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## Cognitive biases in aggressive drivers: Does illusion of control drive us off the road?



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### ABSTRACT

Anger has been shown to be a motivating factor in aggression and it is widely accepted that driving anger may lead to aggressive driving. However, the link between anger and aggressive driving is likely to be mediated by drivers' pre-existing cognitive biases and the subsequent situational evaluations made. This study investigated the extent to which optimism bias, illusion of control beliefs and driver anger predict self-reported hostile driving behaviours. A total of 220 licensed drivers (106 men; 114 women) completed a self-report questionnaire measuring trait driving anger, optimism bias, illusion of control and driving behaviour. Structural Equation Modelling showed that trait driving anger and illusion of control beliefs account for 37% of the variance in hostile driving behaviour scores. Optimism biases were unrelated to hostile driving behaviours. Thus, driving anger propensities and feelings of control over the situation, but not a general tendency to underestimate the likelihood of adverse outcomes, predict aggressive driving.

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## 1. Introduction

### 1.1. Cognitive evaluations and emotion

The influence of emotion on behaviour is often mediated by cognitive evaluations. For example, Lerner and Keltner's (2001) appraisal theory suggests that individuals predisposed to anger are more optimistic about risk. This is particularly evident when risk assessments are compared between self-evaluation of own risk likelihood and that of others. Lerner and Keltner stipulate that the key appraisal tendencies for individuals prone to anger are a sense of individual control over the situation and certainty over the outcomes. They have shown that angry disposition or trait anger is positively related to optimism and it relates to risky choices. Recently, Pietruska and Armony (2013) also demonstrated a relationship between trait anger and optimism, but were unable to link optimism directly to risk behaviour.

Other well-regarded affective-cognitive-behavioural theories have shown expressions of state anger are mediated by appraisals that include assessments of risk (Berkowitz, 1990; Lazarus, 1991). For example, Berkowitz's (1990) cognitive neoassociation model suggests that anger becomes aggression after assessments

of illegitimate goal impediments have been met and are coupled with an individual's belief that they can control the outcome of their reaction. Lazarus (1991) also suggests that the secondary appraisal process, which mediates the experiences and expression of emotion, involves assessments of an individual's ability to cope with the situation and expectations about the outcome.

Arguably, biases in the cognitive appraisals relating to control or risk and optimism about the outcome, are likely to exacerbate the influence of anger on aggression. For example, both *optimism bias* (Weinstein, 1980) and *illusion of control* (Langer, 1975) are biases that have been empirically linked to poorer judgments and increased risk-taking behaviour. Optimism bias is a tendency to overestimate the probability of positive events and underestimate the likelihood of negative events occurring to oneself. This can be an adaptive measure that reduces anxiety (Weinstein, 1980; Weinstein & Klein, 1995). Illusion of control beliefs are defined as the tendency to view chances for success as higher than the probability warrants (Langer, 1975). Individuals with high illusion of control beliefs tend to falsely attribute a chance outcome to their own skill. Both optimism bias and illusion of control have been widely used in psychological research, and both have been found to predict risky behaviour particularly in health (Weinstein, 1980) and gambling (Moore & Ohtsuka, 1997, 1999a, 1999b; Ohtsuka, 2013; Ohtsuka & Ohtsuka, 2010).

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## 1.2. Optimism bias, illusion of control and aggressive driving

Optimism bias and illusion of control beliefs have also been identified as factors in risky driving. Risky driving behaviours include speeding, tailgating and driving under the influence of drugs or alcohol (Dejoy, 1989; Hammond & Horswill, 2002; Harre & Sibley, 2007; Horswill & McKenna, 1999; Shinar, 1998). As risky driving behaviour is commonly observed in aggressive driving, biases toward unrealistic optimism and illusory control beliefs are also likely to predict aggressive driving. Drivers with optimism bias may be less inclined to fear negative repercussions of their aggressive driving acts, as they believe they are less likely than other drivers to experience negative outcomes. Illusion of control beliefs may also contribute to aggressive driving behaviour because in a driving context, drivers with higher illusions of control are likely to (incorrectly) attribute driving successes to their driving ability (Hammond & Horswill, 2002; Horswill & McKenna, 1999). Aggressive driving may, at least in part, rely on incorrect assessments of control. Recently in a self-report study, Sümer, Özkan, and Lajunen (2006) found positive relationships between driver overconfidence, operationalised by variables resembling optimism bias and illusion of control, and risky driving behaviours. However, while the relationship between self-enhancement and risky driving was clear, it is less clear how these relate to aggressive driving behaviour.

