Self-reported likelihood of speeding: The effects of attitudes, personality, and perceived legitimacy of enforcement

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Abstract

The positive relationship between speed and crash risk and severity is robust and well-established. While excessive speeding is typically regarded by the public as a common contributing factor in road crashes, speeding remains a common traffic infringement and an arguably socially acceptable behaviour, particularly at low levels over the speed limit. This suggests that other factors potentially contribute to this disparity between crash perceptions and actual behaviours. Previous work has described associations between perceptions of the legitimacy of speed enforcement, attitudes, and how they relate to the likelihood of speeding. This study sought to more closely examine the nature of the relationships between these variables. In total, 293 Queensland drivers participated in a study that examined how demographics, personality variables, attitudes, and perceptions of the legitimacy of enforcement contributed to drivers' self-reported likelihood of speeding. Results suggested that positive attitudes towards speeding had the greatest impact on likelihood of speeding behaviours. Being younger and higher levels of the personality trait of extraversion were also associated with greater levels of self-reported likelihood of speeding. Attitudes were found to mediate the relationship between perceived legitimacy of speed enforcement and self-reported likelihood of speeding. A subgroup analysis of participants with positive and negative attitudes towards speeding revealed that a differential set of variables were predictive of self-reported likelihood of speeding for the two subgroups. This highlights the potential importance of attitudes in understanding the influence of perceptions of legitimacy of speed enforcement on speeding behaviour, and the need for targeted rather than a 'one size fits all' approach to changing attitudes and ultimately behaviour. The findings of the current study help to further understand why some drivers continue to speed.

Introduction

A number of improvements have been made to reduce risky driving behaviours. These improvements have resulted in substantial decreases in the amount of fatalities and trauma from road crashes. The improvements have partly been brought about by education campaigns, improvements in vehicle and road engineering, and increased enforcement practises. Nonetheless, a number of safety problems still persist and no jurisdiction should be content with their current road safety performance. In particular, speeding (i.e., driving over the posted speed limit or driving too fast for the conditions) still remains a prominent risky driving behaviour that warrants examination.

A substantial amount of research has shown that increases in vehicle speed are positively related to crash risk and severity. As vehicle speed increases, there are five major outcomes: the driver has less time to react to a hazardous situation (Lay, 1986; Shinar, 2007); other road users also have less time to react to the speeding vehicle (Keall, Povey, & Frith, 2001; Lay, 1986); a vehicle becomes less stable for manoeuvres (Carseldine, 2003; Evans, 2004); greater stopping distances are required (Mountain, Hirst, & Maher, 2005; Vaca, 2006); and the severity of any consequent collision increases (Goldenbeld & van Schagen, 2005; Hirst, Mountain, & Maher, 2005). The first four factors attest to findings that speeding increases the likelihood of crashing. However, the last factor is perhaps the most critical factor when considering the severity of speed related collisions. An increase of 1% in speed can increase the fatality risk by 4-12% (Evans, 2004).

Drivers' perceptions regarding the risks associated with speeding may be incongruent with their actual behaviours. Surveys of drivers reveal that speeding is usually cited as the most common risky

driving behaviour in terms of crash risk (e.g., Pennay, 2008; Vanlaar, Simpson, Mayhew, & Robertson, 2008). However, this perception is not always reflected in low incidence rates of speeding. For instance, observational studies of various roads with differing posted speed limits across a number of jurisdictions suggest that approximately half (44.6%) of the drivers observed were exceeding posted speed limits (Glendon, 2007). Similar prevalence rates have been noted in other studies (Glendon & Sutton, 2005; Radalj & Sultana, 2009). Younger drivers (Oltedal & Rundmo, 2006; Williams, Kyrychenko, & Retting, 2006) and male drivers (Iversen & Rundmo, 2002; Stradling, Meadows, & Beatty, 2004) are recognised to engage in speeding more frequently. The disparity between perceptions of the risks associated with speeding and their actual on-road behaviours suggests that other factors could influence drivers' speed choice.

The effects of personality constructs also have the potential to influence the likelihood of speeding. Personality traits can be defined as the individual differences in the tendency to show consistent patterns of thoughts, feelings and behaviours (Goldberg, 1999; McCrae & Costa, 1995). The personality construct of extraversion has been found to have a positive relationship with speeding behaviours (Dahlen & White, 2006). Other studies have shown that personality constructs of conscientiousness and agreeableness have a negative association with speeding behaviours (Arthur & Graziano, 1996; Sümer, Lajunen, & Özkan, 2005). A meta-analytic study found that the personality construct of extraversion was also positively associated with traffic crashes, while conscientiousness and agreeableness were negatively associated (Clarke & Robertson, 2005). These studies suggest that personality constructs can be an important predictor of whether someone will engage in speeding behaviours or not.

Another relevant aspect of personality is the construct of risk taking. Risk taking has been found to be positively associated with self-reported likelihood of engaging in speeding behaviours (Machin & Sankey, 2008). Higher levels of risk taking have also been shown to be associated with retrospective on-road driving crashes (Iversen & Rundmo, 2002; Patil, Shope, Raghunathan, & Bingham, 2006). Moreover, aspects of risk taking have been associated with risky on-road driving behaviours that were observed by global positioning systems (GPS) mounted to drivers' vehicles (Greaves & Ellison, 2011). It has also been noted that younger drivers are more likely to engage in risky driving behaviours (Hatfield & Fernandes, 2009). Therefore, examining the influence that risk taking has on self-reported speeding behaviour appears worthwhile.

