Understanding pedestrians’ road crossing decisions: an application of the theory of planned behaviour

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Abstract

This paper reports a study applying the Theory of Planned Behaviour (TPB) to the prediction of pedestrians’ road crossing intentions. Respondents (N = 210) completed questionnaires which included scenarios of three potentially dangerous road crossing behaviours, followed by measures of attitude, subjective norm, perceived behavioural control, self-identity and intention. The results indicated that the social psychological variables under consideration were able to explain between 39 and 52% of the variance in intentions to cross the road in the manner depicted in the scenarios. The perceived behavioural control component of the TPB emerged as the strongest predictor of pedestrians’ intentions, suggesting that perceptions of control have an important role to play in road safety behaviour. The results are discussed in relation to the predictive utility of the TPB in this area and possible interventions to encourage safe road crossing behaviour.

Introduction

In 1995 over 45 000 pedestrians were injured in road traffic accidents in the UK, of which almost 13 000 were seriously injured or killed (DoT, 1996). In order to help reduce the number of pedestrian casualties initial research has attempted to outline the situations in which pedestrians may be at heightened risk. Ward et al. (1994), in a survey of pedestrian behaviour and accident risk, reported that the majority of pedestrian accidents occurred away from road crossing facilities. In contrast, relatively few accidents occurred at road crossing facilities, although traffic signals with a pedestrian phase and pelican crossings were found to have the most pedestrian accidents. These findings suggest that pedestrians increase their accident risk when they decide to cross away from road crossing facilities. These are the very situations in which the pedestrian has to choose where, when and how to cross the road. When a relatively unsafe choice is made, the pedestrian increases his/her accident risk. A clearer understanding of the motivational and attitudinal determinants of such ‘risky’ choices may aid the development of effective road safety interventions. However, there has been little research aimed at understanding the road crossing behaviour of pedestrians. The Department of Transport (1987) itself concedes that “we do not know anything like enough about public attitudes to road safety, or about the means of influencing these attitudes”. Moreover, further improvements in road safety may be best achieved through attempts to encourage better attitudes towards road safety behaviours (Quimby and Drake, 1989). An examination of the determinants of pedestrians’ road crossing decisions in risky situations through the application of social psychological models of the attitude–behaviour relationship may therefore facilitate the development of strategies for reducing pedestrian casualties.

One such model which might be usefully employed in this context is the Theory of Planned
D. Evans and P. Norman

Behaviour (TPB: Ajzen, 1988, 1991), one of the most widely used social psychological models of health and safety related behaviour (see Conner and Sparks, 1996). The TPB outlines three main influences on an individual's decision (i.e. intention) to engage in a particular behaviour. First, is the individual's attitude towards the behaviour which reflects the extent to which he/she believes that the behaviour will lead to positive or negative outcomes. Second, is the perceived social pressure to perform or not perform the behaviour (i.e. subjective norm). Third, is the individual's perception of control over performing the behaviour (i.e. perceived behavioural control). This last construct was added to an earlier version of the model [Theory of Reasoned Action (TRA), Ajzen and Fishbein, 1980] in order to extend the model to the prediction of non-volitional behaviour, and is seen to cover the perceived influence of both internal (e.g. self-efficacy, skills) and external (e.g. opportunities, constraints) control factors.

While the TPB has been successfully applied to the prediction of a wide range of health-related behaviours (see Conner and Sparks, 1996), its application to road safety behaviour has been limited. There are some studies applying the earlier TRA to road safety behaviours such as seat belt use, and the use of car seats and restraints for children (Wittenbraker et al., 1983; Budd et al., 1984; Martin and Newman, 1990; Stasson and Fishbein, 1990; Thuen and Rise, 1994). In addition, Rutter et al. (1995) used the TRA to identify the social psychological determinants of accident involvement in a prospective national survey of British motorcyclists. They found that the most important predictor of accident involvement over a 1 year period was engaging in violations (i.e. breaking the law and rules about safe riding), which in turn was predicted by behavioural beliefs (i.e. attitude). In contrast, normative influences were found to have little effect on motorcycling behaviour.