It is commonly accepted that anger prone drivers are also more aggressive drivers (Deffenbacher, Oetting, & Lynch, 1994; Stephens & Sullman, under review; Sullman & Stephens, 2013). Deffenbacher et al. (1994) propose the trait of 'driving anger' which is the extrapolation of trait anger into context-specific driving situations. Although a link between driving anger and aggressive driving is indisputable, not all angry drivers will become aggressive drivers. When other triggers for aggressive driving have been examined, situational predictors including presence of aggressive stimuli such as rude bumper stickers or weapons (Turner, Layton, & Simons, 1975), traffic congestion (Hennessy & Wiesenthal, 1999; Shinar, 1998) and status of other vehicles (McGarva & Steiner, 2000; Stephens & Groeger, 2014) have all been highlighted. However, each of these rely on some assessment of the situation and it is this assessment that is likely to lead to reactive behaviour. For example, Stephens and Groeger (2014) examined Berkowitz's hostile aggression theory in a simulated driving environment by subjecting drivers to impediment by slower lead drivers. The impediment was manipulated in terms of behavioural culpability and status of the lead driver. They found that impediment by lower status drivers provoked more anger and aggressive reaction even when these drivers were not culpable for their actions. Further, noting differences in anger expression by high anger drivers (Stephens & Groeger, 2009), cognitive biases, such as those identified in the appraisal tendency framework (Lerner & Keltner, 2001) may determine the degree to which anger contributes to aggressive driving.

The aim of the current study was to examine the contribution of driving anger, optimism bias and illusory control beliefs in predicting self-reported aggressive driving behaviour. It was expected that scores for trait driving anger (Hypothesis 1), Illusion of Control (Hypothesis 2) and Optimism bias (Hypothesis 3) would predict self-reported aggressive driving behaviours.

## 2. Method

### 2.1. Participants

A total of 220 drivers (106 men; 114 women) were recruited from a community sample in Melbourne, Victoria ( $n = 182$ : 99 men, 83 women) and from first-year psychology classes at Victoria

University ( $n = 38$ ; 7 men, 31 women). Participants' age ranged from 18 to over 60, with 52% of the sample aged between 18 and 30. The length of holding a license ranged between 1 year and over 30 years, with an even split for years licensed. For example, approximately 25% of the sample had been driving less than 3 years; approximately 25% had been driving 4–10 years; approximately 25% had been driving 11–20 years and the remaining 25% had been driving over 21 years.

### 2.2. Measures

#### 2.2.1. Driving anger scale (DAS)

The 14-item DAS was used to provide an overall measure of driving anger (Deffenbacher et al., 1994). The scale presents 14 different situations and asks participants to rate how angry each situation would make them feel. Ratings are measured on a five-point Likert-type scale (1 = not at all, 5 = very much). Item scores are combined to form a total DAS score with higher scores indicating greater propensities to become angered while driving. The DAS has demonstrated good internal consistency (Cronbach's  $\alpha = .80$ ; Deffenbacher et al., 1994) and has been found to have good 10 week test–retest reliability (Cronbach's  $\alpha = .84$ ; Deffenbacher, Filetti, Lynch, Dahlen, & Oetting, 2002). The validity of the measure has been demonstrated through correlations with the Trait Anger Scale (Deffenbacher et al., 1994; Villieux & Delhomme, 2007).

