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Applying an extended theory of planned behaviour to understand influences on safe driving intentions and behaviours

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ABSTRACT

Most road safety research and interventions focus on risky or unsafe driving but understanding psychosocial motivators for safe driving behaviours may also be important in efforts to improve road safety. The current study applied an extended Theory of Planned Behaviour (TPB) including attitude, subjective norm, perceived behavioural control (PBC), together with the additional constructs of moral norm, descriptive norm, and anticipated regret in understanding drivers' intentions to engage, and self-reported engagement, in safe driving. As additional extended TPB constructs, personality constructs from the Five Factor Model of Personality (FFM; extraversion, neuroticism [emotional stability], agreeableness, conscientiousness, openness to experience [imagination]) were also investigated. Licensed drivers from Queensland, Australia, aged 17 years and older, completed an initial online survey investigating intentions for safe driving behaviours ($N = 171$) followed by a second online survey-one week later investigating actual behavioural engagement ($N = 63$). Participants answered items related to general safe driving and two safe driving scenarios: namely, leaving an adequate gap between vehicles on a multi-lane highway and reducing speed in storming conditions. Separate hierarchical multiple regressions were conducted to identify the motivators of intentions to engage in safe driving in each scenario. PBC and subjective norm were significant predictors of intentions to engage in general safe driving and the two specific scenarios. Attitude was a significant predictor of intentions to engage in safe driving in the specific highway scenario, moral norm was a significant predictor of intentions in both the general safe driving and the specific highway scenario, and anticipated regret was a significant predictor in the specific storming conditions scenario. Imagination was the sole significant personality-related predictor of intention and that was only in the specific highway scenario. For the predictors of self-reported performance of safe driving behaviour, these were examined regarding only the general ($N = 57$), and the specific highway scenario ($N = 49$) given storms/rainy weather had not occurred in the interim period between surveys. Self-reported safe driving behaviour in the general and specific highway scenario was significantly predicted by intention. This research supports the importance of understanding factors influencing safe driving behaviours and not just risky driving behaviours. Research that identifies influences on safe driving may help to inform interventions that may promote more positive, safe on-road behaviours.

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1. Introduction

The way road users drive can be broadly dichotomised into driving styles that may be considered 'good' or 'bad' (Oz, Ozkan, & Lajunen, 2014). Most literature and indeed research interventions has focused on 'bad' driving behaviours, particularly those behaviours that are aggressive, risky, and/or illegal (Ge et al., 2014; Harris et al., 2014; Jonah, 1986; Kleisen, 2013; Ozkan & Lajunen, 2005). Relatively speaking, much less attention has been paid to 'good' driving behaviours with limited research examining, for example, prosocial, polite, or altruistic driving (Nandavar, Lewis, & White, 2019; Shen, Qu, Ge, Sun, & Zhang, 2018). Interventions aimed at correcting and, thus, reducing risky driving are a crucial aspect of any road safety strategy. Arguably, however, the focus on interventions for 'bad' driving is potentially omitting another important piece of the road safety intervention puzzle. That is, there is potential that research focused on the motivators of 'good' driving behaviours could help inform interventions which seek to increase 'good' driving behaviours. Shifting the focus in this way may contribute to reductions in crashes and overcome some road safety barriers that interventions aimed at 'bad' driving behaviours have been unable to overcome, such as everyday casual speeding (Kleisen, 2013). The purpose of the current study was to identify and examine some psychosocial influences encouraging instances of 'good' driving behaviours.

The concept of 'good' driving behaviours as influenced by legal obligations or to avoid crashes, such as stopping at traffic lights, has been considered by some in road safety research (Harris et al., 2014; Shinar, Schechtman, & Compton, 2001). However, Nandavar et al. (2019) investigated altruistic driving behaviours and defined 'good' driving as those behaviours where individuals showed greater concern for others than for oneself and, importantly, were not behaviours obligated by law or influenced by self-serving motives. Although these studies define 'good' driving behaviour differently, they are similar in that 'good' driving was not simply considered the inverse of 'bad' driving. That is, 'good' driving does not simply mean an absence of risky, dangerous, or illegal behaviours. Theoretical evidence from frameworks such as the Theory of Planned Behaviour (TPB) indicate that doing and not doing a certain behaviour are distinct behaviours and associated with potentially different motivating factors which also vary in their relative importance (Richetin, Conner & Perugini, 2011).

Traditionally, road policing has sought to manage driver behaviour in accordance with deterrence theory (Homel, 1988; Ross, 1982). In Australia, approximately 62 % of crashes are in urban areas, which are known to have high levels of police enforcement and presence; the highest rates of fatal and serious injury crashes occur in 50 km/h and 60 km/h zones (Bradshaw, Turner, Makwasha, & Cairney, 2015). This suggests that violations and crashes still occur in areas with high levels of enforcement; thus, is it unlikely that the certainty, severity, and swiftness of enforcement, as tenets of deterrence theory, are the only influences on driving behaviour, regardless of whether it is 'good' or 'bad' (Truelove et al., 2017).

Moreover, when considering the available studies on 'good' driving, it appears that the research considers such behaviour as 1) impacting both oneself and other drivers, 2) prioritising well-being over other motives, and 3) requiring thought or action influenced by motives not only involving adherence to legally prescribed rules. Considering the definitional ambiguity surrounding 'good' driving, it is important to consider the concept of 'safe' driving. Harris et al. (2014) included safe driving behaviours in their definition of prosocial driving behaviours, denoting safe driving behaviours as those that protect the wellbeing of the driver and others. However, these authors did not specify if this definition related to behaviours that are constrained by adherence to road rules.

Herein, 'safe' driving is defined as driving in a manner that protects the wellbeing of the driver and others but is not specifically obligated by law. Conceptualising 'safe' driving in this way both draws from yet differentiates it from previous understandings of 'good' driving. For example, preserving ones' own wellbeing in equal measure to that of others can be seen as a self-serving motive, and corresponds with the view of Ozkan and Lajunen (2005). Protecting others' well-being equally without the motivation of following predetermined road rules corresponds with the view of Nandavar et al. (2019) that 'good' driving is not necessarily constrained by road rules. Using the aforementioned definition, the current study aims to investigate psychosocial influences on the performance of safe driving behaviours using the TPB (Ajzen, 1985). The TPB is a well-validated behavioural prediction model that has been extensively applied in road safety research. However, of note, much of its application currently has been in predicting and explaining risky road user behaviours. Thus, there is a gap in current knowledge regarding theory-based explorations of the motivators of 'good' driving behaviours.

1.1. The theory of planned behaviour and safe driving

As depicted in Fig. 1, the TPB (Ajzen, 1985) poses that an individual's attitudes towards, subjective norms about, and perceived behavioural control (PBC) regarding a behaviour influence whether they will perform the behaviour through behavioural intention. Attitudes refer to how favourably-one evaluates a particular behaviour, subjective norms are an assessment of the approval or disapproval of performing the behaviour by significant others, while PBC is the judgement a person makes about their capacity to perform the behaviour. Intention is considered the most proximal determinant of behaviour and represents the level of effort a person will exert to achieve a goal. However, the TPB also specifies that, as well as intention, PBC may influence behaviour directly or indirectly through intentions (Ajzen, 1991). In addition, while attitudes, subjective norms, and PBC constitute the 'standard constructs' of the TPB, many studies, consistent with Ajzen's (1991) recommendations, 'extend' the TPB by including additional constructs that may exert influence on intentions and behaviour. In the current study, the TPB was extended with the additional constructs of moral norm, descriptive norm, and anticipated regret (see Fig. 1).