Driver attitudes are also a potentially salient factor in the decision to engage in speeding behaviours. For example, more favourable attitudes towards speeding would likely lead to the individual speeding more. As many drivers choose to drive at speeds that are slightly higher than the posted speed limits (Fleiter & Watson, 2006), it has been argued that speeding, at least at low levels over the limit, is a socially acceptable behaviour (Corbett, 2001; Vaca, 2006), with speeding by small amounts over the posted speed limit not perceived as a genuine traffic offence (Corbett, 2001; Fleiter & Watson, 2006). Positive attitudes towards speeding may be reinforced by the relatively low occurrence of having a crash. That is, when an individual exceeds the speed limit and no negative outcome occurs (i.e., a crash), this can diminish the perception of increased crash risk associated with increased travel speed. Similarly, a number of studies have suggested that avoidance of punishment does more to reinforce behaviour than the experience of punishment does to deter it (Stafford & Warr, 1993). It is possible that repeated experiences of engaging in speeding behaviour without detection and punishment decreases an individuals' perceived risk of getting caught. Lack of negative consequences (crash or penalty) of speeding may serve to reinforce positive attitudes towards speeding.

The cited literature describes several factors that can affect the likelihood of engaging in speeding behaviours. Another factor that is starting to receive an increasing amount of research interest is the effects of the legitimacy of police enforcement for illegal traffic behaviours. If an individual believes that an illegal traffic behaviour does not represent a substantial crash risk, and/or has

positive attitudes towards engaging in the behaviour, then it follows that they may also perceive the enforcement of that behaviour as less legitimate (Watling & Leal, 2012). This belief system could then result in the individual not complying with the traffic laws (McKenna, 2007b).

Perceptions of the legitimacy of speed enforcement could also be a salient issue for compliance with speed limits. Previous work has shown that perceptions of legitimacy of traffic enforcement, attitudes, and self-reported likelihood of engaging in illegal driving behaviours are moderately associated (Watling & Leal, 2012). However, some studies have measured attitudes with items that potentially are measures of perceptions of legitimacy. It has been argued that perceptions of legitimacy and attitudes are separate but related constructs (McKenna, 2007a, 2007b). That is, attitudes surrounding speeding behaviour are, by definition, different from perceptions of enforcement of speeding laws. However, scant research has been conducted regarding their associations and how these two constructs affect likelihood of speeding in a multivariate analysis. Examining the potential influence of perceptions of the legitimacy of speed enforcement on speeding behaviour may enhance our understanding of why speeding remains a relatively widespread traffic behaviour problem.

The Current Study

The aim or '*vision*' of the current study was to examine the associations between self-reported speeding behaviours and a number of individual factors that have been identified as being predictors of speeding behaviour. These individual factors included: demographics; personality constructs; attitudes; and perceptions of the legitimacy of speed enforcement. As there is scant research that has examined how attitudes and perceptions of enforcement affects the likelihood to engage in self-reported speeding behaviours, the second aim was to perform a subgroups analysis. This subgroups analysis examined individuals that have negative attitudes versus positive attitudes and how these two groups differed with respect to the study variables. Enhancing our understanding of the factors that predict the likelihood of engaging in speeding behaviour can potentially lead to the identification of appropriate targets (i.e., '*actions*') for intervention strategies designed to reduce speeding behaviour and associated road trauma (i.e., '*results*').

Method

Participants

Recruitment invitations were sent electronically via email distribution lists of the Queensland University of Technology (QUT), social networking sites and a research participation link on the website of the Centre for Accident Research and Road Safety – Queensland (CARRS-Q). The eligibility criteria for the study included having a current Open driver's licence and currently driving on Queensland roads. In total, 293 valid responses were received. The mean age of the participants was 39.06 years (*SD* = 14.96; range = 20-84 years) with over half of the sample being female (59.1%). Participants were offered the opportunity to enter a draw to win one of six $50 AUD petrol vouchers as a small thank you gift for their time and participation.

Measures

Demographic information

The demographic information collected included participant age, gender and current employment status. Traffic-related demographic data, such as the duration of licensure and a measure of driving exposure (i.e., number of hours driven per week), was also collected.

Likelihood of speeding

Self-reported likelihood of speeding was measured via four custom written items. These items

measured how likely participants reported they would be to engage in four different speeding situations (i.e., drive over the posted speed limit when alone, with passenger/s, when there is little traffic, or on highways) in the next month. These items were measured on a 5-point Likert scale scored from 1 (extremely unlikely) to 5 (extremely likely). The four items were averaged to create a scale score.

Personality

Personality was measured via the 50 item International Personality Item Pool (IPIP) (Goldberg, 1999). The IPIP measures personality with a five-factor model that includes: extraversion; conscientiousness; agreeableness; emotional stability; and intellect/imagination. Each of these factors is assessed by 10 items, which are summated for each personality factor score. Specifically, participants rated how accurately a series of statements described them on a 5-point Likert scale scored from 1 (very inaccurate) to 5 (very accurate). Examples included: "Don't mind being the centre of attention" (Extraversion), "Pay attention to details" (Conscientiousness), "Feel little concern for others" (Agreeableness; reverse scored item), "Get stressed out easily" (Emotional stability), and "Have difficulty understanding abstract ideas" (Intellect/imagination; reverse scored item). The IPIP is a reliable (Socha, Cooper, & McCord, 2010) and valid (McAbee & Oswald, 2013) measure of personality.