#### 2.2.2. Optimism bias (OB)

OB was measured with Dejoy's (1989) 10 scenarios regarding accident risk. Each short scenario describes a crash-related situation that may occur while driving. For example, "losing control of your vehicle at high speed and crashing into another vehicle". Participants rate the likelihood of each scenario happening to them when compared to the average driver. Ratings are on 5-point Likert-type scale (1 = much higher, 5 = much lower). Higher scores indicate higher levels of OB. The scale had good internal reliability in the current study (Cronbach's  $\alpha = .82$ ).

#### 2.2.3. Illusion of control beliefs (IoC)

IoC were also measured using Dejoy's (1989) 10 scenarios of accident risk. IoC beliefs occur in predominantly chance based situations, therefore, participants were asked to rate the amount of control they would have over each scenario. Ratings were on a 5-point Likert-type scale (1 = no control, it's up to chance, 5 = completely controllable). Higher scores on the scale indicate stronger IoC beliefs. The scale had acceptable reliability in the current study (Cronbach's  $\alpha = .66$ ).

#### 2.2.4. Aggressive driving behaviours (ADB)

ADB were measured using 29 scenarios from the hostile behaviour continuum of James and Nahl (2000). Participants were asked to rate on a 5-point Likert-type scale (1 = never; 5 = always) how frequently in the past year they had engaged in each driving behaviour (e.g. "made obscene gestures at other drivers"). Factor analysis on this scale showed two separate factors: *hostile aggressive driving behaviour*, containing 16 items (Cronbach's  $\alpha = .92$ ) and *extreme aggression* containing 9 items (Cronbach's  $\alpha = .85$ ). After dropping four items, the ADB scale provides high internal consistency on *hostile aggressive driving behaviour and extreme aggression*.

### 2.3. Procedure

The study was approved by the University ethics committee. Participants were recruited by convenience sampling methods. Prospective participants who had agreed to take part received a letter of invitation to participate that outlined the purpose of the

study, contained the informed consent form, the questionnaire, and a pre-paid envelope. Participants were requested to complete the survey in their own time and return with the consent form via postal mail. Responses were anonymous. Of 325 surveys distributed, 220 were returned (a response rate of 68%).

### 3. Results

#### 3.1. Data set preparation

Data were excluded for a scale if 10 percent or more of the items were missing. If less than 10 percent, then missing items were replaced with a trimmed mean item score for that scale. Only one case was excluded for too much missing data on the Optimism Bias scale.

Prior to analysis, the distribution of each variable was checked for normality. Skewness and kurtosis of the driving anger scale, optimism bias scale, illusion of control scale and the hostile aggression variable were all within the normal range (skewness < 1; kurtosis < 1.4 in all cases). The extreme aggression factor was positively skewed. This is to be expected given the infrequency of extremely aggressive behaviours. Given the absolute skewness and kurtosis of this variable, square-root transformations were performed which resulted in acceptable absolute values (Skewness < 2; Kurtosis < 7; West, Finch, & Curran, 1995).

#### 3.2. Main analysis

The relationships between trait driving anger, illusion of control beliefs, optimism biases and self-reported hostile aggression and extreme aggression were analysed using Structural Equation Modelling (SEM). For each latent construct in the structural model, three composite variables were created using the item-to-construct parceling method, so that the measurement weighting across the set of indicators was statistically similar. This method helped reduce the number of observed variables and was more appropriate for the sample size (Little, Cunningham, Shahar, & Widaman, 2002). For the DAS, the three composite variables contained, four, five and five items respectively. For IoC and OB scales composites contained three, three and four items. For the hostile aggression variable, composites consisted of six, six and four items; and, for the extreme aggression variable, three, three and two items were grouped in the three composites.

The SEM was conducted using EQS v 6.1 for windows (Bentler, 2005). Robust Maximum Likelihood (ML) method was used as Mardia's normalised co-efficient was >5.00, indicating non-normal multivariate distribution. Goodness of fit indices were taken from the Robust ML estimates and model fit was evaluated using the Satorra-Bentler Scaled Chi-Squared ( $S-B\chi^2$ ),  $S-B\chi^2/df$  index, adjusted Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). Acceptable model fit is traditionally indicated by  $df$  index <5.00, an adjusted CFI of .90 or greater, an RMSEA of 0.06 or less and a confidence interval (C.I.) reporting a

90% interval surrounding the RMSEA acceptable level <.05 (Browne & Cudeck, 1993).