One focus of work with the TPB has been on the determinants of car drivers' intentions to commit driving violations. Parker et al. (1992) presented respondents with scenarios of four different driving violations; these being drink-driving, speeding, close following and dangerous overtaking. It was found that the TPB was able to explain 23-48% of the variance in intentions to commit driving violations, with all three components of the TPB emerging as independent predictors. Perceived behavioural control was found to have a particularly important role, adding 3-21% to the amount of explained variance in driving violation intentions. Interestingly, drivers who reported that they would be likely to commit such violations put this down to a perceived lack of personal control. Parker et al. (1995) have reported similar results in relation to intentions to commit motorway driving violations. The important role of perceived behavioural control has been further confirmed in relation to the use of car restraints for children (Richard et al., 1994). Other studies successfully employing the TPB in this area have looked at cycle helmet wearing among school children (Quine et al., 1998; Sissons Joshi et al., 1994).

The above studies have provided important insights into a number of road safety behaviours, thereby highlighting the potential utility of the TPB in this area. One of the advantages of the TPB is its relative parsimony, i.e. it offers a simple model of the proximal influences on intentions and behaviour. However, as Ajzen (1991) concedes, the TPB is open to the inclusion of further variables if they can be shown to add to the predictive utility of the model. One social cognitive variable which has been put forward as an additional predictor is self-identity (Biddle et al., 1987; Charng et al., 1988), which has its background in both sociological and psychological literatures (Rosenberg, 1981; Gecas, 1982). It is argued that people’s self-identities, i.e. the labels people use to describe themselves, are important determinants of behaviour. Moreover, while a person’s self-identity is likely to be consistent with (and mediated by) his/her attitudes, subjective norms and perceptions of control in a given area, there are situations in which self-identity may have a direct effect on behaviour. As Biddle et al. (1987) argue, a person may have a positive attitude towards doing A, perceive social pressure to do A and believe that...
doing A would be easy, but also believe that they are the type of person who is oriented to doing B and so choose B. In line with this argument, it can be proposed that self-identity may have an effect on people’s decisions over and above the influence of variables from the TPB. For example, Sparks and Shepherd (1992) found that individuals who saw themselves as ‘green consumers’ were more likely to intend to consume organic vegetables, and that this effect was independent of attitude, subjective norm and perceived behavioural control. In the present context, it can therefore be argued that the extent to which an individual thinks of himself or herself as a ‘safe pedestrian’ should predict road crossing decisions and behaviours. Other variables which may be predictive of road safety behaviour are age and sex (Parker et al., 1992, 1995; Rutter et al., 1995).

The present study examined the determinants of pedestrians’ road crossing intentions in a number of potentially hazardous situations. To our knowledge, the TPB has not been applied to the prediction of pedestrian road safety behaviour. Using a similar format to Parker’s (Parker et al., 1992, 1995) work on driving violations, respondents were presented with three short scenarios describing potentially hazardous road crossing behaviours. In this way, we were able to assess predictive utility of the TPB across the different road crossing situations. Given that road crossing behaviour may be influenced by a number of non-volitional factors, such as judgement of speed of traffic, vision and road conditions, it was predicted that perceived behavioural control would be the most important predictor of road crossing intentions.

**Method**

**Respondents**

Potential respondents were recruited from a Road Safety Council of Wales mailing list. Only those living in West Glamorgan, one of the most highly populated and urbanized counties in Wales, were sent a questionnaire together with a covering letter outlining the aims of the study. Of the 400 questionnaires sent, 210 were returned to the authors in prepaid envelopes. The age of the sample ranged from 17 to 75 (mean age = 39.5 years) and included 119 males and 91 females. Nearly all the sample were car drivers (n = 200), with roughly equal numbers driving less than (n = 93) and more than (n = 107) an average of 10 000 miles per year.