Moral norm relates to the belief that a behaviour is 'right' or 'wrong', as governed by an individual's perception of what they ought to do (Parker, Manstead, & Stradling, 1995). Descriptive norm relates to the individual's perceptions of the extent to which the behaviour is performed by others (Forward, 2009; Manning, 2009). Anticipated regret relates to the emotional response experienced in

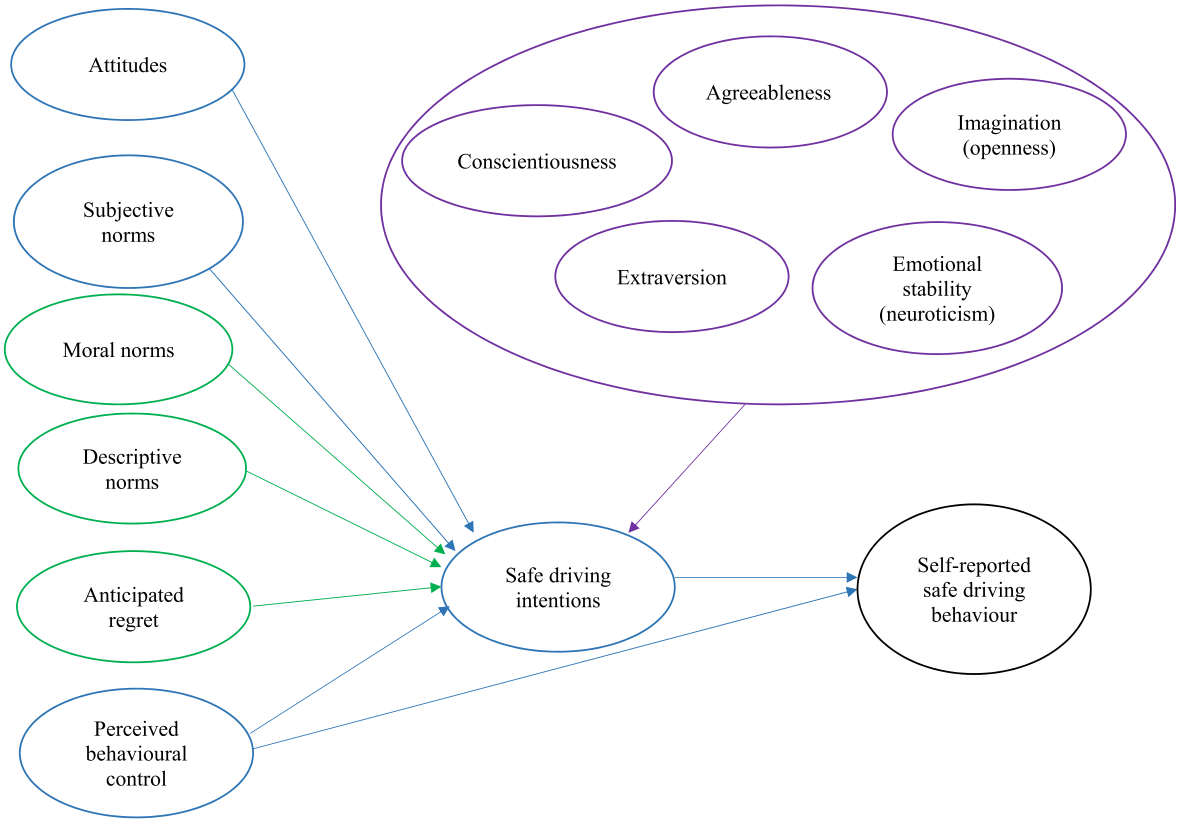

Fig. 1. The Extended TPB underpinning the current study ().
adapted from Ajzen, 1985

the current time when assessing future regret that may be experienced because of having engaged in a particular behaviour, or for not having engaged in a particular behaviour. In the current study, anticipated regret is considered in terms of potential future regret from inaction, from having not engaged in the behaviour under investigation. These constructs have been shown to explain additional variance in intentions and behaviours across a number of studies regarding driver behaviours such that the more one feels that a behaviour is morally correct, that they believe others are also engaging in, and that they would regret not having engaged in, the stronger their intentions and the more behavioural engagement (Chen, Donmez, Hoekstra-Atwood, & Marulanda, 2016; Conner, Parker, Chorlton, Manstead, & Stradling, 2007; Rivis & Sheeran, 2003).

The TPB has been applied widely in studies of health-related behaviours (Armitage & Conner, 2001; Atombo, Zhong, & Zhang, 2016; Chang, Burgess, Choy, & Nakamura, 2019; Evan & Qualls, 2019; Palat & Delhomme, 2012) including traffic psychology. For example, the TPB has been employed when researching 'bad' driving behaviours such as drink driving (Chan, Wu, & Zhang, 2010; Moan & Rise, 2011), driving violations (Elliot, 2012; Palat & Delhomme, 2012), mobile phone use while driving (Bazargan-Hejazi et al., 2017; Rozario, Lewis, & White, 2010) and unsafe driving (Atombo et al., 2016).

Pertinent to the current study, Nandavar et al., (2019) who examined predictors of drivers' altruistic behaviours also applied an extended TPB in their study. Their findings indicated that the standard TPB constructs significantly predicted intention to perform altruistic driving behaviours. The additional variables of anticipated regret and moral norm explained a further significant 6–7 % of variance in altruistic driving intentions. Apart from Nandavar et al., (2019), a review of the literature did not identify any other studies that had utilised the TPB as a basis for studying 'good' or 'safe' driving intentions and behaviour. Thus, the current study represents an important extension upon Nandavar et al.'s research and, in doing so, will contribute to theoretically-based investigations into the psychosocial motivators underpinning 'good' driving intentions and behaviours. Similar to Nandavar et al. the current study included both anticipated regret and moral norm, but unlike Nandavar et al., the current study also included additional predictors of descriptive norm as well as factors relating to individuals' personality (see Fig. 1).

1.2. The five factor model of personality and safe driving

Personality can be defined as the relatively stable, consistent, and long-lasting patterns of emotion and actions that an individual exhibits, that can be recognised and used to describe that person (McCrae & Costa, 1995). Several studies have linked personality and driving (e.g., Linkov et al., 2019, Biernacki & Lewkowicz, 2020, Niranjan et al., 2022). For example, sensation-seeking has been

positively related in a number of studies to risky driving behaviours (Turner & McClure, 2003; Dahlen & White, 2006; Monteiro, de Holanda Coelho, Hanel, Pimentel, & Gouveia, 2018; Tao, Zhang, & Qu, 2017). Trait anger-aggression and impulsive sensation seeking are positively associated with speeding, although at low intensity and not for professional drivers (Sârbescu & Rusu, 2021). Impulsivity and sensation seeking are predictive of risky driving in young drivers but the relationship is complex and impacted when other factors such as metacognitive ability are examined (Miller et al., 2021). One study demonstrated that trait driving anger was positively associated with perceptions of risk caused by 'timid' driving but there was no association with trait anxiety (Lim et al., 2022).

The Five Factor Model of Personality (FFM; Costa & McCrae, 1992) offers a systematic way of organising a range of individual difference facets. The five factors are: openness, conscientiousness, extraversion, agreeableness, and neuroticism. Openness relates to a willingness to try new experiences. Conscientiousness describes the awareness of one's actions and the consequences thereof. Extraversion is related to confident and outgoing behaviour. Agreeableness is characterised by cooperative, helpful, and likeable behaviour. Finally, neuroticism describes an emotionally instable state, typified as insistent worry, and anxious fearful behaviour.

The FFM has been used in studies investigating personality as a predictor of risky driving intentions or behaviours (e.g., Kita & Luria, 2018; Rozario, Lewis, & White, 2010). For example, Harris et al. (2014) found an association between fewer reported traffic violations and crashes with high levels of agreeableness, conscientiousness, openness, and neuroticism. Extraversion was associated with aggressive driving behaviours, which was associated with more traffic violations driving. Regarding more general aspects of driving, Charness, Yoon, Souders, Stothart, and Yehnert, (2018) found that while conscientiousness was associated with greater concern for driving, it was inversely associated with eagerness to drive, which was positively associated with emotional stability and imagination. Openness was positively associated with inclination to surrender driving control, while extraversion was negatively associated.

In summary, these studies suggest that different personality traits may be related in different ways to risky driving. However, few studies have investigated personality characteristics in relation to 'good' driving behaviours and it is unclear if the same personality characteristics are implicated in the decreased performance of risky driving and increased performance of safe driving. More broadly, one issue identified with research investigating individual differences and driving is the relative scarcity of studies that consider multiple personality traits (Dahlen & White, 2006). Given this, and the lack of research, overall, investigating safe driving, it is pertinent to consider in research a range of personality characteristics rather than focus on only one such as sensation seeking.

1.3. The current study

Road safety interventions and research have long tended to focus on 'bad' (risky, aggressive, illegal) driving behaviours and understanding the motivators underpinning such behaviours. However, while this focus is certainly warranted and we do not wish to imply otherwise, it does mean that it has been the focus at the relative omission of efforts to understand more about the psychosocial motivators of 'good' driving intentions and behaviours. We contend that safe driving should not be considered simply the inverse of risky driving and, it follows, that the motivating factors of such behaviour are not simply the inverse direction of influence.

