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Investigating driver willingness to drive through flooded waterways

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## Abstract

Approximately 40% of all drowning deaths involve a motor vehicle. Regardless of its significance as a cause of flood-related mortality, there is continued prevalence of driving through flooded waterways in Australia and worldwide. We aimed to understand the motivational determinates of driving through flooded waterways in low and high-risk scenarios by utilizing an augmented Theory of Planned Behaviour (TPB) with behavioural willingness **as the outcome variable** as well as the influence of additional predictors; namely perceived risk and past behaviour. Participants ( $N = 174$ ;  $M_{age} = 27.43$ ,  $SD = 10.76$ ) answered standard TPB-based questions in regards to attitudes, subjective norm, and perceived behavioural control (PBC), as well as additional variables of perceived risk (i.e., perceived susceptibility and perceived severity) and past behaviour. Support was found for the TPB as attitude, subjective norm, and PBC predicted behavioural willingness. Support was also found for perceived severity in the high-risk but not the low-risk scenario. No support was found for perceived **susceptibility**. Past behaviour emerged as a significant predictor of willingness in the low and high-risk scenario. The findings provide support for an augmented TPB in understanding individuals' willingness to drive through flooded waterways, suggesting that a multi-strategy approach may be critical in attempts to reduce the incidence of such risky driving behaviour.

## 1. Introduction

Floods are among the most widespread of natural disasters and are cited as the highest cause of mortality due to drowning throughout the world (Ashley & Ashley, 2008; Berz et al., 2001). Flood related drowning deaths are continuing to rise in Australia and a reported risk factor of many drowning fatalities is driving through flooded waterways (Royal Life Saving Society Australia, 2011). Regardless of its significance as a cause of flood-related mortality, little is known about risk factors for motor-vehicle related drowning (Yale, Cole, Garrison, Runyan, & Riad Ruback, 2003). Research has found that people continue to ignore flood warnings and choose to drive into flooded roads. Drowning death research by FitzGerald, Du, Jamal, Clark, and Hou (2010) found that the use of a motor vehicle was involved in drowning deaths 48.5% of the time and 39.7% of this was attempting to negotiate flooded bridges, streams, and roads. Other noteworthy research has found between 35-60% of all drowning deaths to be vehicle related (Coates, 1999; Jonkman & Kelman, 2005; Perry, 2012).

It is apparent that most drivers are often unsuccessful in recognizing the risks associated with flooded waterways. Research investigating driving through flooded

waterways leads to a number of common findings: a) six inches (approximately 15 centimeters) of water will reach the bottom of most passenger cars which can cause loss of control and even stalling (NOAA, 2012), b) many cars will start to float in as little as 30 centimeters of water, and c) virtually all cars including four-wheel drives will float in 60 centimeters of water (Royal Life Saving Society Australia, 2011). Once a vehicle becomes buoyant the water will easily push it sideways. At this point, most vehicles will then tend to roll over leaving only seconds for those inside to escape.

Many fatalities associated with floods can be avoided and, to address this issue, policy makers in Queensland, Australia employed a campaign with the slogan “If it’s flooded, forget it” after the January 2011 floods. Additionally, the city council on the Gold Coast, Queensland, Australia employed a two-pronged floodwater safety campaign that was directed at 1) primary school aged students through their schooling and 2) motorists through advertising and communications about flooding ‘hotspots’. Although every effort was taken to attempt to reduce the number of people who drive through flooded waterways, vehicle-related drownings remain a concern. Furthermore, these efforts induced behaviour change externally as they did not individually tailor interventions by targeting the audiences’ motivations regarding driving through flooded waterways. Campaigns to induce behaviour change need to have an intrinsic effect on the driver’s decision to drive through a flooded waterway (Curry, Wagner, & Grothaus, 1991). To effectively reduce the rate of motor vehicle-related drownings it is necessary to establish empirical evidence that is grounded in sound theory on key determinants that guide people’s decisions to drive through flooded waterways. By applying sound decision making models to understand people’s behaviour to drive through flooded waterways will aid in the development of resultant intervention programs that can ultimately save human lives, not only in Australia, but worldwide.

### *1.1. The Theory of Planned Behaviour*

The Theory of Planned Behaviour (Ajzen, 1991; Ajzen & Madden, 1986) is a well validated decision making model that has been used extensively to explain human social and health behaviours (Armitage & Conner, 2001; Godin & Kok, 1996). The TPB is regarded as a deliberative processing model and suggests that individuals' decisions are constructed after systematic consideration of available evidence (Conner & Sparks, 2005). In this model, the intention to act is the most proximal determinate of behaviour. Intentions are proposed to encompass the motivational aspects that influence behaviour which include attitudes, subjective norms, and perceived behavioural control (PBC). Attitude towards the behaviour refers to the individual's global positive or negative evaluation or assessment of performing the behaviour. Subjective norm is a social factor that reflects perceived pressures from significant others to perform or not to perform the target behaviour. PBC (which is also proposed to influence behaviour directly) refers to the perceived extent to which the behaviour is under volitional control and whether the individual believes they have the necessary resources and opportunities to undertake the behaviour (Ajzen, 1991). The PBC construct is congruent to Bandura's self-efficacy construct (Bandura, 1977, 1989) which refers to individual's beliefs about their confidence in their capabilities to have control over events that affect their lives and their own level of functioning. In addition, past behaviour is often included within the TPB as it has been shown to explain more variance in people's intention and behaviour than that accounted for by the TPB variables alone (Ajzen, 1991; Conner & Armitage, 1998). Repeated performance of a behaviour may lead to the development of habitual processes which makes subsequent performance more likely (Conner & Armitage, 1998).