Risk taking

Risk taking was measured with eight items that specifically focused on the driving context (Donovan, 1993). Participants rated how often they would engage in the behaviours using a 4-point Likert scale scored from 1 (never) to 4 (very often); for example "Drive dangerously because you enjoy it". Item scores were averaged to create a risk taking scale score. The scale has shown good reliability (i.e., Cronbach's alpha = .83) (Donovan, 1993) and has demonstrated predictive and construct validity (Bingham, Elliott, & Shope, 2007).

Attitudes

The attitudes of participants towards speeding were measured using the definitions component from Akers' social learning theory (Akers, Krohn, Lanza-Kaduce, & Radosevich, 1979). Participants indicated their agreement with two positive (e.g., "People who exceed the speed limit are generally more careful on the road"), two neutral (e.g., "It's okay to exceed the speed limit, as long as no one gets hurt"), and two negative (e.g., "There is no excuse for speeding") statements using a 5-point Likert scale scored from 1 (strongly disagree) to 5 (strongly agree). The negative items were reversed scored and then the six item scores were averaged to create a scale score.

Perceived legitimacy

The perceived legitimacy of speed enforcement was measured via seven items that described enforcement activities in seven different situations. Participants indicated their agreement with the statements using a 5-point Likert scale scored from 1 (strongly disagree) to 5 (strongly agree). Example items included: "It is fair to enforce speeding laws using fixed speed camera devices" and "It is fair to enforce speeding laws anywhere on the road network". The format of the items was based on the phrasing used by Poulter and McKenna (2007). The seven item scores were averaged to produce a scale score.

Procedure

Ethical and health and safety approvals were obtained prior to the distribution of electronic invitations to participate in the study. The electronic invitations were distributed via university research participation webpages, university mailing lists, and a social networking site (i.e., Facebook). When participants navigated via their web browser to the survey webpage, they were

presented with information about the study before completing the survey. Submission of the survey constituted consent. The survey took approximately 10-15 minutes to complete.

Results

Demographic characteristics

The majority of participants (86.4%) were employed in some capacity (i.e., full-time 57.7%, part-time 10.2%, casual 8.9%, self-employed 9.6%) with the remaining sample being unemployed (4.4%) or students (9.2%). The average duration of licensure was 19.68 years (*SD* = 14.70). The majority of the sample drove between 1-10 hours per week (61.1%), while one third (33.1%) of the sample drove 10-20 hours per week and 5.8% drove more than 20 hours per week.

The means, standard deviations, and Cronbach's alphas for likelihood of speeding, personality factors, risk taking, attitudes, and perceived legitimacy scales can be found in Table 1. The internal consistency of all scales was adequate (Cronbach's alpha > .70). The distribution of risk taking scores was extremely positively skewed and therefore could not be used in the regression analysis. These scores were recoded into a dichotomous variable to those that show some (scores greater than 1, 46.90% of sample) or no risk taking propensity (scores of 1, 53.10%) for use in analyses.

Table 1. Means, Standard Deviations, and Cronbach's Alphas for study variables

Variable	*M*	*SD*	Cronbach's α	No. items	Range
Likelihood of speeding	2.94	1.33	.95	4	1-5
IPIP Extraversion	32.63	7.27	.88	10	10-50
IPIP Conscientiousness	33.66	5.30	.80	9[a]	9-45[a]
IPIP Agreeableness	40.39	5.23	.79	10	10-50
IPIP Emotional stability	33.68	7.17	.87	10	10-50
IPIP Intellect/imagination	37.59	5.09	.74	10	10-50
Risk taking	1.20	0.36	.90	8	1-4
Attitudes	2.29	0.96	.89	6	1-5
Perceived legitimacy	3.66	0.98	.91	7	1-5

[a] Due to a technical error, the data from one item on this scale was not recorded in the database.

Bivariate analysis

Table 2 displays the bivariate correlations between the study variables. A number of the study variables were significantly correlated with the dependent variable of speeding likelihood. The significant correlations between the study variables and the speeding likelihood variable were moderate in their strength of association, except for the correlation with attitudes, which was a large correlation. The largest correlation in the study was between the predictor variables, attitudes and perceived legitimacy.

Table 2. Bivariate correlations between speeding likelihood and study variables

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Speeding likelihood	-										
2. Age	-.27**	-									
3. Gender (male)[a]	-.04	-.18**	-								
4. IPIP Extraversion	.18**	.17**	-.28**	-							
5. IPIP Conscientious	-.16**	-.17	.02	.11	-						
6. IPIP Agreeableness	-.09	-.04	.36**	.41**	.23**	-					
7. IPIP Emotional Stability	-.09	-.15*	.19**	.16**	.34**	.13*	-				
8. IPIP Intellect Imagination	.03	.07	-.20**	.38**	.13*	.31**	.11	-			
9. Risk taking (some)[a]	.37**	-.15*	-.19**	.06	-.16**	-.08	-.05	.11	-		
10. Attitudes	.64**	-.20**	-.03	.01	-.13*	-.11	.05	.04	.29**	-	
11. Perceived legitimacy	-.40**	.07	.04	-.05	.02	-.03	-.09	-.05	-.24**	-.71**	-

** $p < .01$, * $p < .05$; [a] Point bi-serial correlation

Multivariate analyses

Predicting Self-reported Likelihood of Speeding

A hierarchical regression was performed to examine the predictive utility of the independent variables in explaining self-reported likelihood of speeding (see Table 3).