#### 3.2.1. Variable means and Intercorrelations

The intercorrelations between driving anger, illusion of control beliefs, optimism bias and self-reported aggressive behaviours are listed in Table 1, as are the means, standard deviations and internal consistency alpha coefficients. The mean driving anger score was 2.50 (1.90) out of a possible five, indicating that drivers in the sample had tendencies to become moderately angered while driving. One sample  $t$ -tests confirmed the driving anger scores were significantly lower ( $ps < .05$ ) than reported means for drivers in New Zealand ( $M = 2.72$ ,  $SD = .68$ ; Sullman & Stephens, 2013), Turkey ( $M = 2.88$ ;  $SD = .68$ ; Sullman, Stephens, & Kuzu, 2013), England ( $M = 2.69$ ;  $SD = .66$ ) and Ireland ( $M = 2.92$ ;  $SD = .64$ ; Stephens and Sullman, under review).

The means for illusion of control beliefs and optimism bias were both greater than three, the midpoint on a five-point scale. Namely, values greater than three indicate that on average drivers considered themselves more likely to be able to control a situation (IoC) or less likely to have negative situations happen to them (OB) when compared to other drivers. One-sample  $t$ -tests confirmed that scores for both optimism bias ( $t(219) = 18.33$ ,  $p < .001$ ) and illusion of control ( $t(219) = 20.51$ ,  $p < .001$ ) were significantly greater than 3. Thus, the self assessment of driver cognition indicates the presence of two types of cognitive constructs (biases) in the sample.

When the intercorrelations between the variables were examined, the strongest relationship was found between trait driving anger and self-reported aggressive behaviour. This relationship confirms that drivers who were more prone to anger while driving also reported more aggressive expressions of anger. Illusion of control had no relationship with trait driving anger and shared moderate, reliable correlations with optimism biases and hostile aggression.

#### 3.2.2. Modelling self-reported aggressive driving

To understand the extent to which driving anger, illusion of control and optimism biases predict self reported aggressive behaviours, data were analysed using SEM. The measurement model, based on Robust ML estimates, showed good fit to the data:  $S-B\chi^2_{(38)} = 69.55$ ,  $p < .01$ ,  $S-B\chi^2/df$  index = 1.83,  $CFI = .95$ ,  $RMSEA = 0.06$ , (90% C.I. = 0.04–0.08). All factor loadings were statistically significant and ranged from 0.62 to 0.98. The largest factor loading was between the hostile aggression item and overall aggressive factor. The Rho was 0.92.

The structural model (see Fig. 1) loaded the factors for driving anger, optimism bias and illusion of control on to the overall aggression factor. The model produced acceptable goodness of fit indices with a RMSEA value within the stringent upper limit of 0.07 (Steiger, 2007):  $S-B\chi^2_{(38)} = 75.05$ ,  $p < .01$ ,  $S-B\chi^2/df$  index = 1.97,  $CFI = .95$ ,  $RMSEA = 0.07$ , (90% C.I. = 0.04–0.09).

Figure 1 shows that the optimism bias factor was not a statistically significant predictor of self-reported hostile driving

**Table 1**  
Pearson correlations among variables; means, standard deviation and internal consistency.

	1	2	3	4	5
1. Trait driving anger	$\alpha = 0.89$				
2. Illusion of control	.01	$\alpha = 0.66$			
3. Optimism bias	.15*	.37***	$\alpha = 0.82$		
4. Hostile aggression	.62***	.30***	.30***	$\alpha = 0.92$	
5. Extreme aggression	.35***	.20**	.16*	.55***	$\alpha = 0.85$
M (SD)	2.50 (1.90)	3.35 (0.52)	3.66 (0.54)	0.82 (0.40)	0.25 (0.30)

Notes. \*\*\* $p < .001$ ; \*\* $p < .01$ ; \* $p < .05$ ;  $\alpha$  = Cronbach's Alpha coefficient.