Meta-analytic reviews provide support for the TPB in explaining people's intentions and behaviour (Conner, Norman, & Bell, 2002). Armitage and Conner (2001) examined 185 independent studies across a range of social and health behaviours and found the TPB to

explain 27% and 39% of the variance in behaviour and intention respectively. The TPB has also been used to explain various risky driving behaviours including texting/calling while driving (Walsh, White, Hyde, & Watson, 2008), dangerous over-taking (Forward, 2009), and speeding in rural (Letirand & Delhomme, 2005; Wallen Warner & Aberg, 2008) and urban areas (Elliot, Armitage, & Baughan, 2003, 2005; Parker, Manstead, Stradling, Reason, & Baxter, 1992; Wallen Warner & Aberg, 2008).

### *1.2. Willingness to drive through flooded waterways*

Despite the support for the TPB, a criticism of the model and that of the majority of attitude-behaviour models, is the underlying assumption that the decision to engage in a specific behaviour is a rational and goal-directed process (Gibbons, Gerrard, Blanton, & Russell, 1998). Accordingly, these models do not account for the more impulsive and irrational nature of people's actions (Gibbons, Gerrard, Ouellette, & Burzette, 1998). The predominance of attitude-behaviour consistency research has been focused on intentions to engage in health-promoting behaviours (e.g., physical activity) with little research conducted in predicting health-risk behaviours (e.g., driving through flooded waterways) (Gibbons & Gerrard, 1995; Gibbons, Gerrard, Blanton, et al., 1998). In regards to predicting health-promoting behaviour, the rational approaches have performed well. However, these models have been less successful in predicting behaviours that are considered to be impulsive and irrational (Stacy, Bentler, & Flay, 1994). For example, it would be difficult to comprehend that behaviours that damage one's health or well-being or puts one at risk for negative consequences, such as driving through flooded waterways, are goal-directed or reasoned (Gibbons, Gerrard, Blanton, et al., 1998). As a result, a measure of willingness in the context of the current study might be more appropriate than intentions to do so.

Behavioural willingness, examined more frequently in the context of the prototype willingness model (PWM; Gibbons & Gerrard, 1995) is separate from behavioural intention

in that it is concerned with a lack of planning and is reactive rather than deliberate (Gibbons, Gerrard, Blanton, et al., 1998). It involves comparatively little forethought resulting in less consideration of the consequences (Gibbons, Gerrard, Ouellette, et al., 1998) and, thus, less acceptance of responsibility for the outcomes from the behaviour (Wells, 1980). The willingness-behaviour relationship has been found to be more powerful than the intention-behaviour relationship when predicting more risk taking-type behaviours. An individual's willingness to engage in risky behaviour, given the right social opportunity, perhaps is greater than their planned intention to engage in risky behaviour. Thus, due to the potential risks involved in driving through flooded waterways, which may be considered impulsive and guided by less reasoned decision making pathways, a measure of willingness was adopted in place of intention.

### *1.3. Perceived risk*

Given that there is a large proportion of variance remaining unaccounted for by the TPB (Armitage & Conner, 2001), it is suggested that there is flexibility for improving the prediction of both intentions and behaviour and that potentially important, theoretically relevant influences be considered. Given the risk undertaken when driving through flooded waterway, the current study sought to investigate perceptions of risk, adopted from the Health Belief Model (HBM; Janz & Becker, 1984), in this risky driving context.

Perceived risk is a cognitive assessment about the extent to which one is vulnerable to the many risks associated with a specific behaviour (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008). Considerable research has shown that the evaluation of risk is generally a multifaceted process that is contingent on circumstances such as the context in which the risk information is being presented, how it is being described, and cultural and personal characteristics (van der Pligt, 1998). Risks that are more cognitively available due to past experience or coverage in the media are more prone to being over-estimated (Coleman, 1993;

Slovic, Fischhoff, & Lichtenstein, 1979; Wahlberg & Sjöberg, 2000). Interestingly, media affects people's general risk perceptions in that they overestimate the likelihood of events that are more available to them. However, most people think that their personal risk (i.e., themselves, friends/family) is much less in comparison to 'the average person' (van der Pligt, 1998; Wahlberg & Sjöberg, 2000), a phenomenon also known as unrealistic optimism (Weinstein & Lyon, 1999). A consequence of unrealistic optimism may be a failure on the part of the individual to initiate effective precautionary behaviour to avoid such misfortune. For example, it has been established that unrealistic optimism frequently occurs in situations that involve the perceived risk of negative health outcomes (McKenna, 1993; Peterson & De Avila, 2006; Weinstein, 1987). Driving through flooded waterways can have numerous serious negative health outcomes; for example injury or death, and when faced with a flooded road, individuals may not perceive these potential risks as likely to occur to them when considering driving through the water.