Table 3. Hierarchical regression table for self-reported likelihood of speeding and study variables

Step and variable	*B*	SE *b*	*β*	$r_{ab.c}$	$r_{a(bc)}$
Step 1					
Age	-.03**	.01	-.28	-.28	-.28
Gender (male)	-.23	.17	-.09	-.09	-.08
Constant	4.28**	.38			
Adjusted R^2 = .07; $F(2, 253)$ = 10.56**					
Step 2					
Age	-.01*	.01	-.16	-.15	-.14
Gender (male)	-.02	.17	-.01	-.01	-.01
IPIP Extraversion	.04**	.01	.20	.18	.17
IPIP Conscientiousness	-.02	.02	-.06	-.06	-.06
IPIP Agreeableness	-.03	.02	-.11	-.10	-.09
IPIP Emotional stability	-.01	.01	-.04	-.04	-.04
IPIP Intellect/imagination	-.02	.02	-.06	-.06	-.06
Risk taking (some)	.83**	.16	.31	.32	-.30
Constant	4.46**	.38			
Adjusted R^2 = .19; $F(8, 245)$ = 8.27**; Δ Adjusted R^2 = .12; $F_{change}(6, 245)$ = 7.01**					
Step 3					
Age	-.01**	.01	-.16	-.21	-.15
Gender (male)	.20	.13	.07	.09	.06
IPIP Extraversion	.03**	.01	.18	.22	.15
IPIP Conscientiousness	.01	.01	.01	.01	.01
IPIP Agreeableness	-.02	.01	-.08	-.10	-.07
IPIP Emotional stability	-.02	.01	-.08	-.11	-.08
IPIP Intellect/imagination	-.02	.01	-.09	-.11	-.08
Risk taking (some)	.44**	.13	.16	.22	.15
Attitudes	.84**	.07	.60	.64	.56
Constant	2.11**	.69			
Adjusted R^2 = .51; $F(9, 244)$ = 30.70**; Δ Adjusted R^2 = .32; $F_{change}(1, 244)$ = 165.64**					
Step 4					
Age	-.02**	.01	-.17	-.21	-.15
Gender (male)	.22	.13	.08	.10	.07
IPIP Extraversion	.03**	.01	.18	.22	.15
IPIP Conscientiousness	.01	.01	.01	.02	.01
IPIP Agreeableness	-.02	.01	-.07	-.08	-.06
IPIP Emotional stability	-.01	.01	-.08	-.10	.07
IPIP Intellect/imagination	-.02	.01	-.09	-.12	-.08
Risk taking (some)	.46**	.13	.17	.23	.16
Attitudes	.97**	.09	.69	.57	.47
Perceived Legitimacy	.17*	.09	.13	.13	.09
Constant	.98	.88			
Adjusted R^2 = .52; $F(10, 243)$ = 28.39**; Δ Adjusted R^2 = .01; $F_{change}(1, 243)$ = 4.11*					

Note. The minimum sample size to detect a medium sized effect requires n = 130 according to S. B. Green (1991).
** $p < .01$, * $p < .05$

When the demographic variables of age and gender were entered in the first step of the regression, the model significantly predicted self-reported likelihood of speeding and accounted for 7% of the variance. However, age was the only significant predictor. The second step involved adding the personality factors and risk taking variables. This second step was also a significant predictor of self-reported likelihood of speeding, now accounting for 19% of the variance. This was a significant

increase in the amount of variance explained. Age remained a significant predictor (although its predictive utility was reduced), with extraversion and risk taking also significantly predicting self-reported likelihood of speeding.

The attitudes scores were added at the third step in the model, which now accounted for 51% of the variance in self-reported likelihood of speeding. This 32% increase in variance explained was significant. At this step, the attitudes variable was a significant predictor of self-reported likelihood of speeding, while age, extraversion, and risk taking continued to be significant predictors. However, the strength of association of the latter two variables in the model decreased. The fourth and final step involved the addition of the perceived legitimacy variable to the model. The model significantly predicted self-reported likelihood of speeding, accounting for 52% of the variance. This was a small (1%) but statistically significant increase in the amount of variance explained. Age, extraversion, risk taking, attitudes all remained significant predictors of self-reported likelihood of speeding at this step. Perceived legitimacy was a significant predictor of self-reported likelihood of speeding, however, the direction of association changed from negative (as found in the bivariate correlations) to positive.

This unexpected change in direction of association appeared to be related to the inclusion of attitudes scores in the model. When the regression was performed following the stepped procedure described above, with the exception that perceived legitimacy was entered at step three and the attitude variable was entered at step four, perceived legitimacy had a negative relationship with self-reported likelihood of speeding at step three, but the direction changed to positive when attitudes was entered at step four.

Mediation of Self-reported Likelihood of Speeding

As the bivariate correlations in Table 2 and the results of the hierarchical regressions described above suggest a relationship between perceived legitimacy, attitudes, and self-reported likelihood of speeding, a mediation effect is possible (Baron & Kenny, 1986) and was further investigated.

The relationship between perceived legitimacy and self-reported likelihood of speeding was found to be significant $\beta = -.40$, $p < .001$. A second bivariate regression was performed with the perceived legitimacy and attitudes variables and a significant relationship was found $\beta = -.71$, $p < .001$. To evaluate the significance of the relationship between attitudes and self-reported likelihood of speeding, when controlling for the association of perceived legitimacy of speed enforcement with likelihood of speeding, a multivariate regression analysis was performed. A significant association was found between attitudes and self-reported likelihood of speeding when controlling for the association of perceived legitimacy with speeding likelihood, $\beta = .72$, $p < .001$. The relationship between perceived legitimacy and self-reported likelihood of speeding decreased to $\beta = .11$, $p = .11$ when controlling for the effect of attitudes. To determine the significance of the mediation relationship (shown in Figure 1), the unstandardised coefficients were used in Sobel's (1982) test. Sobel's (1982) test was significant ($Z = -9.03$, $p < .001$), indicating that attitudes mediate the relationship between perceived legitimacy and speeding likelihood.