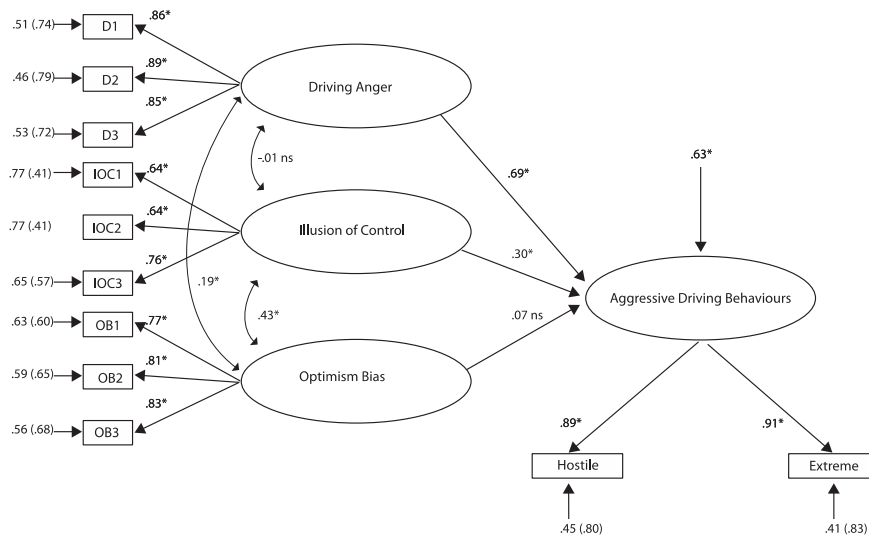


Fig. 1. Structural Equation Model of self-reported aggressive driving behaviours.

behaviours. Driving anger and illusion of control both predicted hostile behaviours and accounted for 37% of the variance in the hostile behaviour scores. Driving anger shared the largest relationship with hostile driving behaviours. Driving anger and illusion of control were unrelated.

#### 4. Discussion

The aim of the current study was to examine the contribution of trait driving anger, optimism bias and illusion of control in self-reported aggressive driving behaviours. A structural model showed that, as hypothesised, aggressive driving behaviour, comprising hostile aggressive behaviours (such as making hostile gestures or slowing down when being tailgated) and more extreme aggression (getting out of the car to yell at someone) could be predicted by *trait* driving anger (Hypothesis 1) and illusion of control beliefs (Hypothesis 2). Contrary to what was expected, scores for optimism bias (Hypothesis 3) did not significantly contribute to the prediction model of self-reported aggressive driving.

The results offer support for McKenna's (1993) suggestion that illusion of control, not optimism bias, is important in assessment of traffic accident risk. McKenna argued that researchers tend not to distinguish between controllable and uncontrollable situations when measuring optimism bias and thus, relationships between optimism bias and estimates of positive outcomes are confounded by perceived control. For example, DeJoy (1989) examined optimism biases in risk assessments of drivers and concluded that optimism bias exists because drivers overestimate the control they have in specific situations. McKenna addressed this point by measuring safety beliefs for participants when they were imagining both driving a motor vehicle, and when being driven in a motor vehicle. He found that optimism biases were only present in situations where the participants *imagined* driving, and thus had a sense of control. In the study of drivers reported above, illusion of control and optimism bias were moderately correlated suggesting these constructs are similar, yet still distinct from each other. Both illusion of control and optimism bias scores shared positive correlations with self-reported aggressive driving behaviours in correlational analysis. However, bivariate correlations do not take into account the joint effects of these on either anger or aggression. When considered simultaneously in the structural model, it was the element of control that contributed toward aggressive driving behaviour. Thus we speculate that optimism bias is related to

perceived positive driving outcomes because, in the driving context, drivers base a part of their judgment on the sense of control they have over the outcome. This sense of control is likely to result from underlying perceived skills, which overlap with illusion of control. Indeed drivers tend to self-enhance their skills compared to reference drivers (McKenna, 1993).