Research on perceived risk and health-risk behaviour supports the use of this component within the TPB. Walsh, White, Hyde, and Watson (2008) investigated mobile phone use while driving and discovered partial support for perceived risk as an additional predictor of intentions to text while driving but not calling while driving. Interestingly, it was drivers with an increased awareness of the risk that reported they were more likely to intend to text message and drive. The authors suggested that drivers who intend to text message while driving perceive risk as minimal in comparison to the benefits of this behaviour. For the purpose of the current study, the perceived risk tenets of the HBM (i.e., perceived susceptibility and perceived severity) were investigated (see figure 1). These risk perception constructs in the HBM have demonstrated strong support across a variety of behaviours (e.g., seat-belt use, breast screening, smoking; Janz & Becker, 1984). Understanding individuals' perceptions of risk when in the context of driving through flooded waterways, therefore, may

help to determine how awareness of the dangers of this behaviour should be raised to aid in developing tools to increase people's perception of risk and, ultimately, decrease this risky and potentially fatal driving behaviour.

#### *1.4. The present study*

The aim of the current study was to understand the underlying decision-making processes guiding people's willingness to drive through a flooded waterway. To date, no research has investigated this behavioural decision-making process, nor done so via adopting a theoretically rigorous approach. The current study adopted a TPB-based approach to gain this understanding and augmented the model to include the concept of willingness from the PWM and perceptions of risk from the HBM, to further improve our understanding of this important, potentially fatal risk taking behaviour of driving through a flooded waterway. Further, given the differences in consequences due to the depth of water (Perry, 2012; Royal Life Saving Society Australia, 2011) scenarios of low and high risk situations were also investigated.

In accordance with the TPB, it is hypothesized that willingness to drive through a flooded waterway will be predicted by attitude, subjective norms, and PBC (Hypothesis 1). It is further hypothesized that there will be a significant and negative association between an individuals' perceived risk (perceived susceptibility and perceived severity; Hypothesis 2) and willingness to drive through a flooded waterway, and that this prediction would more likely occur in the high risk scenario. Finally, it is hypothesized that past behavior will significantly and positively predict willingness to drive through a flooded waterway (Hypothesis 3).

## **2. Method**

### *2.1. Participants*

The sample consisted of 174 Australian individuals ranging in age from 17 to 65 years ( $M_{age} = 27.43$   $SD = 10.76$ ). Participants were recruited via convenience sampling using online



advertising (e.g., Facebook, emails), face-to-face (e.g., university campuses), and snowball methods. Participants were given the option to enter a prize draw to win one of five AUD\$20 Coles/Myer gift vouchers. Additionally, first year undergraduate psychology students could receive course credit for their participation. The majority of participants reported coming from an English speaking background ( $n = 158$ , 90.8%), being in paid employment ( $n = 127$ , 73%), and not having any children ( $n = 124$ , 71.3%). Over half of the participants reported being in a partnered relationship ( $n = 99$ , 56.9%) and holding a current open drivers license ( $n = 100$ , 57.5%).

## 2.2. Measures

The target behaviour was, *driving through a flooded waterway*. The term “flooded waterway” was based on the definition provided the Australian Government Department of Geoscience Australia (2013) and operationalised as, “an overflowing of water onto land that is normally dry and is not limited to roads”. Based on prior research of flooded roads and water level risks for experiencing difficulties (Perry, 2012; Queensland Government, 2011), two driving scenarios depicting a low and high-risk situation of driving through a flooded waterway were presented. The low risk scenario was: “You are driving in a mid-size car immediately after a thunderstorm. You approach a section of the road that is completely covered in 20cm of water”. The high-risk scenario was: “You are driving in a mid-size car immediately after a thunderstorm. You approach a section of the road that is completely covered in 60cm of water”. The generic description of each scenario was adopted from Drobot, Benight, and Grunfest (2007).

The main questionnaire employed a measure of willingness as the dependent variable and, for the independent variables, standard TPB items (attitude, subjective norms, and PBC), as outlined by (Ajzen, 1991) as well as measures of perceived risk (i.e., perceived susceptibility and perceived severity) and past behaviour were adopted. Standard TPB

measures have displayed sound reliability for a variety of behaviours (e.g., dietary behaviour, weight control, alcohol use, and exercise; see Blue & Marrero, 2006; Hutching, Lac, & LaBrie, 2008; Perugini & Bagozzi, 2001; Rhodes & Blanchard, 2006) with internal consistencies ( $\alpha = .74$  and above) and test-retest reliability (Pearson's  $r = .48 - .75$ ) for the constructs typically high, as well as good predictive validity of the TPB over a three-month period (Armitage & Conner, 1999). All items, other than the demographic background information were measured on a 7 point Likert scale from *strongly disagree* (1) to *strongly agree* (7) unless otherwise stated. **Scale reliability was calculated xxx**

### 2.2.1. Willingness

Two items assessed the strength of willingness to implement the target behaviour (e.g., "In general I would be willing to drive through the flooded waterway in this situation", scored *strongly disagree* [1] to *strongly agree* [7]). The measure produced a composite scale with a significant correlation for the 20cm scenario,  $r(170) = .75, p < .001$ , and the 60cm scenario,  $r(164) = .81, p < .001$ .