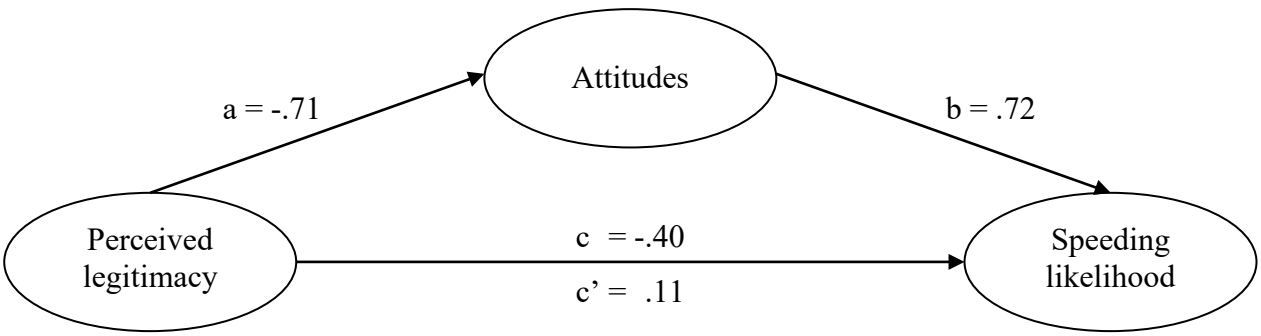

Figure 1. Mediation model of perceived legitimacy, attitudes, and speeding likelihood

Subgroup Analysis: Predicting likelihood of speeding for attitude groups

A set of regressions were performed to examine whether different attitudes towards speeding resulted in a differential set of predictors of speeding likelihood. The sample was separated into two groups using a mean split, with the groups labelled as those who held negative and positive attitudes towards speeding. The descriptive statistics for the study variables and the results of the multiple regressions performed on each subgroup are reported in Table 4.

Table 4. Subgroups multiple regression results for self-reported likelihood of speeding

	Negative attitude group (*n* = 151)				**Positive attitude group (*n* = 133)**			
	M (SD)	***b***	**SE *b***	***β***	***M (SD)***	***b***	**SE *b***	***β***
Speeding likelihood (DV)	2.31 (1.17)	-	-	-	3.64 (1.12)	-	-	-
Age	39.22 (15.04)	-.02**	.01	-.31	38.84 (15.16)	-.01	.01	-.09
Gender (male)	31.33%	.01	.21	.01	50%	.25	.22	.11
IPIP Extraversion	32.68 (7.08)	.02	.02	.11	32.78 (7.31)	.04*	.02	.24
IPIP Conscientiousness	34.45 (5.16)	-.01	.02	-.04	32.78 (5.40)	.01	.02	.05
IPIP Agreeableness	41.17 (4.75)	-.03	.02	-.14	39.70 (5.68)	-.01	.02	-.07
IPIP Emotional stability	33.64 (6.90)	-.02	.02	-.09	33.70 (7.50)	-.01	.02	-.07
IPIP Intellect/imagination	37.56 (5.05)	-.05**	.02	-.23	37.64 (5.08)	.03	.02	.14
Risk taking (some)	35.57%	.47*	.20	.19	58.46%	.40	.21	.18
Perceived Legitimacy	4.14 (0.68)	-.29*	.14	-.17	3.12 (0.98)	-.15	.10	-.13
Constant	-	7.92**	1.30		-	1.97	1.18	
Adjusted R^2 =		.25; $F(9, 121) = 5.69$**				.15; $F(9, 106) = 3.24$**		

Note. The minimum sample size to detect a medium sized effect requires *n* = 122 according to S. B. Green (1991).

The regression model for the negative attitudes group was a significant predictor of self-reported likelihood of speeding and accounted for 25% of the variance. Age, intellect/imagination, risk taking, and perceived legitimacy variables were all significant predictors. The regression for the positive attitudes group was a significant predictor of self-reported likelihood of speeding, accounting for 15% of the variance. However, only one study variable (extraversion) was a significant predictor for this group.

Discussion

The '*vision*' or aim of this study was to examine the relationships between self-reported likelihood of speeding and a number of individual factors identified as predictors in the literature, including age, gender, personality characteristics, attitudes towards speeding, and perceived legitimacy of speed enforcement. This study also aimed to more closely examine the relationships between attitudes, perceived legitimacy of speed enforcement and likelihood of speeding to better understand the inter-relationships between these variables, and inform effective interventions ('*action*') designed to reduce speeding behaviour ('*results*').