Extending upon Nandavar et al.'s study (2019), the current study applied an extended TPB (Ajzen, 1985) to investigate the psychosocial influences underpinning 'good' driving intentions and behaviour. Specifically, the current study investigated the extent to which the TPB standard constructs together with the additional predictors of moral norms, descriptive norms, anticipated regret, as well as FFM personality constructs. Informed by theory and empirical evidence, this study examined the following hypotheses:

> H_1: Attitude, subjective norm, and PBC (as the standard constructs of the TPB) would significantly and positively predict drivers' intentions to drive safely.
> H_2: Anticipated regret, moral norm, and descriptive norm (as additional constructs within the extended TPB), would significantly explain additional variance in intention to drive safely, over and above that of the standard TPB constructs.
> H_3: As theoretically expected, self-reported performance of safe driving behaviours will be significantly and positively predicted by intention and PBC.

In addition to investigating these psychological influences on safe driving, the current study sought to gain preliminary understanding of how personality characteristics may impact good or safe driving. Due to the relative dearth of literature examining personality and safe driving, the investigation of FFM personality constructs on safe driving was not associated with specific or directional hypotheses and, thus, was exploratory.

2. Method

2.1. Participants

Participants were required to be 17 years or older, hold a current driver's licence, and reside in the Australian State of Queensland (the State in which the study was being conducted). Specifying State of residence as a criterion was to ensure the driving context and associated legislative requirements associated with the behaviours under investigation were held constant. N = 171 participants (M = 40.70 years, SD = 17.93 years; 113 female) aged between 17 and 77 years and who reported driving an average of 9 (SD = 7.91) hours

Table 1
General safe driving and specific safe driving scenarios investigated in the current study.

General safe driving behaviour definition
For the purposes of this survey, the term "safe driving behaviours" is defined as driving to protect your own and/or others' wellbeing that is not specifically motivated by following road rules, but does not break them.
Scenario 1: Storming conditions
As an example: You're driving on a typical suburban road and it begins to rain. The rain is heavy enough that you need to use your windscreen wipers to see. There are puddles on the road and the shoulders of the road are gathering water also. There is a moderate level of traffic around you. A safe driving behaviour would be to reduce your speed to below the speed limit.
Scenario 2: Highway driving
As an example: You're driving on a multi-lane highway, there is good visibility and there is no rain. There is a moderate level of traffic around you. There is a car in front of you travelling in the same lane as you. A safe driving behaviour would be for you to leave adequate space between your vehicle and the vehicle in front of you.

per week, completed the Time 1 survey. Of those participants, N = 63 (M = 48.89 years, SD = 16.44 years; 37 female) aged between 17 and 76 years went on to also complete the Time 2 survey, representing an attrition rate of 63 %.

It is acknowledged that this is a relatively high rate of attrition, and this aspect is discussed further in subsequent sections. Some differences between the Time 1 and Time 2 samples are evident. Participants were, on average, 8.19 years older in the Time 2 sample, although the age range of each sample was consistent (Time 1 = 60 years, Time 2 = 59 years). The proportion of females in the Time 1 sample was slightly larger than the Time 2 sample but the difference was less than 10 %. Thus, overall, the Time 1 and Time 2 samples are relatively similar despite the high level of attrition. The age and gender of study participants were also considered in relation to published licensing statistics (see appendix A). While a convenience sample was recruited, there is general alignment with the Queensland licensed driving population although female study participants were over-represented.

2.2. Design and procedure

Consistent with a prospective application of the TPB, the current study consisted of two online surveys administered to participants one week apart; the first, Time 1, based on intentions as the key outcome of focus and the second, Time 2, based on actual behaviour in the intervening week between surveys. This one-week period was chosen based on it being considered an adequate period for participants to have had the opportunity to potentially perform, and to be able to recall having engaged in, safe driving behaviours (Rhodes, Blanchard, & Matheson, 2003). The surveys examined safe driving with respect to a general definition of safe driving and two different specific safe driving scenarios. These scenarios as examined in the current study are provided in Table 1. Prior qualitative research conducted via a series of semi-structured focus groups (Five groups comprising N = 10; Female = 6) informed the identification of the study scenarios (i.e., confirming they were realistic and feasible scenarios representing safe driving). Consistent with the TPB and behavioural prediction being enhanced, Table 1 shows that the study scenarios were defined in accordance with Target, Action, Context, and Time (i.e., the TACT principle; Ajzen, 2020).

In both surveys, all participants first responded to items in relation to the general scenario. The same items were then presented for the specific safe driving scenarios, scenario 1 and scenario 2. The scenarios were presented in the same order to all participants in both surveys, thus, holding any potential order effects constant. The Time 1 survey had items investigating the extended TPB, as well as demographics, and the FFM personality characteristics. The Time 1 survey took approximately 30 min to complete. The follow-up Time 2 survey was, relative to the Time 1 survey, a much briefer survey (approx. 10 min). Data for this study were collected between June and September 2019. Ethical clearance (QUT Reference Number: 1900000405) was gained for this study prior to data collection. Of note, the data collection for this study occurred prior to the COVID-19 pandemic and, thus, prior to the imposition of travel restrictions in Queensland, Australia.

The Time 1 survey link was promoted through paid social media (i.e., Facebook advertising) disseminated via the authors' University's Social Media Unit. Invitations to participate were also extended to the first-year psychology undergraduate pool of the authors' University. After clicking on the survey link, participants viewed a digitised participant information form and were informed that submission of the survey (partially or fully complete) would imply consent.

At Time 1, demographic questions were answered first, followed by the extended TPB constructs. As noted earlier, these items were responded regarding the general safe driving scenario followed by their assessment regarding the study's two specific safe driving scenarios. Participants then were asked to complete the measures relating to the FFM personality trait profile. At its conclusion, participants were asked to provide an email address where the researchers could send the link to the Time 2 survey. All participants who completed the Time 1 Survey and provided a contact email address were provided with the link to the Time 2 Survey.

The Time 2 survey comprised questions that sought drivers' responses regarding their 1) opportunity to have engaged in safe driving behaviours in the intervening week and 2) the frequency with which they performed safe driving behaviours in that period. Only those participants who reported having had opportunity to engage in safe driving in the previous week were presented with the items asking about frequency of potential behavioural performance. To protect participant confidentiality, responses to the two surveys were linked using a unique ID code created by each participant based on a given set of instructions.

Table 2
Details of Time 1 survey items including example wording and reliability of measures.

Construct	Example item	Number of scale items	Type	Rating scale	Reliability for general safe driving, scenario 1, scenario 2
Standard TPB constructs					
Intention	I intend to perform safe driving behaviours	3	Likert-type	(1) Strongly disagree – (7) Strongly agree	0.97, 0.96, 0.93
Subjective norm	Most people who are important to me think that I should perform safe driving behaviours	2	Likert-type	(1) Strongly disagree – (7) Strongly agree	0.78, 0.87, 0.81
PBC	I am confident that I can perform safe driving behaviours	4	Likert-type	(1) Strongly disagree – (7) Strongly agree	0.86, 0.88, 0.81
Attitude	For me to perform safe driving behaviours in the next week is…	4	Semantic differential	(1) good - (7) bad; (1) wise- (7) foolish; (1) beneficial- (7) harmful; and (1) desirable- (7) undesirable	0.90, 0.92, 0.86
Extended TPB constructs					
Moral norm	I feel a moral obligation to perform safe driving behaviours	2	Likert-type	(1) Strongly disagree – (7) Strongly agree	0.78, 0.59, 0.76
Descriptive norm	How many drivers your age would perform safe driving behaviours	2	Likert-type	(1) Strongly disagree – (7) Strongly agree	0.84, 0.70, 0.83
Anticipated regret	How much would you regret it if you did not perform safe driving behaviours	2	Likert-type	(1) Strongly disagree – (7) Strongly agree	0.75, 0.70, 0.72
IPIP					
Extraversion	Am the life of the party	10	Likert-type	(1) Very inaccurate - (5) Very accurate	0.90
Agreeableness	Am interested in people	10	Likert-type	(1) Very inaccurate - (5) Very accurate	0.85
Conscientiousness	Am always prepared	10	Likert-type	(1) Very inaccurate - (5) Very accurate	0.78
Emotional stability	Am relaxed most of the time	10	Likert-type	(1) Very inaccurate - (5) Very accurate	0.88
Imagination	Have a rich vocabulary	10	Likert-type	(1) Very inaccurate - (5) Very accurate	0.75

Notes. TPB = Theory of Planned Behaviour; PBC = Perceived Behavioural Control; IPIP = International Personality Item Pool (Goldberg, 1992); TPB constructs based on Ajzen (1991), Extended TPB constructs, moral norm based on Parker et al, (1995), descriptive norm based on Forward (2009), anticipated regret based on Sandberg and Conner (2008). Reliability for scales with greater than 3 items = Cronbach's alpha while reliability for scales with 2 items = Pearson's r (p <.001); IPIP items responded to once. Attitude items were reverse scored prior to analysis.

