger. This relative lack of gender differences in this study replicates few gender differences in other studies (e.g., Deffenbacher, Deffenbacher, *et al.*, in press). However, even when gender differences are found, they do not always replicate. For example, gender differences were found in this study for three forms of anger expression, whereas men and women differed only on physically aggressive expression in another study (Deffenbacher *et al.*, 2002).

Before turning to theoretical explanations of findings, it is important to consider parsimonious alternatives. One such explanation is differential exposure to provocation. Assuming a somewhat random base rate of provocation on the road, if high anger drivers drove more frequently and/or more miles, then they would be exposed to greater provocation and frustration. They might, therefore, report more anger and aggressive and risky behavior as a function of exposure, rather than anything about their proclivity to become angry. There was, however, no support for this notion. High and low anger drivers did not differ in the frequency with which they drove or the number of miles driven. Therefore, findings are not attributable to differential exposure, but appear more to reflect something about the driver's emotional-behavioral repertoire in interaction with events while driving.

Hypotheses derived from state-trait anger theory received moderate to strong support. The frequency hypothesis was supported because high anger drivers reported being angered more than twice as often as low anger drivers, replicating findings from other studies of both general (Deffenbacher, Deffenbacher, in press; Deffenbacher, Lynch, Oetting, *et al.*, 2001) and clinical populations (Deffenbacher *et al.*, 2000).

The intensity hypothesis was supported on every measure. High anger drivers reported more intense anger in their driving diaries (Logs), in all common driving situations (Scenarios), in their worst case situations (Personal Situations), and in response to visualizing a frustrating event (State Anger). These findings supported the intensity hypothesis as found by others (Deffenbacher, Deffenbacher, *et al.*, 2000; Deffenbacher *et al.*, 2000; Deffenbacher, Lynch, Oetting, *et al.*, 2001) and extends them to situations involving greater interpersonal provocation and to the person's personally most provocative events.

The aggression and reduced positive coping with provocation hypotheses were also supported in every case. High anger drivers reported engaging in roughly three times more aggression on both the driving diaries and on the three-month survey, more verbal and physical aggressive urges following visualizing a provocation, and greater expression of anger via verbal, physical, and vehicular forms of aggressive expression. Additionally, they reported that they were less likely to express their anger through prosocial, adaptive/constructive means and that they were less likely to cope positively with anger following visualizing the anger-provoking incident in the parking lot. These findings support the aggression and reduced coping hypotheses and corroborate findings of Deffenbacher, Deffenbacher, *et al.* (in press).

Collateral hypotheses were at least partially supported. High anger drivers reported 1.7 to 1.8 times more risky behavior on their Logs and Driving Surveys and more moving violations, close calls and losses of concentration while driving, although no differences were found for major or minor accidents or losses of vehicular control, perhaps due to their relatively low bases rates. Thus, the risky behavior hypothesis was supported, and the negative outcomes hypothesis was partially supported, similar to findings of Deffenbacher, Deffenbacher, *et al.* (in press) and Deffenbacher *et al.* (2000).

Confidence in these conclusions is strengthened by four things. First, findings converge across methodologies (i.e., general surveys, state assessment following a visualized provocation, and diaries in the field). Second, findings generally replicated those in previous studies. Third, with a small number of exceptions, anger effect sizes are moderate to large in size, attesting to the magnitude of support for conclusions. Fourth, the absolute differences in several variables were quite large. For example, high anger drivers engaged in approximately triple the amount of aggression and nearly twice as much risky behavior, again suggesting robust, meaningful differences.

High anger drivers were also more generally angry and reported handling that anger in less constructive ways (i.e., higher in Anger-In and Anger-Out and lower in Anger-Control). Greater general anger and outward, negative expression of anger is similar to the findings of Lajunen and Parker (2001) who reported positive correlations between measures of general anger/hostility and aggressive expression and aggression on the road. Other research (Deffenbacher, Lynch, *et al.*, 2002; Richards, Deffenbacher, & Lynch, 2000) suggests that high anger drivers are more generally anxious and impulsive as well. Such characteristics may interact negatively with the driving anger and exacerbate anger, aggression, and risk-taking while driving. That is, because of the elevated general anger and poorer handling of that anger, the high anger driver is more likely to get behind

the while in an angry, agitated state and react with more anger and impulsive, perhaps risky and aggressive behavior, demonstrating anger facilitation effects wherein anger from a prior provocation that has little situational parallel to the next provocation increases the probability of anger and aggression (Zillman, 1971). Increased anxiety and distress from elevated trait anxiety may also lead to facilitation anger and aggression (Berkowitz, 1990), wherein many negative physical and affective states, other than anger increase the probability of anger and aggression. Either or both of these effects increase the probability of anger for the high anger driver who is entering an environment, driving, to which he/she is already vulnerable for anger and aggression. These characteristics suggest greater chances of anger and distress carrying over from the pre-driving environment and eventuating in greater anger and tension behind the wheel, which, in turn, are more likely to carryover from the driving environment and influence post-driving relationships, performance of various roles (e.g., spouse, parent, or worker), general health and well being.

In summary, predictions derived from state-trait theory received support, except for the negative outcomes hypothesis, which was only partially supported. Taken together, findings also suggest that high anger drivers are an at-risk group. They were more frequently and intensely angered, engaged in more aggressive and risky behavior, experienced more of some crash-related outcomes, and possessed other psychological characteristics that were likely to exacerbate these characteristics.

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