Factors Associated with Likelihood of Speeding

Consistent with previous research, the bivariate correlations in this study showed that age (e.g., Harrison, Fitzgerald, Pronk, & Fildes, 1998; Oltedal & Rundmo, 2006; Williams, et al., 2006), extraversion (e.g., Clarke & Robertson, 2005; Dahlen & White, 2006), conscientiousness (e.g., Arthur & Graziano, 1996; Sümer, et al., 2005), risk taking (e.g., Iversen & Rundmo, 2002; Machin & Sankey, 2008; Patil, et al., 2006), attitudes towards speeding (e.g., Corbett, 2001; De Pelsmacker & Janssens, 2007; Fleiter & Watson, 2006) and perceived legitimacy of speed enforcement (e.g., Watling & Leal, 2012) were significantly related to self-reported likelihood of speeding. In this study, increased likelihood of speeding was associated with lower ages, high extraversion scores, low conscientiousness scores, some propensity for risk taking, positive attitudes towards speeding and low perceived legitimacy of speed enforcement. The strongest relationships with self-reported likelihood of speeding were moderate relationships with attitudes towards speeding, and perceived

legitimacy of speed enforcement. However, there was a strong relationship between these two predictors, and small to moderate relationships between a number of other pairs of study variables.

When the relationships between the study variables and self-reported likelihood of speeding were examined in a hierarchical regression analysis to control for the relationships between predictor variables, the model significantly predicted self-reported likelihood of speeding, explaining just over half of the variance. Variables were entered into the model according to their theoretical interest to this study, such that demographic variables (age and gender) were entered first, followed by the personality (including risk taking) variables, attitudes, and finally perceived legitimacy of speed enforcement. Attitudes towards speeding was the strongest predictor in the model, however an interesting result was the *positive* association between perceived legitimacy of speed enforcement and the dependent variable when attitudes towards speeding were included in the model. That is, individuals who perceived speed enforcement as legitimate reported *greater* likelihood of engaging in speeding behaviour in the next month.

Although perceived legitimacy was a significant predictor in the multivariate model, its importance was much lower than would be expected (given its bivariate relationship with likelihood of speeding) when attitudes towards speeding was already included in the model, as evidenced by the beta value and small increase in additional variance explained. This is presumably explained by the strong correlation with attitudes towards speeding, suggesting these variables are sharing the variance in likelihood of speeding they explain. Further evidence of the influence of attitudes on the relationship between perceived legitimacy of speed enforcement and likelihood of speeding was the shift from a negative to a positive relationship between perceived legitimacy and the dependent variable when attitudes were included in the model.

To better understand the relationships between attitudes towards speeding, perceived legitimacy of enforcement and likelihood of speeding, a mediation analysis was performed and found that the relationship between perceived legitimacy of speed enforcement and self-reported likelihood of speeding was mediated by attitudes towards speeding. When the sample was divided into two groups based on a mean split of attitudes scores, separate regressions showed that perceived legitimacy of speed enforcement is only a significant predictor of likelihood of speeding for individuals who hold negative attitudes towards speeding. Among individuals with a negative attitude towards speeding, lower ages, low intellect/imagination scores, some propensity for risk taking and low perceived legitimacy of speed enforcement were significant predictors of likelihood of speeding, although the model explained only one quarter of the variance in the dependent variable.

Among individuals with a positive attitude towards speeding, only high extraversion scores were associated with increased likelihood of speeding, in a model explaining only 15% of the variance in the dependent variable. These subgroup results show how critical attitudes towards speeding are in understanding likelihood to engage in the behaviour in future, but also for understanding the relationship between other predictors and likelihood of speeding. For those who hold a positive attitude towards speeding, other variables seem largely irrelevant, suggesting it is these attitudes that must be targeted for this group. However, for individuals that have a more negative attitude towards speeding, their perceptions of the legitimacy of speed enforcement may be an additional target to further reduce their likelihood of speeding. Previous work has shown that speeding interventions targeting attitudes increases an individuals' perceived legitimacy of speed enforcement (McKenna, 2007a). As a result, this may be a promising '*action*' for future interventions, such as when developing educational campaigns to reduce speeding. However, the subgroup analysis results show that tailored advertising campaigns to certain groups rather than utilising a 'one size fits all' approach is required. For example, different types of speeding advertising campaigns (e.g., pride, humour, or fear-based campaigns) can have differential

effectiveness for message acceptance for different audiences (Lewis, Watson, & Tay, 2007; Lewis, Watson, & White, 2010).

Future Research

There are several limitations of the current study that require consideration when interpreting the results and developing future research projects in this area. Firstly, the use of a convenience sampling methodology has the potential to result in self-selection bias and influence the results. Another limitation was the use of a self-report measure for the outcome variable of likelihood of speeding. Self-report data can be influenced by the effects of social desirability (Wåhlberg, Dorn, & Kline, 2010) which is especially true when assessing data of a sensitive nature, such as speeding. However, given speeding (particularly at low levels above the speed limit) is generally considered socially acceptable, and many participants in this study were willing to report risky attitudes and behaviours, social desirability bias may not have been a significant problem in this study. Moreover, the current study utilised an online questionnaire where participant anonymity was assured, with prior research suggesting the effect of social desirability is diminished when the data is collected in private environments verses public environments (Lajunen & Summala, 2003; Sullman & Taylor, 2010).

Future research should seek to more thoroughly examine the dynamics between perceptions of the legitimacy of speed enforcement and attitudes towards speeding, and methods of influencing these variables with the aim of reducing the likelihood of speeding. Future research should also examine the influence of these variables on actual on-road speeding behaviours to complement the observed relationships with self-reported likelihood of speeding. Although the relationship between self-reported intentions to commit illegal behaviours and actual behaviour is quite strong (r = .79-.83: D. E. Green, 1989; Kim & Hunter, 1993), an examination of actual on-road behaviours (e.g., via GPS tracking) would provide more robust evidence of the associations between the individual factors examined in the current study and speeding behaviours.