2.3. Materials

2.3.1. Time 1 survey

Demographic items included age (in years), gender (male, female, other), licence category (Learner, Provisional 1, Provisional 2, Open),[1] and state of residence. The standard TPB constructs of subjective norms, PBC, as well as intentions and the extended TPB constructs of moral norm, descriptive norm, and anticipated regret were measured on 7-point Likert scales ranging from (1) strongly disagree to (7) strongly agree. Higher scores indicated higher levels of that construct. Attitudes were measured using four 7-point semantic differential scales anchored with (1) good to (7) bad; (1) wise to (7) foolish; (1) beneficial to (7) harmful; and (1) desirable to (7) undesirable. Higher scores indicated more negative attitudes towards safe driving. Therefore, attitude items were reverse scored prior to analysis to aid interpretation of findings such that all constructs were in the same direction.

The 50-item International Personality Item Pool (IPIP) (Goldberg, 1992) was used to assess personality. The IPIP is an analogue measure of the FFM which has been found to be reliable and valid (Maples, Guan, Carter, & Miller, 2014). The personality traits in the IPIP closely mirror those in the FFM. However, openness is referred to as imagination, and neuroticism is referred to as emotional stability which is more in line with the positive valence of the other personality trait labels in the FFM. IPIP items were measured on a scale ranging from (1) very inaccurate to (5) very accurate. Thus, higher scores indicated that a particular trait was perceived by an individual as being more strongly represented in their personality. Details about the scale items for each construct, example items, and scale reliabilities are provided in Table 2.

[1] Queensland operates a four stage Graduated Driver Licensing (GDL) program where young people entering the licensing system must progress through a series of age and criteria-based licence categories before obtaining a full, open, unrestricted licence. More information about the Queensland GDL can be found at https://www.qld.gov.au/transport/licensing/getting/young-drivers.

2.3.2. Time 2

Behavioural opportunity to engage in safe driving since the Time 1 survey was measured by one item that corresponded to each of the study's three scenarios (e.g., "In the last week, how often were you in a situation where you could decide whether or not to [general scenario/specific scenario]"). Participants responded on Likert-type scales ranging from (1) not at all to (7) very often. Behavioural performance was measured for general safe behaviours by one item ("In the past week, how frequently have you performed safe driving behaviours") using a seven-point Likert scale ranging from (1) not at all to (7) a large extent. Two items each were used to measure behaviour performance for the specific scenarios (e.g., "In the past week, how frequently have you left adequate space between your vehicle and the vehicle in front of you on a multi-lane highway"). These items were measured on a seven-point Likert-type scale ranging from (1) not at all to (7) very often and combined into separate scales representing safe driving in the specific storming conditions scenario ($r = 0.73$, $p = .001$), and the specific highway scenario ($r = 0.79$, $p < .001$).

3. Results

All analyses were conducted with IBM SPSS version 27.

3.1. Time 1 survey

3.1.1. Data preparation and statistical analyses

For Time 1, missing values analyses indicated that 39 cases had up to 10 % missing data. Little's MCAR test was non– significant (χ (7603) = 4245.24, p = 1.00) suggesting that there was no systematic bias in items that participants did not answer. To maximise statistical power, values were imputed for these cases (Tabachnick & Fidell, 2019). The Fully conditional specification (MCMC) multiple imputation method with 10 iterations was used to estimate and replace missing values. Imputed values were visually checked and judged to be similar to non-imputed values, and all were assessed to be within plausible ranges for scores on assessment instruments. Statistical assumptions including linearity, normality of residuals and heteroscedasticity were assessed, and the dataset was judged adequate for the planned analyses. The possibility of multicollinearity was assessed first by examining bivariate correlations between predictors and reconfirmed by assessing Variance Inflation Factors (VIF). No indication of multicollinearity was found. Descriptive statistics were initially examined, following by three hierarchical multiple regressions, one each for the general scenario and the two specific scenarios. In each regression, demographic variables, the standard and extended TPB constructs and the IPIP were the predictor variables and intentions to perform general safe driving behaviours, safe driving behaviours in the storming/raining conditions, and intentions to perform safe driving behaviours on the highway driving were the criterion variables, respectively. The alpha level used in all analyses was $p < .05$.

3.1.2. Descriptive statistics

Tables 3, 4 and 5 show, the means (and standard deviations) for the standard TPB constructs were high for general safe driving and both specific scenarios, respectively. Overall, according to these descriptive statistics, participants in this study's sample believed they could drive safely, had positive attitudes towards safe driving, thought that important others would approve of their safe driving behaviour, and intended to engage in safe driving. Similarly, the high mean scores for the extended TPB constructs suggested participants were likely to have a relatively strong negative emotional response to not driving safely (anticipated regret), had strong beliefs regarding the 'goodness' of safe driving (moral norms), and perceived that safe driving was generally engaged in by drivers (descriptive norm). Attitude, subjective norm, PBC, anticipated regret, and moral norms were significantly positively correlated with intention in each of the safe driving scenarios. Descriptive norm was significantly positively correlated with intention in both scenarios but not with intentions in the general safe driving scenario. The authors decided to prioritise consistency and remove descriptive norms from subsequent analyses because it was not significantly correlated to intentions in all three scenarios. This decision was further justified conceptually as well given that the extended TPB framework already featured other normative influences including subjective norm and moral norm. Consequently, normative influences could be examined even in the absence of descriptive norm.

The means for all five personality traits were relatively similar and were close to the midpoint of their scales. However, the mean for agreeableness was slightly higher than the means of the other personality traits. This suggests that the sample was not biased with the inclusion of individuals high in a particular personality trait. For general safe driving behaviours, agreeableness and conscientiousness were significantly positively correlated with intention. For the storming conditions scenario, no personality traits were significantly correlated with intention. Agreeableness and conscientiousness were significantly, strongly, and positively correlated with intention in the specific highway scenario. Imagination was also significantly correlated with intention in a positive direction, however, to a lesser extent. While some personality traits were not significant in all three scenarios, in the absence of other personality constructs and the potentially important contribution that the investigation would make to contemporary literature, the authors decided to retain all five personality traits in the subsequent analyses.

3.2. Hierarchical multiple regressions predicting intention in the safe driving scenarios.

Three separate hierarchical multiple regressions, one for each of the three safe driving scenarios under investigation, were conducted to investigate influences on safe driving. Intentions to perform general safe driving behaviours, intentions to reduce speed below the speed limit in storming conditions, and intentions to leave adequate space between vehicles while driving on the highway were entered as the dependent variables. In each regression, and to control for their potential effects, age and gender were entered in

Table 3
Means, standard deviations, and bivariate correlations between predictors and intentions (from the Time 1 survey) for general safe driving behaviours.

	M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Intention	6.45 (1.09)	–	0.70***	0.29***	0.63***	0.28***	0.48***	0.06	0.01	0.15*	0.15*	-0.01	0.07	0.14	0.07
2. PBC	6.34 (1.03)		–	0.17*	0.59***	0.09	0.29***	0.05	0.10	0.13	0.24**	0.13	0.08	-0.01	0.11
3. Attitude	6.61 (0.85)			–	0.15	0.30***	0.32***	0.18*	-0.07	0.11	0.13	0.02	0.08	0.07	0.15*
4. Subjective norm	6.33 (1.19)				–	0.06	0.29***	0.14	0.05	0.13	0.10	-0.02	0.06	0.10	-0.12
5. Anticipated regret	5.50 (1.58)					–	0.52***	0.13	-0.15*	0.26***	0.10	-0.18*	-0.03	0.12	0.12
6. Moral norm	6.30 (1.20)						–	0.31***	-0.11	0.18*	0.15	-0.03	-0.03	0.16*	0.23*
7. Descriptive norm	4.70 (1.21)							–	0.01	0.13	0.04	0.02	0.02	0.08	0.05
8. Extraversion	3.17 (0.84)								–	0.20**	-0.05	0.21**	0.12	0.12	-0.09
9. Agreeableness	4.01(0.63)									–	0.12	-0.09	0.23**	0.22**	0.10
10. Conscientiousness	3.61 (0.62)										–	0.14	0.05	0.03	0.10
11. Emotional Stability	3.14 (0.79)											–	0.06	-0.24**	0.37***
12. Imagination	3.82 (0.53)												–	-0.16*	0.17*
13. Gender[#]	–													–	-0.18*
14. Age	40.70 (17.93)														–

Notes. M = mean; SD = standard deviation; Statistical significance: *p <.05, **p <.01, ***p <.001. [#]Point-biserial correlation calculated: Female = 1, Male = 2.