### 2.2.2. Attitude

Attitude, the individuals overall positive and negative evaluations of executing the target behaviour (Ajzen, 1991) of driving through the flooded waterway in each scenario was measured using five, 7-point semantic differential scales, including two reverse scored items (e.g., "If I were to drive through the flooded waterway in this situation it would be..." *intelligent* [1] to *stupid* [7]). The scale score for the attitudes measure revealed low internal consistency for the 60cm scenario (.40). Removal of the *good/bad* item improved the internal consistency of the measure with an alpha co-efficient of .91 and .80 for the 20cm and 60cm scenarios, respectively.

### 2.2.3. Subjective norm

Subjective norm, the perceived pressures from significant others to perform or not to perform the behaviour in question (Ajzen, 1991), was evaluated using three items for each scenario (e.g., “Most people who are important to me would approve of me driving through the flooded waterway in this situation”, scored *strongly disagree* [1] to *strongly agree* [7]). The measure was reliable with an alpha co-efficient of .94 and .90 for the 20cm and 60cm scenarios, respectively.

#### 2.2.4. *Perceived behavioural control*

PBC, the extent to which the behaviour is easy or difficult for the individual (Ajzen & Madden, 1986) was measured with two items for each scenario (e.g., “It would be easy for me to drive through the flooded waterway in this situation”, scored *strongly disagree* [1] to *strongly agree* [7]). The measure produced a composite scale with a significant correlation for the 20cm scenario,  $r(170) = .82, p < .001$ , and the 60cm scenario,  $r(164) = .65, p < .001$ .

#### 2.2.5. *Risk perception: perceived susceptibility and perceived severity*

Six items based on the constructs from the HBM (Janz & Becker, 1984) measured participants’ risk perception by assessing their perceived susceptibility and perceived severity. Three items in each scenario assessed participants’ beliefs regarding their perceived susceptibility, which Janz and Becker (1984) states is one’s opinion of the risk of experiencing difficulty/danger while performing the target behaviour (e.g., “My chances of experiencing difficulties if I were to drive through the flooded waterway in this situation are great”, scored *extremely unsusceptible* [1] to *extremely susceptibility* [7]). The measure was reliable with an alpha co-efficient of .95 and .94 for the 20cm and 60cm scenarios, respectively.

Two items in each scenario measured participants’ beliefs regarding their perceived severity, which Janz and Becker (1984) states is one’s feelings involving the seriousness of the specific situation and the consequence of engaging in a particular behaviour (e.g., “If you

drove through the flooded waterway in this situation the consequences would be...”, scored *not at all severe* [1] to *extremely severe* [7]). The measure produced a composite scale with a significant correlation for the 20cm scenario,  $r(170) = .83, p < .001$ , and the 60cm scenario,  $r(162) = .70, p < .001$ .

### 2.2.6. Past behaviour

Two items were used to assess participants’ engagement in driving through flooded waterways in general. These items included; “To what extent have you driven through a flooded waterway in this situation”, scored a *small extent* [1] to a *large extent* [7] and “How often have you driven through a flooded waterway in this situation”, scored *never* [1] to *very often* [7]. The measure produced a composite scale with a significant correlation for the 20cm scenario,  $r(170) = .74, p < .01$ , and the 60cm scenario,  $r(161) = .62, p < .01$ .

### 2.3. Design and procedure

Ethical clearance was granted by the University Human Research Ethics Committee (PSY/B5/12/HREC). A cross-sectional study involving a correlational design was implemented to investigate the ability of the TPB and additional variables to predict drivers’ willingness to drive through flooded waterways. Participation involved individuals completing a self-report questionnaire, which were counterbalanced to avoid order effects (i.e., participants randomly received a survey with either the low or high-risk scenario presented first), either online ( $n = 142, 72.8\%$ ) or paper-based ( $n = 53, 27.2\%$ ). Bivariate analyses with bonferroni adjustment of the study variables across the methods of questionnaire delivery as well as order of scenario delivery revealed no substantive differences. Prior to involvement, all participants were given an information sheet containing details of the study and informed consent was acknowledged through the completion and return of the questionnaire. Gift vouchers were drawn on completion of the study and all participants were given the option to receive a summary of the research findings if requested.