Conclusion

Despite strong evidence of the risks associated with speeding, some drivers continue to exceed the speed limit. While a number of factors have been identified in previous research studies as influential in the decision to speed, there is relatively little evidence of the effect of perceived legitimacy of speed enforcement on likelihood of speeding, and the extent to which this construct is independent of attitudes towards speeding. The '*vision*' of this study was to better understand the inter-relationships between attitudes towards speeding and perceived legitimacy of speed enforcement and their utility in predicting likelihood of speeding. Understanding how these constructs influence speeding behaviour will assist in identifying appropriate '*actions*' for different groups of drivers to achieve the '*results*' of reducing speeding behaviour and associated road trauma.

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References

Akers, R. L., Krohn, M. D., Lanza-Kaduce, L., & Radosevich, M. (1979). Social learning and deviant behavior: A specific test of a general theory. *American Sociological Review, 44*(4), 636-655.

Arthur, W., Jr., & Graziano, W. G. (1996). The five-factor model, conscientiousness, and driving accident involvement. *Journal of Personality, 64*(3), 593-618.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Bingham, C. R., Elliott, M. R., & Shope, J. T. (2007). Social and behavioural characteristics of young adult drink/drivers adjusted for level of alcohol use. *Alcoholism: Clinical and Experimental Research, 31*(4), 655-664.

Carseldine, D. (2003). *Fixed, digital speed cameras in NSW: Impacts on vehicle speeds and crashes*. Paper presented at the 2003 Road Safety Research, Policing and Education Conference Program.

Clarke, S., & Robertson, I. T. (2005). A meta-analytic review of the Big Five personality factors and accident involvement in occupational and non-occupational settings. *Journal of Occupational and Organizational Psychology, 78*(3), 355-376.

Corbett, C. (2001). Explanations for "understating" in self-reported speeding behaviour. *Transportation Research Part F: Traffic Psychology and Behaviour, 4*(2), 133-150.

Dahlen, E. R., & White, R. P. (2006). The Big Five factors, sensation seeking, and driving anger in the prediction of unsafe driving. *Personality and Individual Differences, 41*(5), 903-915.

De Pelsmacker, P., & Janssens, W. (2007). The effect of norms, attitudes and habits on speeding behavior: Scale development and model building and estimation. *Accident Analysis & Prevention, 39*, 6-15.

Donovan, J. E. (1993). Young adult drinking-driving: Behavioral and psychosocial correlates. *Journal of Studies on Alcohol, 54*(5), 600-613.

Evans, L. (2004). *Traffic safety*. New York: Van Nostrand Reinhold.

Fleiter, J. J., & Watson, B. C. (2006). The speed paradox : the misalignment between driver attitudes and speeding behaviour. *Journal of the Australasian College of Road Safety, 17*(2), 23-30.

Glendon, A. I. (2007). Driving violations observed: An Australian study. *Ergonomics, 50*(8), 1159-1182.

Glendon, A. I., & Sutton, D. C. (2005). Obsevring motorway driving violations. In D. A. Hennessy & D. L. Wiesenthal (Eds.), *Contemporary Issues in Road User Behavior and Traffic Safety*. New York: Nova Science Publishers.

Goldberg, L. R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt & F. Ostendorf (Eds.), *Personality Psychology in Europe* (Vol. 7, pp. 7-28). Tilburg, The Netherlands: Tilburg University Press.

Goldenbeld, C., & van Schagen, I. (2005). The effects of speed enforcement with mobile radar on speed and accidents: An evaluation study on rural roads in the Dutch province Friesland. *Accident Analysis & Prevention, 37*, 1135-1144.

Greaves, S. P., & Ellison, A. B. (2011). Personality, risk aversion and speeding: An empirical investigation. *Accident Analysis & Prevention, 43*(5), 1828-1836.

Green, D. E. (1989). Past behavior as a measure of actual future behavior: An unresolved issue in perceptual deterrence research. *The Journal of Criminal Law and Criminology, 80*, 781-804.

Green, S. B. (1991). How many subjects does it take to do a regression analysis? *Multivariate Behavioral Research, 26*(3), 499-510. doi: 10.1207/s15327906mbr2603_7

Harrison, W. A., Fitzgerald, E. S., Pronk, N. J., & Fildes, B. N. (1998). An investigation of characteristics associated with driving speed. Melbourne, Australia: Monash University Accident Research Centre.

Hatfield, J., & Fernandes, R. (2009). The role of risk-propensity in the risky driving of younger drivers. *Accident Analysis & Prevention, 41*(1), 25-35.

Hirst, W. M., Mountain, L. J., & Maher, M. J. (2005). Are speed enforcement cameras more effective than other speed management measures?: An evaluation of the relationship between speed and accident reductions. *Accident Analysis & Prevention, 37*, 731-741.

Iversen, H., & Rundmo, T. (2002). Personality, risky driving and accident involvement among Norwegian drivers. *Personality and Individual Differences, 33*, 1251-1263.

Keall, M. D., Povey, L. J., & Frith, W. J. (2001). The relative effectiveness of a hidden versus a visible speed camera programme. *Accident Analysis & Prevention, 33*, 277-284.

Kim, M.-S., & Hunter, J., E. (1993). Attitude-Behavior Relations: A Meta-Analysis of Attitudinal Relevance and Topic. *The Journal of Communication, 43*(1), 101-142.