Table 4
Means, standard deviations, and bivariate correlations between predictors and intentions (from the Time 1 survey) for specific storming conditions scenario.

	M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Intention	6.19 (1.34)	–	0.82***	0.38***	0.69***	0.33***	0.42***	0.18*	-0.02	0.14	0.07	0.02	0.07	0.05	0.16*
2. PBC	6.26 (1.14)		–	0.24***	0.67***	0.22**	0.22**	0.17*	-0.00	0.06	0.12	0.11	0.08	-0.05	0.12
3. Attitude	6.48(0.94)			–	0.35***	0.26***	0.35***	0.12	-0.18*	0.07	0.08	-0.04	-0.03	0.11	0.09
4. Subjective norm	6.13 (1.34)				–	0.21**	0.29***	0.17*	-0.02	0.17*	0.12	-0.03	0.06	-0.02	-0.09
5. Anticipated regret	4.79 (1.79)					–	0.71***	0.05	-0.08	0.23**	0.03	-0.13	-0.04	0.13	0.07
6. Moral norm	5.57 (1.57)						–	0.19*	-0.06	0.15	0.06	-0.08	-0.07	0.10	0.15
7. Descriptive norm	4.31 (1.32)							–	-0.00	0.03	0.08	0.09	-0.10	0.03	0.08
8. Extraversion	3.17 (0.84)								–	0.20**	-0.05	0.21**	0.12	0.12	-0.09
9. Agreeableness	4.01 (0.63)									–	0.12	-0.09	0.23**	0.21**	0.10
10. Conscientiousness	3.61 (0.62)										–	0.14	0.05	0.03	0.10
11. Emotional Stability	3.14 (0.79)											–	0.06	-0.24**	0.37***
12. Imagination	3.82 (0.53)												–	-0.16*	0.17*
13. Gender[#]	–													–	-0.18*
14. Age	40.7 0 (17.93)														–

Notes. M = mean; SD = standard deviation; Statistical significance: *p <.05, **p <.01, ***p <.001. [#] Point-biserial correlation calculated: Female = 1, Male = 2.

Table 5
Means, standard deviations, and bivariate correlations between predictors and intentions (from the Time 1 survey) for specific highway scenario.

	M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Intention	6.44 (1.05)	–	0.65***	0.43***	0.67***	0.44***	0.54***	0.17*	-0.11	0.25**	0.23**	-0.11	0.17*	-0.02	0.06
2. PBC	6.21 (1.07)		–	0.23**	0.63***	0.38***	0.38***	0.20*	0.08	0.21**	0.28***	0.01	0.06	0.01	-0.08
3. Attitude	6.75 (0.74)			–	0.26**	0.12	0.32***	0.14	-0.09	0.09	0.12	-0.01	0.07	0.00	0.10
4. Subjective norm	6.38 (1.04)				–	0.39***	0.39***	0.09	-0.06	0.26**	0.25**	-0.12	-0.00	0.07	-0.14
5. Anticipated regret	5.00 (1.71)					–	0.59**	0.08	-0.07	0.17*	0.21**	-0.05	0.02	-0.02	0.12
6. Moral norm	5.77 (1.42)						–	0.23**	-0.07	0.15	0.14	-0.06	0.00	0.06	0.15
7. Descriptive norm	4.07 (1.38)							–	0.01	0.04	0.06	0.04	-0.16*	-0.03	0.03
8. Extraversion	3.17 (0.84)								–	0.20**	-0.05	0.21**	0.12	0.12	-0.09
9. Agreeableness	4.01 (0.63)									–	0.12	-0.09	0.23**	0.22**	0.10
10. Conscientiousness	3.61 (0.62)										–	0.14	0.05	0.03	0.10
11. Emotional Stability	3.14 (0.79)											–	0.06	0.24**	0.37***
12. Imagination	3.82 (0.53)												–	-0.16*	0.17*
13. Gender[#]	–													–	-0.18*
14. Age	40.70 (17.93)														–

Note. *M* = mean; *SD* = standard deviation; Statistical significance: *p <.05, **p <.01, ***p <.001. [#] Point-biserial correlation calculated: Female = 1, Male = 2.

the step 1. The standard TPB constructs, Attitude, subjective norm, and PBC, were entered into step 2. Step 3 included the extended TPB constructs of anticipated regret and moral norms. In step 4, the constructs from the FFM of extraversion, agreeableness, conscientiousness, emotional stability, and imagination were entered. Essentially, the analyses sought to determine whether the extended TPB constructs added additional variance explained in intentions across the three driving scenarios beyond the standard TPB constructs. And, in addition, to determine if the FFM personality constructs contributed further variance explained beyond that able to be accounted for by the other constructs of the extended TPB framework.

3.2.1. General safe driving behaviours

The results of the regression investigating intentions to perform general safe driving behaviours are displayed in Table 6. It is noted that 3 cases were removed from the dataset for this analysis because they were identified as unduly influential outliers as assessed by examining Cook's Distance with a cut-off score greater than 1. Therefore, the final sample comprised 169 cases. The model investigated in step 1 was not-significant; F (2,166) = 2.47, p =.088. However, the model became significant in step 2, F (3,163) = 49.05, p <.001, and significantly explained 60.1 % of intentions to perform general safe driving behaviours. Attitude, subjective norm, and PBC, were all significant positive predictors of intention. The addition of the extended TPB constructs in step 3 significantly explained a further 4.5 % of variance in intention to engage in general safe driving behaviours, F (2,161) = 41.98, p <.001. Moral norm, subjective norm and PBC were significant predictors in step 3. No additional overall variance was explained by the model investigated in step 4 but the overall model remained significant, F (12, 156) = 24.18, p <.001. The personality traits entered in step 4 were not significant predictors of intention to engage in general safe driving behaviours. PBC, subjective norm, and moral norm remained significant in the final step of the model explaining 36 %, 20 % and 13 %, respectively, of the variance in intentions to engage in general safe driving behaviours.

3.2.2. Specific storming conditions scenario

The results of the regression predicting intention to reduce speed during storming conditions are provided in Table 7. No unduly influential outliers were identified for this analysis. The model investigated in step 1 was not-significant; F (2,166) = 2.73, p =.068. Step 2 significantly explained 74.9 % of the variance in intention to reduce speed during storming conditions, F (3,163) = 97.4, p <.001, with attitude, subjective norm, and PBC each being positive and significant predictors. The addition of moral norm and anticipated regret in step 3 significantly accounted for an additional 3.4 % of variance in intention to reduce speed during storming conditions, F (2,161) = 82.97, p <.01. Anticipated regret, subjective norm, and PBC were significant positive predictors of intention in

Table 6
Hierarchical multiple regression analysis predicting intention to perform general safe driving behaviours (N = 169).

	Variable	β	R^2	$R^2_{Adjusted}$	F_{Change}	R^2 $_{Change}$	sr^2	B [95 % CI]
Step 1			0.03	0.02				
	Gender	0.16*					0.40	0.37 [0.01, 0.72]
	Age	0.10					0.30	0.01 [-0.00, 0.02]
Step 2			0.60***	0.59***	77.37	0.57***		
	Gender	0.12*					0.33	0.26 [0.03, 0.50]
	Age	0.05					0.22	0.00 [-0.00,0.01]
	Attitude	0.15**					0.37	0.19 [0.06, 0.32]
	Subjective norm	0.31***					0.49	0.29 [0.17, 0.41]
	PBC	0.49***					0.62	0.51 [0.38, 0.65]
Step 3			0.65***	0.63***	8.63	0.05***		
	Gender	0.08					0.26	0.17 [-0.05, 0.39]
	Age	-0.00					0.06	0.00 [-0.01, 0.01]
	Attitude	0.08					0.27	0.10 [-0.03, 0.23]
	Subjective Norm	0.28***					0.46	0.26 [0.15, 0.37]
	PBC	0.46***					0.60	0.49 [0.36, 0.63]
	Anticipated regret	0.11					0.29	0.07 [-0.01, 0.15]
	Moral norm	0.17**					0.36	0.15 [0.04, 0.26]
Step 4			0.65***	0.62***	0.33	0.00		
	Gender	0.09					0.29	0.21 [-0.03, 0.45]
	Age	-0.00					0.03	0.00 [-0.01, 0.01]
	Attitude	0.08					0.27	0.10 [-0.03, 0.23]
	Subjective norm	0.28***					0.45	0.25 [0.14, 0.37]
	PBC	0.48***					0.60	0.51 [0.37, 0.64]
	Anticipated regret	0.11					0.29	0.08 [-0.01, 0.16]
	Moral norm	0.17**					0.36	0.16 [0.05, 0.27]
	Extraversion	-0.02					0.13	-0.03 [-0.16, 0.11]
	Agreeableness	-0.04					0.18	-0.06 [-0.25, 0.12]
	Conscientiousness	-0.04					0.18	-0.06 [-0.23, 0.11]
	Emotional Stability	-0.01					0.11	-0.02 [-0.17, 0.14]
	Imagination	0.05					0.21	0.10 [-0.11, 0.30]

Notes. β = standardised regression coefficient; R^2 = coefficient of determination; $R^2_{Adjusted}$ = Adjusted coefficient of determination; sr^2 = squared semi-partial correlations; B = unstandardized regression coefficient; CI = confidence intervals.
Statistical significance: *p <.05, **p <.01, ***p <.001.