### 3. Results

#### 3.1. Descriptive analysis of data

The means, standard deviations, correlations, and Cronbach's alpha coefficients of the study's variables are presented in Table 1. Overall, people were significantly more willing to drive through the flooded waterway in the 20cm scenario than the 60cm scenario,  $t(161) = 13.02, p < .001, d = 2.05, 95\% \text{ CI } [1.60, 2.18]$ . Men ( $M = 4.12, SD = 1.71$ ) were more willing to drive through the flooded waterway in the 20cm scenario than women ( $M = 3.32, SD = 1.78; t[169] = 2.87, p < .01, d = .46, 95\% \text{ CI } [.25, 1.35]$ ); however, there was no significant difference in willingness between men ( $M = 1.68, SD = 1.00$ ) and women ( $M = 1.84, SD = 1.34; t[163] = -.78, p = .44, d = .13, 95\% \text{ CI } [-.55, .24]$ ) for the 60cm scenario. Inspection of the correlation matrix for the 20cm scenario showed willingness to be correlated with all variables, with PBC having the strongest correlation ( $r = .84, p < .001$ ) for the 20cm scenario and ( $r = .77, p < .001$ ) for the 60cm scenario. As expected, for the additional variables, significant and negative associations were found for willingness and perceived susceptibility ( $r = -.71, r = -.56$ ) and perceived severity ( $r = -.56, r = -.55$ ), for the 20cm scenario and 60cm scenario, respectively.

#### 3.2. Analysis predicting behavioural willingness

##### 3.2.1. Data analysis overview.

A hierarchical multiple regression analysis was performed on the dependent variable of willingness for both scenarios. The TPB variables of attitude, subjective norm and PBC were entered together in Block 1, with the additional variables of perceived risk (i.e., perceived susceptibility and perceived severity) entered together at Block 2, and past behaviour entered in Block 3.

##### 3.2.2. Model analysis for 20cm scenario.

Results of the 20cm scenario analysis are presented in Table 2. Results showed that the TPB variables entered at Step 1 accounted for 77% (adjusted  $R^2 = .77$ ) of the variance in willingness,  $F(3, 166) = 188.92, p < .001$ . All three of the predictor variables, attitude ( $\beta = .28, p < .001$ ), subjective norm ( $\beta = .19, p < .001$ ), and PBC ( $\beta = .51, p < .001$ ), contributed significantly to the model. The addition of perceived risk (i.e., perceived susceptibility and perceived severity) at Step 2 significantly added to approximately 1.3% of the variance,  $F_{change}(2, 164) = 5.01, p < .01$ ; however, neither perceived susceptibility nor perceived severity emerged as significant. The entering of past behaviour at Step 3 significantly added approximately 1.6% of the variance in willingness,  $F_{change}(1, 163) = 13.60, p < .001$ . In the overall model four of the predictor variables, attitude ( $\beta = .25, p < .001$ ), subjective norms ( $\beta = .18, p < .001$ ), PBC ( $\beta = .37, p < .001$ ), and past behaviour ( $\beta = .15, p < .001$ ) contributed significantly to willingness to drive through a flooded waterway that was covered with 20cm of water. The final model explained 80% (adjusted  $R^2 = .80$ ),  $F(6, 163) = 110.69, p < .001$ , of the variance in willingness to drive through the flooded waterway.

### 3.2.3. Model analysis for 60cm scenario.

The results of the 60cm scenario analysis are presented in Table 3. Results revealed that the TPB variables entered at Step 1 accounted for 73% (adjusted  $R^2 = .73$ ) of the variance in willingness,  $F(3, 158) = 144.55, p < .001$ . Attitude ( $\beta = .25, p < .001$ ), subjective norm ( $\beta = .37, p < .001$ ), and PBC ( $\beta = .35, p < .001$ ) all contributed significantly to the model. The addition of perceived risk (i.e., perceived susceptibility and perceived severity) at Step 2 significantly added to approximately 1.5% of the variance,  $F_{change}(2, 156) = 4.69, p < .05$ . Attitude ( $\beta = .21, p < .001$ ), subjective norm ( $\beta = .36, p < .001$ ), and PBC ( $\beta = .29, p < .001$ ) remained significant predictors, with perceived severity ( $\beta = -.12, p < .05$ ) also contributing significantly to the model. The entering of past behaviour at Step 3 added approximately 1% of variance in willingness,  $F_{change}(1, 155) = 4.71, p < .05$ . In the overall model five of the

predictor variables, attitude ( $\beta = .22, p < .001$ ), subjective norm ( $\beta = .34, p < .001$ ), PBC ( $\beta = .27, p < .001$ ), perceived severity ( $\beta = -.12, p < .05$ ), and past behaviour ( $\beta = .10, p < .05$ ), significantly contributed to willingness to drive through a flooded waterway in the 60cm scenario. The final model explained 75% (adjusted  $R^2 = .75$ ),  $F(6, 155) = 79.84, p < .001$ , of the variance in willingness to drive through the flooded waterway.

#### **4. Discussion**

The aim of the current study was to understand the underlying decision-making processes guiding people's willingness to drive through a flooded waterway in both a low and high-risk situation. The results of this study supported the efficacy of the TPB in predicting individuals' willingness to drive through flooded waterways. The study aimed also to examine additional potentially important, theoretically relevant influences of behavioural willingness relevant to the current context. For the 20cm scenario, the additional predictors of perceived susceptibility and perceived severity did not significantly predict driver willingness. While the results did not support the inclusion of perceived susceptibility for the 60cm scenario, the additional predictor of perceived severity was supported within this model. The predictive model also included a measure of past behaviour that was found to significantly add additional variance in explaining driver willingness in both scenarios.