**Questionnaire**

The questionnaire outlined three potentially dangerous road crossing behaviours. These were: crossing a dual carriageway, crossing at a pelican crossing against a ‘red man’ and crossing a busy residential road between parked cars. Each scenario was written in the second person singular to encourage respondents to imagine themselves in the scenario described. The scenarios were as follows:

(A) **Dual carriageway.** You have come to town shopping, placing your car in a long stay car park on the edge of the shopping centre. Some hours later, loaded with your purchases, you find yourself opposite the car park with a busy dual carriageway between you and your car. To the left of you, some 40 metres away is a footbridge, to the right, but further away, are a set of phased traffic lights: you are tired and eager to get home, so you hurry across the carriageway during a gap in the traffic.

(B) **Pelican crossing.** It is late on a wet and windy afternoon, you are in hurry to pick up your suit from the dry cleaners before they close. They are situated across the street from your place of work. There is a pelican crossing almost right outside your door. At this pelican crossing two other people are standing, waiting for the ‘green man’; there is, however, no traffic about at that moment so you run across the road.

(C) **Residential street.** You see and hail a friend whom you have not seen for some time, on the other side of the road from you. It is a busy residential street with cars parked along each side. There is a zebra crossing close by, but is on the opposite direction from where
A series of questions based on the TPB and rated on seven-point response scales with anchors, followed each scenario. The salient behavioural beliefs and referents for each scenario were generated through pilot interviews with 20 adults, following Ajzen and Fishbein's (1980) recommendations.

For the behavioural beliefs six salient beliefs were used (three positive, three negative). The strength of the beliefs (e.g. 'My crossing the dual carriageway would get me to my car more quickly') was assessed using response scales ranging from unlikely (-3) to likely (+3). For each belief statement there was a corresponding outcome evaluation (e.g. 'Getting to the car more quickly would be ... bad/good') (scored -3 to +3). The products of these ratings were averaged to produce a belief-based measure of attitude for each scenario.

Six referents were used in the measure of normative beliefs, these being: the police, family/friends, children, motorists, other pedestrians and people in the same situation. Respondents were asked to indicate the likelihood that each referent would approve or disapprove of them crossing the road in the depicted manner (scored +3 to -3) and whether they were motivated to comply with their wishes (scored 1 to 7). The products of these ratings were averaged to produce a belief-based measure of subjective norm for each scenario.

In line with Parker et al.'s (1992, 1995) studies on driving violations, two items were used to measure perceived behavioural control. These asked respondents to indicate how easy or difficult it would be to cross the road in each scenario was used as a measure of perceived behavioural control, as this item was deemed to the better of the two operationalizations of perceived behavioural control in relation to the behaviours under consideration.

Self-identity was measured using six items designed to assess the extent to which respondents saw themselves as careful pedestrians (e.g. 'Generally, do you consider yourself to be a “safety conscious” pedestrian'). Coefficient α for the self-identity scale was 0.81.

Behavioural intention was assessed using two items (see Parker et al., 1992, 1995). Respondents were asked to indicate how likely it was that they would cross the road in the manner depicted in the scenario and how likely it was that a situation would arise during the next 12 months in which they would cross the road in such a manner (e.g. 'How likely is it that you would cross over the dual carriageway in the situation described?') (scored −3 to +3). These two items were found to be highly correlated (Scenario A, $r = 0.77$; Scenario B, $r = 0.71$; Scenario C, $r = 0.77$). For each scenario, the average of the two items was used as a measure of behavioural intention.

### Results

#### Descriptive data

The first stage in the analysis of the data was to compare responses across the three scenarios though a series of one-way ANOVAs. As shown in Table I, respondents had a negative attitude towards crossing the dual carriageway and the residential road, but a positive attitude towards crossing against the ‘red’ man at the pelican crossing ($F(2,180) = 58.05, P < 0.001$). No differences were found between the scenarios in relation to the subjective norm component ($F(2,206) = 0.99, NS$), with respondents indicating that all three road crossing behaviours would attract social disapproval. Considering perceptions of control, crossing against the ‘red’ man at the pelican crossing was seen to be easier to perform than the...
Correlates of road crossing intentions

For each scenario, zero-order correlations were computed between behavioural intentions and attitude, subjective norm, perceived behavioural control, self-identity, sex and age (see Table II). In each scenario, intention to cross the road in the depicted manner was significantly correlated with attitude, subjective norm, perceived behavioural control and self-identity (negative correlation). Perceived behavioural control was the strongest correlate for each scenario with those who thought it was relatively easy to cross the road in the depicted manner being more likely to intend to do so. In addition, age was found to correlate negatively with behavioural intention in each scenario.