Table 7
Hierarchical multiple regression predicting intention to reduce speed during storming conditions ($N = 171$).

	Variable	β	R^2	$R^2_{Adjusted}$	F_{Change}	R^2_{Change}	sr^2	B [95 % CI]
Step 1			0.03	0.02				
	Gender	0.08					0.28	0.22 [-0.21, 0.66]
	Age	0.18*					0.41	0.01 [0.00, 0.03]
Step 2			0.75***	0.74***	154.83	0.72***		
	Gender	0.09*					0.30	0.27 [0.04, 0.49]
	Age	0.11**					0.33	0.01 [0.00, 0.01]
	Attitude	0.12**					0.33	0.18 [0.06, 0.30]
	Subjective norm	0.24***					0.40	0.24 [0.12, 0.35]
	PBC	0.63***					0.67	0.74 [0.61, 0.87]
Step 3			0.78***	0.77***	8.58	0.03***		
	Gender	0.07					0.25	0.19 [-0.02, 0.40]
	Age	0.08*					0.28	0.01 [0.00, 0.01]
	Attitude	0.08					0.27	0.11 [-0.00, 0.23]
	Subjective Norm	0.19**					0.36	0.19 [0.08, 0.30]
	PBC	0.64***					0.68	0.75 [0.63, 0.87]
	Anticipated regret	0.12*					0.30	0.09 [0.01, 0.17]
	Moral norm	0.10					0.25	0.08 [-0.01, 0.18]
Step 4			0.79***	0.77***	0.71	0.01***		
	Gender	0.07					0.25	0.19 [-0.04, 0.42]
	Age	0.10*					0.28	0.01 [0.00, 0.01]
	Attitude	0.08					0.27	0.12 [-0.00, 0.24]
	Subjective norm	0.19**					0.36	0.19 [0.08, 0.31]
	PBC	0.64***					0.39	0.16 [0.63, 0.88]
	Anticipated regret	0.12*					0.28	0.09 [0.01, 0.17]
	Moral norm	0.09					0.25	0.08 [-0.01, 0.18]
	Extraversion	0.02					0.14	0.03 [-0.10, 0.16]
	Agreeableness	-0.02					0.14	-0.04 [-0.22, 0.14]
	Conscientiousness	-0.05					0.22	-0.10 [-0.27, 0.06]
	Emotional Stability	0.04					0.17	-0.07 [-0.21, 0.08]
	Imagination	0.03					0.17	0.07 [-0.13, 0.27]

Notes. β = standardised regression coefficient; R^2 = coefficient of determination; $R^2_{Adjusted}$ = Adjusted coefficient of determination; sr^2 = squared semi-partial correlations; B = unstandardized regression coefficient; CI = confidence intervals.
Statistical significance: *p <.05, **p <.01, ***p <.001.

this model. At the final step of the analysis, age, subjective norm, PBC, and anticipated regret were significant positive predictors of intention and the overall model significantly explained 78.8 % of variance in intention, F (12, 156) = 48.20, p <.001. The addition of the personality traits did not significantly explain any additional variance in intention to reduce speed during storming conditions. Of the significant predictors at the final step of the model, PBC uniquely explained 15 % of the variance in intentions while subjective norm explained 13 %, anticipated regret and age each accounted for 8 %.

3.2.3. Specific highway scenario

The results of the regression conducted to predict intention to leave adequate space between vehicles on a multi-lane highway are presented in Table 8. Cook's Distance was examined, and no unduly influential outliers were identified for this analysis. Again, the model investigated in step 1 was not-significant, F (2,162) = 0.28, p =.758, but became significant at step 2. This step of the model significantly explained 61 % of the variance in intention, F (2, 157) = 49.74, p <.001. Attitude, subjective norm, PBC and age were positive significant predictors of intentions. In step 3, moral norm and anticipated regret were added and this step of the model was significant, F (7, 157) = 40.61, p <.001, accounting for an additional 3.4 % of variance in intention. Attitudes, subjective norm, PBC and moral norm were significant positive predictors of intentions. The overall model examined in step 4 significantly accounted for 67.7 % of the variance in intention to leave adequate space between vehicles on a multi-lane highway, F (12, 152) = 26.55, p <.001. In the final step of the model, PBC explained 25 %, subjective norm explained 22 %, attitude explained 17 %, moral norm explained 14 %, and imagination significantly and uniquely explained 12 % of the variance in intention.

3.3. Time 2 survey

3.3.1. Data preparation and statistical analysis

Despite the best efforts of the researchers, as was noted earlier, the attrition rate between the Time 1 and Time 2 was relatively high at 63 %. As noted previously, only those who reported that they had the opportunity to perform the safe driving behaviours under investigation were presented with the questions investigating their actual performance of the behaviours further reducing the sample size used in the analyses. The final sample sizes for the general safe driving scenario ($N = 57$) and the specific safe driving scenario on the highway ($N = 49$) were modest but acceptable for a scaled down analysis of predictors of behaviour in these two contexts. That is, rather than exploration of the full extended TPB in relation to prediction of prospective behaviour as was initially planned, just the constructs of intention and PBC, as predictors of behaviour, were to be analysed in the final regressions predicting behaviour.

Table 8
Hierarchical multiple regression predicting intention to leave adequate space between vehicles on a multi-lane highway (N = 171).

	Variable	β	R^2	$R^2_{Adjusted}$	F_{Change}	R^2_{Change}	sr^2	B [95 % CI]
Step 1			0.00	-0.01				
	Gender	0.00					0.00	0.00 [-0.34, 0.34]
	Age	0.06					0.25	0.00 [-0.01, 0.01]
Step 2			0.61***	0.59***	82.57	0.61***		
	Gender	-0.02					0.14	-0.04 [-26, 0.17]
	Age	0.12*					0.33	0.01 [0.00, 0.01]
	Attitude	0.23***					0.47	0.32 [0.18, 0.46]
	Subjective norm	0.39***					0.55	0.39 [0.26, 0.52]
	PBC	0.37***					0.53	0.35 [0.23, 0.48]
Step 3			0.64***	0.63***	4.97	0.03***		
	Gender	-0.04					0.17	-0.08 [-0.28, 0.13]
	Age	0.07					0.27	0.00 [-0.00, 0.01]
	Attitude	0.20***					0.42	0.37 [0.13, 0.41]
	Subjective Norm	0.34***					0.50	0.34 [0.21, 0.46]
	PBC	0.32***					0.49	0.31 [0.19, 0.42]
	Anticipated regret	0.05					0.20	0.03 [-0.04, 0.10]
	Moral norm	0.19**					0.37	0.14 [0.04, 0.23]
Step 4			0.68***	0.65***	3.13	0.03***		
	Gender	-0.03					0.17	-0.06 [-0.28, 0.16]
	Age	0.07					0.25	0.00 [-0.00, 0.10]
	Attitude	0.18***					0.41	0.25 [0.11, 0.39]
	Subjective norm	0.31***					0.47	0.31 [0.18, 0.44]
	PBC	0.34***					0.50	0.33 [0.21, 0.45]
	Anticipated regret	0.03					0.17	0.02 [-0.05, 0.09]
	Moral norm	0.18**					0.37	0.14 [0.05, 0.22]
	Extraversion	-0.09					0.28	-0.11 [-0.24, 0.01]
	Agreeableness	0.03					0.17	0.05 [-0.12, 0.22]
	Conscientiousness	0.00					0.00	0.01 [-0.16, 0.17]
	Emotional Stability	-0.08					0.27	-0.11 [-0.25, 0.03]
	Imagination	0.13**					0.35	0.26 [0.07, 0.45]

Notes. β = standardised regression coefficient; R^2 = coefficient of determination; $R^2_{Adjusted}$ = Adjusted coefficient of determination; sr^2 = squared semi-partial correlations; B = unstandardized regression coefficient; CI = confidence intervals. Statistical significance: *p <.05, **p <.01, ***p <.001.