##### *4.1. Support for the theory of planned behaviour*

Results of the current study provide substantial evidence for the use of the TPB in understanding and predicting individuals' decisions to drive through flooded waterways, supporting for Hypothesis 1. Attitude, subjective norm, and PBC were all found to be significant predictors of willingness in both situations of risk. Thus, positive attitudes to drive through flooded waterways as well as perceiving social pressure and being confident to do so, are all important factors to consider in combating this risky driving behaviour. It is interesting to note that unlike previous research and meta-analyses which have found the

subjective norm construct to be the weakest predictor within the TPB (Armitage & Conner, 2001; Hagger, Chatzisarantis, & Biddle, 2002), the current research suggests that subjective norm is a sound predictor of willingness to drive through flooded waterways in both low and high-risk situations. These findings compare favourably to other applications of the TPB in that both the 20cm scenario and the 60cm scenario explained a large portion of variance in willingness (80% and 74%, respectively). This is larger than typical findings found by Armitage and Conner (2001) and McEachan, Conner, Taylor, and Lawton (2011) who reported 39% and 44.3% of the variance in intention, respectively, to be explained. Furthermore, the current TPB model augmented with behavioural willingness explained a greater portion of variance in willingness than the typical amount (31%) in the current literature (Hyde & White, 2010). Overall, the current findings support the utility of the TPB and its constructs as motivational antecedents of driving through flooded waterways.

#### *4.2. Additional factors: risk perceptions and past behaviour*

In the test of the role of perceived risk (i.e., perceived susceptibility and perceived severity) on individuals' willingness to drive through flooded waterways, partial support was found for Hypothesis 2, with perceived severity emerging as a significant additional predictor of willingness for the 60cm scenario, accounting for an additional 2% of variance within the model. However, perceived susceptibility did not emerge as a significant predictor in either scenario. Past behaviour on the other hand emerged as a significant predictor of willingness to drive through a flooded waterway in both scenarios, providing support for Hypothesis 3.

With respect to the perceived risk measures, perceptions of susceptibility and severity did not play an important role in willingness to drive through flooded waterways for the 20cm scenario. Perceived severity, though not susceptibility, predicted willingness in the 60cm scenario. This indicates that people recognize the severity of the potential consequences of driving through flooded waterways in situations of greater risk; however, they do not consider



these consequences to be applicable to themselves. This is consistent with prior research on health-risk behaviours (McKenna, 1993) which has suggested that while people estimate relative risk, they believe others to be more vulnerable to the risks than themselves (van der Pligt, 1998; Wahlberg & Sjoberg, 2000). This is also known as unrealistic optimism (Weinstein & Klein, 1996). Within the context of the current study, people may focus on more immediate possibilities (e.g., reaching their destination) rather than long-term risks (e.g., injury or death; Loewenstein, Weber, Hsee, & Welch, 2001), thus suggesting why individuals do not perceive themselves to be vulnerable to the risk.

Past behaviour was also included in the current study as previous literature has indicated that past behaviour is a strong predictor of future behaviour (Conner & Armitage, 1998; Oulette & Wood, 1998). Within the model, past behaviour emerged as a significant predictor of willingness in both scenarios, indicating that people with experience of the behaviour are likely to be more willing to drive through a flooded waterway. This is consistent with other research on past behaviour as a predictor of risky driving behaviour (Elliot et al., 2003) and may be taken as evidence to support past actions are important to consider in this context.

#### *4.3. Application of the findings*

The findings of the current study have a number of practical implications for the development of strategies to reduce the incidence of driving through flooded waterways. Although the TPB has been employed to evaluate interventions (Hardeman et al., 2002), it has rarely been used to guide theoretical interventions (Rhodes, Blanchard, Courneya, & Plotnikoff, 2009). The current study provides evidence for the importance of an approach that incorporates TPB-based constructs of attitudinal, normative, and control influences when designing programs to reduce people driving through flooded waterways. Resultant intervention designs that incorporate 1) attitudinal change (such as encouraging people to

consider the potential negative outcomes of the behaviour for example becoming stuck/encountering hidden hazards outweigh any positive outcomes of the behaviour for example reaching their destination) and 2) social disapproval strategies as well as 3) techniques to challenge people's beliefs about their ability to perform and/or avoid the behavior, may be useful in eliciting behaviour change in relation to driving through flooded waterways. In addition, as prior experience of driving through a flooded waterway was related to greater willingness to do so, reminding people that all attempts at this risky driving behaviour can incur negative consequences may be useful in combating further attempts to drive through water.