Lajunen, T., & Summala, H. (2003). Can we trust self-reports of driving? Effects of impression management on driver behaviour questionnaire responses. *Transportation Research Part F: Traffic Psychology and Behaviour, 6*(2), 97-107.

Lay, M. G. (1986). *Handbook of road technology*. New York: Gordon and Breach.

Lewis, I. M., Watson, B., & Tay, R. (2007). Examining the effectiveness of physical threats in road safety advertising: The role of the third-person effect, gender, and age. *Transportation Research Part F: Traffic Psychology and Behaviour, 10*, 48-60.

Lewis, I. M., Watson, B. C., & White, K. M. (2010). Response efficacy : the key to minimizing rejection and maximizing acceptance of emotion-based anti-speeding messages. *Accident Analysis & Prevention, 42*(2), 459-467.

Machin, M. A., & Sankey, K. S. (2008). Relationships between young drivers' personality characteristics, risk perceptions, and driving behaviour. *Accident Analysis & Prevention, 40*, 541-547.

McAbee, S. T., & Oswald, F. L. (2013). The Criterion-Related Validity of Personality Measures for Predicting GPA: A Meta-Analytic Validity Competition. *Psychological Assessment*.

McCrae, R. R., & Costa, P. T. (1995). Trait explanations in personality psychology. *European Journal of Personality, 9*(4), 231-252.

McKenna, F. P. (2007a). *Do attitudes and intentions change across a speed awareness workshop?* Paper presented at the Behavioural Research in Road Safety 2007 Seventeenth Seminar.

McKenna, F. P. (2007b). The perceived legitimacy of intervention: A key feature for road safety *Improving Traffic Safety Culture in the United States: The Journey Forward* (pp. 77-91). Washington, DC: AAA Foundation for Traffic Safety.

Mountain, L. J., Hirst, W. M., & Maher, M. J. (2005). Are speed enforcement cameras more effective than other speed management measures?: The impact of speed management schemes on 30 mph roads. *Accident Analysis & Prevention, 37*, 742-754.

Oltedal, S., & Rundmo, T. (2006). The effects of personality and gender on risky driving behaviour and accident involvement. *Safety Science, 44*(7), 621-628.

Patil, S. M., Shope, J. T., Raghunathan, T. E., & Bingham, C. R. (2006). The Role of Personality Characteristics in Young Adult Driving. *Traffic Injury Prevention, 7*(4), 328 - 334.

Pennay, D. (2008). Community Attitudes to Road Safety: 2008 survey report. Canberra, Australia: Australian Government Department of Infrastructure, Transport, Regional Development and Local Government.

Poulter, D. R., & McKenna, F. P. (2007). Is speeding a "real" antisocial behavior? A comparison with other antisocial behaviors. *Accident Analysis & Prevention, 39*(2), 384-389.

Radalj, T., & Sultana, S. (2009). Driver Speed Behaviours on Western Australian Road Network 2000, 2003, 2004, 2005, 2007 and 2008. Perth: Main Roads Western Australia.

Shinar, D. (2007). *Traffic safety and human behavior*. London: Elsevier Science.

Sobel, M. E. (1982). Asymptotic intervals for indirect effects in structural equations model. In S. Leinhart (Ed.), *Sociological methodology* (pp. 290-312). San Fransisco: Jossey-Bass.

Socha, A., Cooper, C. A., & McCord, D. M. (2010). Confirmatory factor analysis of the M5-50: An implementation of the International Personality Item Pool item set. *Psychological Assessment, 22*(1), 43-49.

Stafford, M. C., & Warr, M. (1993). A reconceptualization of general and specific deterrence. *Journal of Research in Crime and Delinquency, 30*, 123-135.

Stradling, S., Meadows, M., & Beatty, S. (2004). Characteristics and crash involvement of speeding, violating and thrill-seeking drivers. In T. Rothengatter & R. D. Huguenin (Eds.), *Traffic and Transport Psychology: Theory and Applicaiton - Proceedings of the ICTTP 2000* (pp. 177-192). Amsterdam: Elsevier.

Sullman, M. J. M., & Taylor, J. E. (2010). Social desirability and self-reported driving behaviours: Should we be worried? *Transportation Research Part F: Traffic Psychology and Behaviour, 13*(3), 215-221.

Sümer, N., Lajunen, T., & Özkan, T. (2005). Big Five Personality Traits as the Distal Predictors of Road Accident Involvement. In G. Underwood (Ed.), Traffic and Transport Psyhology (pp. 215-227). Amsterdam: Elsevier Ltd.

Vaca, F. (2006). Speeding: Socially acceptable but often fatal. *Annals of Emergency Medicine, 48*, 471-472.

Vanlaar, W., Simpson, H., Mayhew, D., & Robertson, R. (2008). Fatigued and drowsy driving: A survey of attitudes, opinions and behaviors. *Journal of Safety Research, 39*, 303-309.

Wåhlberg, A. E. a., Dorn, L., & Kline, T. (2010). The effect of social desirability on self reported and recorded road traffic accidents. *Transportation Research Part F: Traffic Psychology and Behaviour, 13*(2), 106-114.

Watling, C. N., & Leal, N. L. (2012). *Exploring perceived legitimacy of traffic law enforcement*. Paper presented at the ACRS 2012 National Conference, 9-10 August 2012, Menzies Sydney Hotel, Sydney, NSW.

Williams, A. F., Kyrychenko, S. Y., & Retting, R. A. (2006). Characteristics of speeders. *Journal of Safety Research, 37*(3), 227-232.