Regarding the sample size for the specific safe driving scenario referring to storming conditions, it was too small (i.e., $N = 17$) for sufficient power to undertake a regression analysis. This result was not surprising given that Queensland was in drought at the time of data collection and, therefore, it was unlikely that that particular scenario would occur in the intervening week of the study. Given this small sample size, no further analyses were able to be conducted for this specific safe driving scenario.

3.3.2. Descriptive statistics

Summary statistics associated with behaviour in relation to the general safe driving and the specific highway scenario are shown in Table 9. The mean score for behaviour was high for both general safe driving behaviours and the specific highway scenario, thus, indicating that participants reported often engaging in safe driving behaviours in the intervening week. Intention and PBC were significantly correlated with behaviour within both scenarios. Intention and PBC were highly correlated (r = 0.85) in the general safe driving analysis suggesting potential issues with multicollinearity. However, as it is consistent with theory to use both variables in analyses predicting behaviour, both constructs were retained for the regression analyses.

3.3.3. Regressions predicting safe driving behaviour

The results of the linear multiple regressions predicting behaviour in both the general safe driving scenario and the specific highway scenario are presented in Table 10. The model investigating general safe driving significantly explained 43.1 % of the

Table 9
Means, standard deviations, correlations between intention, PBC, and behaviour.

	M (SD)	1	2	3
General safe driving behaviours (N = 57)				
1. Behaviour	6.11(*1.36*)	–	0.66***	0.57***
2. Intention	6.50 (1.19)		–	0.85***
3. PBC	6.43 (0.98)			–
Specific highway scenario (N = 49)				
1. Behaviour	5.96 (1.44)	–	0.75***	0.44**
2. Intention	6.63 (0.89)		–	0.60***
3. PBC	6.36 (0.78)			–

Note. M = mean; SD = standard deviation; Statistical significance: *p <.05, **p <.01, ***p <.001.

Table 10
Regression analyses predicting general safe driving and safe driving in specific highway scenario.

	β	R^2	$R^2_{Adjusted}$	sr^2	B [95 % CL]
General safe driving behaviours ($N = 57$)					
		0.43***	0.41***		
Intention	0.60**			0.57	0.69 [0.24, 1.12]
PBC	0.07			0.17	0.09 [-0.45, 0.63]
Specific highway scenario ($N = 49$)					
		0.56***	0.54***		
Intention	0.75***			0.78	1.22 [0.82, 1.61]
PBC	-0.01			0.10	-0.01 [-0.47, 0.44]

Notes. β = standardised regression coefficient; R^2 = coefficient of determination; $R^2_{Adjusted}$ = Adjusted coefficient of determination; sr^2 = squared semi-partial correlations; CI = confidence intervals. Statistical significance: *p <.05, **p <.01, ***p <.001.

variance in performance of safe driving behaviours, F (2,54) = 20.41, p <.001. Intention was the only significant predictor of engagement in general safe driving behaviour. Its influence was positive such that the more one reported intention to, the more they had engaged in general safe behaviours. For the specific highway scenario, the overall model significantly accounted for 56 % of variance in the performance of the safe driving behaviours, F (2, 46) = 29.25, p <.001. In this model, intention was a significant positive predictor of safe driving behaviour while PBC was not significant.

4. Discussion

Interventions informed by research examining 'good' driving behaviours may have a positive effect on road safety by emphasising the performance of safe driving, rather than encouraging people not to perform unsafe and illegal driving behaviours or penalising them if they do. The current study investigated the extent to which psychosocial factors influenced safe driving intentions and self-reported safe driving behaviours in three different safe driving scenarios. Along with the standard constructs of the TPB (attitudes, subjective norm, PBC), the study examined the influence of moral norm and anticipated regret on safe driving. The effect of the personality constructs of imagination (openness), conscientiousness, extraversion, agreeableness, and emotional stability (neuroticism) on safe driving intentions was also explored.

Overall, the extended TPB explained statistically significant variance in general safe driving intentions and behaviours, as well as intentions to and self-reported performance of leaving adequate space between vehicles on the highway. A statistically significant amount of variance in intention to slow down in storming conditions was also found; however, given this context did not present itself during the interim week period, it was not possible to assess actual behaviour in this context. The findings of this study are consistent with others that have demonstrated the TPB is beneficial in understanding a range of health and injury contexts including in relation to road safety (e.g., Chan, Wu, & Zhang, 2010; Conner & Sparks, 2005, Elliot, 2012, Palat & Delhomme, 2012, Rozario et al., 2010). In the road safety context, while the framework has been applied to numerous studies of different types of risky driving-related behaviours, its application to understanding the motivations of more positive or safe driving behaviour is less common with Nandavar et al. (2019) representing a notable exception.

Overall, in the current study, the standard TPB constructs together with moral norm and anticipated regret were significant predictors of safe driving. Personality traits, generally, were not significant predictors of intentions for safe driving behaviours, although imagination (openness) was a significant predictor of intention in the specific highway scenario. The remaining discussion focuses on the findings related to each of the study's hypotheses.

The hypothesis that the standard TPB constructs (attitude, subjective norm, PBC) would predict intentions for safe driving was partially supported. Subjective norm and PBC were significant predictors of intention in each model (across the three scenarios). These findings indicate that drivers intended to drive safely when they perceive those important to them would approve of them driving safely, and believed they had control over their ability to drive safely. Attitude was only significant in the specific highway scenario. This is consistent with previous literature about the performance of safe behaviours more broadly (not road safety) (Johnson & Hall, 2005). However, the finding that subjective norm was a stronger and more consistent predictor than attitudes differs from other TPB studies where subjective norm has often been found as the relatively weaker predictor of intentions (Conner & Sparks, 2005). The findings of the current study suggest that when it comes to safe driving behaviour, it is perhaps normative influences that play a particularly important role in whether individuals intend to engage in such behaviours.

PBC was the strongest predictor of intention for general safe driving and in the specific storming conditions scenario. In contrast, in the specific highway scenario, subjective norm was the strongest predictor of intention, followed by PBC. These findings suggest that intention to drive safely in the specific highway scenario was strongly influenced by the social pressure participant's perceived regarding engaging in this behaviour. Nevertheless, taken together, the results indicate that safe driving intentions, regardless of the driving environment, are strongly influenced by an individual's perceived ability to drive safely. Therefore, it is suggested that interventions that target PBC in relation to safe driving may be of value. Such interventions should seek to promote the perception that individuals can choose to drive safely, and it is within their driving repertoire.

The hypothesis that the addition of moral norm and anticipated regret would add to the explanatory power of the TPB in predicting safe driving intentions was partially supported. Anticipated regret and moral norm significantly explained relatively modest amounts of variance of safe driving intentions. These findings are consistent with other driving research where prediction of future regret for

driving behaviours (Parker et al., 1995), and the belief a driving behaviour was morally right or wrong (Conner et al., 2007), were found to significantly predict driving behaviours. Anticipated regret was only significant in predicting intentions in the specific storming conditions scenario, while moral norm was a significant predictor of general safe driving behaviours and the specific highway scenario behaviours. These findings suggest drivers' intention to drive safely in general and in the specific highway scenario was significantly influenced by the belief it was morally 'right' to engage in such behaviours. Intention to drive safely in the specific storming condition scenario was influenced by the anticipation of feeling regretful for not having driven safely in such a scenario.

Although only speculative, these differences in significant predictors across scenarios could be connected to other perceptions of different external factors, such as weather. That is, the perception of storming weather described in the third scenario may have triggered stronger perceptions of anticipated regret because wet weather conditions are uncontrollable and are often cited as a factor in traffic crashes, an obvious and potentially distressing result of not driving safely in the rain.

The hypothesis that intention and PBC would predict self-reported engagement in safe driving was partially supported. Intention significantly and positively predicted general safe driving behaviours and safe driving behaviours in relation to the specific highway scenario, but PBC did not. These results suggest that increasing driver's intentions (through targeting the precursor predictors of such intentions) to drive safely may lead to an increase in actual performance of safe driving behaviours, both in general and in situations such as when they are driving on a multi-lane highway.