The study is the first to examine optimism bias and illusion of control beliefs in relation to self-reported aggressive driving behaviour and the first to model the relationship of these with trait driving anger propensities. The study is also among the first to offer comparisons of driving anger propensities from an Australian sample with drivers from other countries. Driving anger means were reliably lower than those reported for drivers from neighbouring countries such as New Zealand (Sullman & Stephens, 2013) or in the Northern hemisphere, such as Turkey (Sullman et al., 2013), United Kingdom and Republic of Ireland (Stephens & Sullman, under review). Trait anger scores have been found to sometimes (Deffenbacher, Lynch, Filetti, Dahlen, & Oetting, 2003), but not always (Berdoulat, Vavassori, & Sastre, 2013), differ across gender. However, the current study had a relatively even gender split and this is similar to the distributions in the studies to which the means have been compared. One exception is that the Turkish sample was all men. The age of the current sample had a wide distribution, although the majority of drivers (53%) were less than 30 years old. The average ages of drivers in the comparative studies were older (ranging between 35 and 42 years). As driving anger is also expected to decline with age (e.g. Stephens & Groeger, 2009) it is unlikely that the differences found in mean scores are due to average ages in the samples. Thus, although there may be other contributing factors that were not measured in this study, the Australian sample reported that they were less prone to driving anger compared to their counterparts abroad. However, under the condition with moderate predispositions toward driving anger in this sample, SEM predicts both mild and extreme forms of driver aggression.

The results are consistent with previous research demonstrating relationships between trait anger, perceived control and aggression (Lerner & Keltner, 2001) and extend these findings by demonstrating the anger-control-aggression relationships in a sample of drivers. These relationships are likely to be reciprocal. For example, expressions of anger are reliant upon an appraisal process that includes assessments of control (e.g. Lerner & Keltner, 2001). Feelings of control in turn are likely to trigger anger (e.g. Berkowitz, 1990). Berkowitz (1990) suggests that anger is



more likely to be produced when a goal has been blocked, the cause of which is attributed to another person. Participants with self-enhanced perceptions related to control and by its nature, perceptions of skill, may be more likely to view obstructions as the result of another driver, and perceive a “deficiency” in the other person’s driving skills. Attributing anger or misattributing blame is a common error when the driver being blamed is perceived to be of a lesser status (Stephens & Groeger, 2014). Illusion of control beliefs may also compensate, or overcompensate, for loss of control (James & Nahl, 2000). Driving anger often occurs in situations when progress is impeded (Deffenbacher et al., 1994; Stephens & Groeger, 2011). In these circumstances perceptions of lost control are probable. Illusion of control provides a more practical reaction in a driving situation than learned helplessness. Unfortunately, illusion of control is no longer adaptive when it culminates in aggressive driving.

#### 4.1. Study limitations

The study suffers from the usual criticisms relating to the use of self-report scales that can elicit socially desirable responses. The driving anger scale and the self-reported driving behaviours are likely to be the most vulnerable given their sensitive nature. Although concerns are raised with regard to the influence of social desirability on self-report measures (e.g. van Hooft & Born, 2012; Viswesvaran & Ones, 1999), the driving anger scale has been extensively tested and has a body of published norms. Strong correlations have been found with state anger (see Deffenbacher et al., 1994) as well as with dangerous driving behaviours measured in driving simulators (Deffenbacher et al., 2003) and in real traffic conditions (Underwood, Chapman, Wright, & Crundall, 1999). Lajunen and Summala (2003) investigated the influence of social desirability on self-reported aberrant driving behaviours and reported little evidence of socially desirable responses. Further, Sullman and Taylor (2010) also suggest that the effect of social desirability bias on self-reported risky driving behaviours is not necessarily substantial. However, more research using more objective affective and behavioural measurements is needed to further explore the issue of illusion of control in driving aggression.

#### 4.2. Implications

The results provide evidence that an illusion of control may exacerbate the influence of trait driving anger on aggressive driving behaviours. While the relationship between anger and aggressive driving is indisputable, not all angry drivers will become aggressive and not all aggressive drivers will be angry. Thus, identifying how cognitive biases may influence driving behaviour, particularly in situations where arousal is likely to influence situational evaluation is an important first step in identifying strategies to reduce these dangerous driving behaviours.

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