It is important to note, however, that in attempting to increase the awareness of negative behavioural consequences (e.g., potential injury or death) caution should be taken. Research on fear appeals and threatening messages in regards to changing health-risk behaviour appears inconclusive and research suggests that positive emotional appeals may be more successful in changing behaviour (Lewis, Watson, White, & Tay, 2007). Considering perceptions of risk were not significant in the lower risk scenario, emphasizing the positives of not driving through flooded waterways (e.g., not being swept away) may be justified. Prior research has shown that highlighting the positives of safe driving behaviour produces successful results in reducing risky driving behaviour (Sibley & Harre, 2009).

#### *4.4. Strengths and limitations*

The current study has a number of strengths including the investigation of an at-risk driving behaviour that has, to date, not been investigated extensively; adoption of a systematic, theoretical method to investigate the behaviour under two levels of risk; and use of a large community sample. The current study also has limitations which should be noted. The sample was predominantly Caucasian and living in Queensland, Australia; thus, the findings may not generalize to other ethnic communities or cultures. **However, the**

geographical location where data was collected is prone to flooding and, therefore, many individuals would encounter and experience the situation of driving through flooded water. As such, locations that flood infrequently and where people may be less aware of the dangers involved in driving through water can learn from these findings to prevent future actions that may place themselves in potential danger. A further limitation was the use of self-report measures which may be susceptible to social desirability bias particularly when investigating socially undesirable behaviours (Beck & Ajzen, 1991). The TPB, however, is a good predictor of both actual and self-reported behaviour (Armitage & Conner, 2001). Furthermore, the current study employed a measure of willingness, which refocuses some of the responsibility for the behaviour from the individual to the context (Gibbons, Gerrard, Ouellette, et al., 1998). As a result, this study may have been less affected by social desirability constraints that are usually present in the more 'traditional' measures of intentions (Gibbons, Gerrard, Blanton, et al., 1998). Finally, the study investigated behavioural willingness without explicitly examining driving behaviour. Research, however, reveals behavioural willingness to be the strongest predictor of subsequent behaviour with respect to health-risk behaviours (Gibbons, Gerrard, Blanton, et al., 1998; Gibbons, Gerrard, & Lane, 2003).

## **5. Conclusion**

The current study aimed to understand the social cognitive determinants of people's willingness to drive through low and high-risk flooded waterways, a risky driving behaviour that is of national and international importance, and until now, had yet to be investigated systematically. Overall the findings support the efficacy of the TPB in that attitude, subjective norm, and PBC significantly predicted willingness to drive through low and high-risk flooded waterways. The findings suggest also that in either low or high-risk situations, people may not perceive there to be substantial consequences for the behaviour; however,

they may recognize the severity of the consequences for the behaviour in situations of greater risk (i.e., where flood waters are at a substantially higher depth). In addition, the findings of the current study suggest that if one has previously engaged in driving through a flooded waterway, they are then more likely to be more willing to drive through such risky situations again. This study provides a useful start in trying to understand people's driving decisions for an important safety behaviour. The findings of the current study and continued efforts to understand this risky driving behaviour will inform the development of resultant interventions designed to deter people from driving through flooded waterways which, in turn, will ultimately help to save lives.

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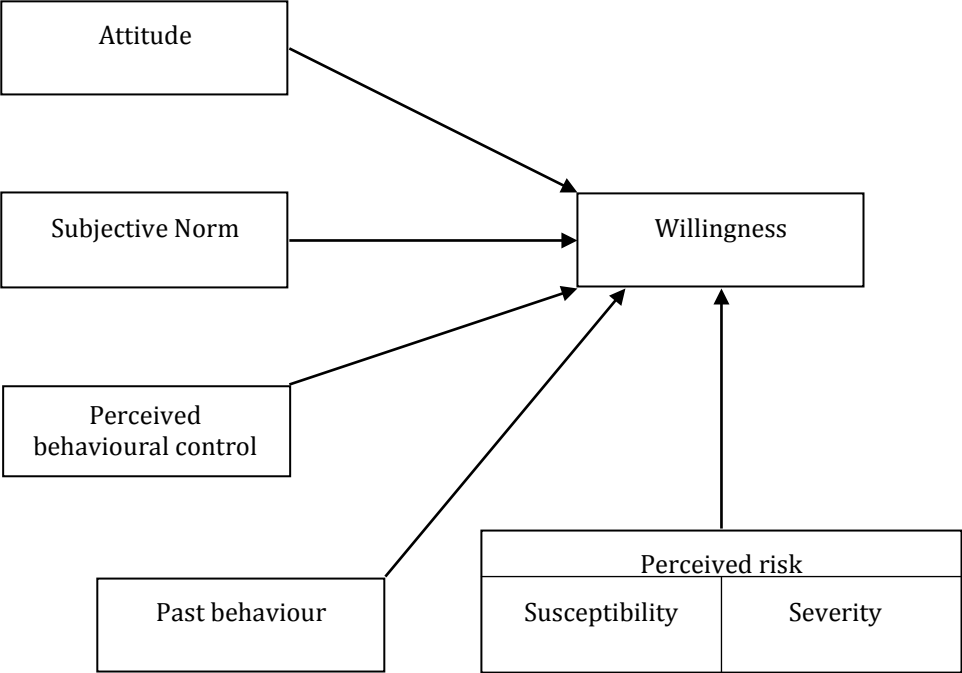
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Figure 1