Overall, the exploratory investigation of personality traits in the current study suggested that they do not influence intention to drive safely. In the current study, only one personality trait, imagination (openness) predicted safe driving intention and that was in only one of the three driving scenarios; namely, the specific safe driving scenario regarding highway driving. To some extent, this finding is consistent with studies that have found imagination to be a significant predictor of other driver behaviour such as not using a mobile phone while driving (Kita & Luria, 2018) and, pertinent to the current study, of pro-social driving (Harris et al., 2014). Conversely, the findings that the other FFM personality traits did not significantly predict safe driving intentions is inconsistent with other studies that have reported certain personality traits may influence 'bad' driving behaviours (Dahlen & White, 2006; Tao et al., 2017). Generally, however, it is acknowledged that the literature surrounding the influence of personality on road user behaviour is mixed. For example, while some studies have found extraversion (Lajunen, 2001; Harris et al., 2014), conscientiousness (Arthur & Doverspike, 2001; Charness et al., 2018), agreeableness (Harris et al., 2014), and neuroticism (Dahlen & White, 2006) to be significant predictors of certain driving behaviours, others have found them not to be significant predictors (Rozario et al., 2010; Harris et al., 2014; Charness et al., 2018).

One possible reason that the personality variables in the study were not strongly associated with safe driving intentions relates to the inclusion of the TPB as the foundational model for the study. Theoretically, TPB is expected to subsume variance from other potential predictors such as age, other sociodemographic factors and personality traits (Ajzen, 2020). Given this, it is possible that personality influences on safe driving intentions are mediated or moderated through the standard TPB constructs. For example, someone who has a personality profile that is high in both neuroticism and agreeableness may be more prone to worry or ruminate about the views and perceptions of other people. Therefore, the influence of these two personality traits may manifest via a cognitive pathway that includes subjective norms, intentions and then behaviour. Of course, this example is speculative and could not be tested using the statistical tests applied in the current study. It would be beneficial for future studies to apply a more sophisticated technique such as path analysis or Structural Equation Modelling to confirm such hypothetical relationships. Regardless, definitive conclusions about the role of personality in influencing 'good' driving intentions and behaviours cannot be drawn from the current study alone and further research extending the exploration across other 'good' driving scenarios is also required.

4.1. Strengths and limitations

Little research has been conducted investigating safe driving and, as such, the findings of the current study provide an important foundation for future research. A strength of this study was the application of an extended TPB which included prediction of both intention and behaviour. The examination of general safe driving and two specific safe driving scenarios ensured that there was both depth and breadth in the analysis and application to real world driving contexts. To the authors knowledge this was the first study to specifically examine personality traits and safe driving. Thus, the current study encourages future research to also investigate individual differences and safe driving.

These positive aspects notwithstanding, some limitations of the study need to be acknowledged. First, the study relied on self-report surveys which may suffer from biases or incorrect reporting. However, given the anonymous nature of participation and the topic pertaining to safe driving and, thus, not questions about engagement in illegal driving behaviours, it would seem unlikely that participants would be motivated to answer questions incorrectly. Nevertheless, there remains the potential that participants responded in ways to present themselves as safer drivers than they actually are. Future studies should make efforts to guard against this possibility, for example by including a measure of social desirability bias in the survey (Larson, 2019) or by using a more objective measure of safe driving, such as by taking direct recordings from instrumented vehicles.

Second, it is noted that there were issues with attrition between the Time 1 and Time 2 surveys. Additionally, the small sample size for the specific storming scenario was likely because most of Queensland, where the study was conducted, was drought-affected during the data collection period. Because of this reduced sample size, it was not possible to conduct analyses investigating self-reported behavioural performance related to the storming conditions scenario. In future research, the use of non-self-report measures of driving behaviours, such as in-vehicle data recorders or by assessing a participant's behaviour in a driving simulator, could be an alternative to verify the current study's findings based on self-report measures only.

Third, it should be noted that the sample comprised mostly female respondents which is not representative of the Queensland

driving population. Moreover, the sample comprised individuals from Queensland and as such may not be generalisable to other populations. Representativeness and generalisability were not specific aims of the current study due to the preliminary nature of the study and the convenience sampling utilised. However, there was some general alignment between the study sample and the population of licensed drivers in Queensland (see appendix A). Nevertheless, future studies could employ more detailed or targeted recruitment strategies to obtain highly representative results. In particular, efforts should be made to ensure that the gender make-up of the sample is aligned with that of the general population of drivers, something that was not the case in the current study.

Fourth, the intent of this exploratory study was to gain an initial understanding of some potential predictors of safe driving behaviour in a general sample of drivers. As such, the analyses did not comprehensively examine sociodemographic or other differences within the licensed driving population that may be important. For example, a beneficial direction for future studies to take could be to investigate group differences related to age, gender, socioeconomic status, driving experience, neurological health or mental health, and interactions between these factors and the variables included in the current study. In particular, investigations focused on the interaction of gender and driving experience and its impact on safe driving are likely to be beneficial, given research suggesting these variables are important in explaining risky driving behaviour.

Finally, the measure of behavioural performance for general safe driving and each scenario was confined to a single self-report item which may have less psychometric validity than a multi-item scale. Future research should consider expanding this measure, or as noted, utilise a different more objective measure for the dependent variables in the analyses.

4.2. Practical implications

The practical implications of this research are many. First, and most importantly, the findings suggest that the development of future road safety interventions, with a focus on safe driving opposed to risky driving, can utilise the TPB as a theoretical basis. Interventions could highlight the association of safe driving and advantages of performing the behaviour (attitude), emphasise the approval of important others of safe driving (subjective norm), and aim to calibrate the perceived control a driver has in performing safe driving behaviours with their actual ability to do so. Additionally, the significant extended TPB constructs could be used to illustrate safe driving as the morally 'right' thing to do (moral norm).

4.3. Concluding remarks

The current study offers innovative insights into the psychosocial motivations underpinning safe driving behaviour and, in doing so, addressing a relative gap in existing knowledge. The findings suggest that it may be possible to develop theoretically underpinned and empirically based interventions to promote safe driving behaviours. Doing so may help to foster a safe(r)-driving culture and help to reduce the heavy burden of road trauma impacting individuals and society.

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CRediT authorship contribution statement

Sophia Armitage: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft, Writing – review & editing. **David Rodwell:** Supervision, Conceptualization, Methodology, Writing – review & editing. **Ioni Lewis:** Supervision, Conceptualization, Methodology, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A

Official licensing data for 2019 was retrieved from the Queensland Department of Transport and Main Roads (TMR) website: https://www.tmr.qld.gov.au/safety/transport-and-road-statistics/licensing-statistics.aspx. Average age of licensed driver is not published; however, the proportion of licensed drivers according to a standardised set of age cohorts was calculated (see Table A1). In

Table A1
Age-range of Queensland licensed drivers in 2019.

Age-range	Number of licenced drivers	Proportion (%)
16 years	43,104	1.1
17 years	51,900	1.4
18 years	56,599	1.5
19 years	57,179	1.5
20 year	57,869	1.5
21–24 years	238,085	6.3
25–29 years	327,328	8.6
30–39 years	690,033	18.1
40–49 years	669,528	17.6
50–59 years	630,896	16.6
60–69 years	524,852	13.8
70–74 year	212,058	5.6
75 years and older	246,966	6.5
Total	3,806,397	100
Reproduced from https://www.tmr.qld.gov.au/safety/transport-and-road-statistics/licensing-statistics.aspx		

Table A2
Gender of licensed drivers in Queensland in 2019.

Gender	Number of licensed drivers	Proportion (%)
Male	1,889,012	51
Female	1,830,754	49
Total	3,719,766	100
Reproduced from https://www.tmr.qld.gov.au/safety/transport-and-road-statistics/licensing-statistics.aspx		

2019, when the data for the current study was collected, the 40–49 age cohort made up 18 % of all licensed Queensland drivers, which along with the 30–39-year-old drivers (also 18 %), were the largest age cohorts in Queensland. The second largest age group was 50–59-year-old drivers (17 %) followed by 60–69-year-olds (14 %). Thus, the average age of the samples in the current study, being 40.70 (SD = 17.93) and 48.89 (*SD* = 16.44) years, appears to be somewhat consistent with the age of the largest cohorts of drivers in Queensland, and the age distribution of licensed drivers in Queensland in 2019 which skewed older. However, using statistics from TMR (see Table A2), it was found that the samples in the current study were over-represented with females compared to the Queensland licensed driver population; 49 % of the licensed driving population in Queensland were female compared to 66 % in the Time 1 sample and 59 % in the Time 2 sample.

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