TPB, DRIVING AND FLOODWATERS

**Table 1**

*Means, Standard Deviations, Bivariate Correlations and Alpha Coefficients Between all Variables in the Model<sup>a</sup>*

Variable	1	2	3	4	5	6	7	<i>M</i>	<i>SD</i>
1. Attitude		.68***	.66***	-.50***	-.49***	.24**	.73***	1.88	1.02
2. Subjective norm	.67***		.67***	-.49***	-.42***	.33***	.77***	1.69	1.03
3. Perceived Behavioural Control	.69***	.71***		-.54***	-.53***	.36***	.76***	2.10	1.38
4. Perceived Susceptibility	-.63***	-.60***	-.69***		.46***	-.41***	-.56***	5.97	1.20
5. Perceived Severity	-.62***	-.63***	-.66***	.75***		-.26**	-.55***	5.27	1.27
6. Past Behaviour	.28***	.25**	.45***	-.42***	-.35***		.40***	1.51	1.05
7. Willingness	.75***	.74***	.84***	-.71***	-.69***	.48***		1.79	1.24
<i>M</i>	3.37	3.21	4.06	4.40	3.26	2.67	3.60		
<i>SD</i>	1.44	1.59	1.78	1.64	1.61	1.70	1.79		

<sup>a</sup>Correlations for the 60cm scenario are above the diagonal; correlations for the 20cm scenario are below the diagonal. \*\* $p < .01$ ; \*\*\* $p < .001$

TPB, DRIVING AND FLOODWATERS

**Table 2**

*Hierarchical Multiple Regression Analysis of Willingness to Drive Through a Flooded Waterway in the 20cm Scenario*

Variable	Model 1				Model 2				Model 3			
	B	$\beta$	$sr^2$	95% CI	B	$\beta$	$sr^2$	95% CI	B	$\beta$	$sr^2$	95% CI
1. Attitude	.35	.28***	.04	[.21, .48]	.29	.23***	.02	[.15, .42]	.31	.25***	.03	[.18, .44]
2. Subjective Norm	.21	.19**	.02	[.09, .34]	.17	.15**	.01	[.05, .30]	.21	.18**	.01	[.08, .33]
3. Perceived Behavioural Control	.51	.51***	.11	[.40, .63]	.44	.44***	.07	[.32, .56]	.37	.37***	.04	[.25, .49]
4. Perceived Susceptibility					-.11	-.10	.00	[-.24, .02]	-.07	-.07	.00	[-.20, .05]
5. Perceived Severity					-.10	-.09	.00	[-.23, .03]	-.09	-.08	.00	[-.22, .03]
6. Past Behaviour									.16	.15***	.02	[.07, .24]
				Stats.				Stats.				Stats.
R <sup>2</sup>				.77 <sup>a</sup>				.78 <sup>b</sup>				.80 <sup>c</sup>
F				188.92***				120.82***				110.69***
$\Delta R^2$								.01				.02
$\Delta F$								5.01**				13.60***
<i>n</i>				170				170				170

Note: <sup>a</sup> 95% CI [0.71, 0.83]; <sup>b</sup> 95% CI [0.74, 0.84]; <sup>c</sup> 95% CI [0.85, 0.91]. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

**Table 3**

*Hierarchical Multiple Regression Analysis of Willingness to Drive Through a Flooded Waterway in the 60cm Scenario*

Variable	Model 1				Model 2				Model 3			
	B	$\beta$	$sr^2$	95% CI	B	$\beta$	$sr^2$	95% CI	B	$\beta$	$sr^2$	95% CI
1. Attitude	.30	.25***	.03	[.16, .45]	.25	.21**	.02	[.11, .40]	.27	.22***	.02	[.13, .42]
2. Subjective Norm	.44	.37***	.06	[.29, .59]	.43	.36***	.05	[.28, .57]	.41	.34***	.05	[.27, .55]
3. Perceived Behavioural Control	.31	.35***	.06	[.21, .42]	.26	.29***	.03	[.15, .37]	.24	.27***	.03	[.13, .35]
4. Perceived Susceptibility					-.07	-.07	.00	[-.17, .03]	-.04	-.04	.00	[-.15, .06]
5. Perceived Severity					-.12	-.12*	.01	[-.21, -.02]	-.11	-.12*	.01	[-.21, -.02]
6. Past Behaviour									.11	.10*	.01	[.01, .22]
				Stats.				Stats.				Stats.
R <sup>2</sup>				.73 <sup>a</sup>				.74 <sup>b</sup>				.75 <sup>c</sup>
F				144.55***				92.66***				79.84***
$\Delta R^2$								.02				.01
$\Delta F$								4.69*				4.71*
n				161				161				161

Note: <sup>a</sup> 95% CI [0.66, 0.80]; <sup>b</sup> 95% CI [0.69, 0.81]; <sup>c</sup> 95% CI [0.70, 0.82]. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$