Predictors of road crossing intentions: regression analyses

A series of hierarchical regressions was then used to assess the contribution of the components of the TPB to the prediction of behavioural intention, along with measures of self-identity, sex and age. For each scenario, three blocks of variables were used to predict behavioural intentions: (i) attitude, subjective norm and perceived behavioural control, (ii) self-identity, and (iii) sex and age. In this way it was possible to assess the additional predictive utility of self-identity and the ability of the social psychological measures to mediate the influence of the socio-demographic variables.

Considering Scenario A (crossing at a dual carriageway), Table III(A) shows that TPB variables accounted for 38% of the variance in be-
Table III. Predicting road crossing intentions: hierarchical regression analyses

<table>
<thead>
<tr>
<th>Step</th>
<th>Predictor</th>
<th>$R^2$</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Dual carriageway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Attitude</td>
<td>0.22***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subjective norm</td>
<td>0.15*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perceived behavioural control</td>
<td>0.38</td>
<td>0.36***</td>
</tr>
<tr>
<td>2</td>
<td>Self-identity</td>
<td>0.39</td>
<td>-0.10</td>
</tr>
<tr>
<td>3</td>
<td>Sex</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>0.41</td>
<td>-0.13*</td>
</tr>
<tr>
<td>B</td>
<td>Pelican crossing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Attitude</td>
<td>0.20***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subjective norm</td>
<td>0.26***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perceived behavioural control</td>
<td>0.49</td>
<td>0.38***</td>
</tr>
<tr>
<td>2</td>
<td>Self-identity</td>
<td>0.52</td>
<td>-0.16***</td>
</tr>
<tr>
<td>3</td>
<td>Sex</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>0.52</td>
<td>-0.10</td>
</tr>
<tr>
<td>C</td>
<td>Residential road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Attitude</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subjective norm</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perceived behavioural control</td>
<td>0.37</td>
<td>0.44***</td>
</tr>
<tr>
<td>2</td>
<td>Self-identity</td>
<td>0.40</td>
<td>-0.19**</td>
</tr>
<tr>
<td>3</td>
<td>Sex</td>
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</tr>
<tr>
<td></td>
<td>Age</td>
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<td>-0.02</td>
</tr>
</tbody>
</table>

*p < 0.05; **p < 0.01; ***p < 0.001.

behavioural intention. The addition of self-identity ($F$ change = 3.71, NS) and the socio-demographic variables ($F$ change = 2.98, NS) led to small, but non-significant, increases in the amount of variance explained. In the final regression equation, four significant independent predictors of behavioural intention emerged: these being attitude, subjective norm, perceived behavioural control and age. In total 41% of the variance in intention to cross the dual carriageway was explained ($F(6,191) = 22.20, P < 0.0001$).

As shown in Table III(B), the TPB variables were able to explain 49% of the variance in intentions to cross the road against the ‘red’ man at the pelican crossing (Scenario B). The addition of self-identity led to a significant increment in the amount of variance explained ($F$ change = 12.27, $P < 0.001$). The socio-demographic variables failed to increase the amount of variance explained ($F$ change = 1.91, NS). Overall, the variables under consideration were able to explain 52% of the variance in intention to cross the road against the ‘red’ man at the pelican crossing ($F(6,196) = 36.06, P < 0.0001$). In the final regression equation, all three variables from the TPB emerged as significant independent predictors along with self-identity.

The TPB variables were able to explain 37% of the variance in intentions to cross a busy residential road by nipping between parked cars (Scenario C) (see Table IIIC). Self-identity explained a further 3% of the variance ($F$ change = 8.59, $P < 0.01$), while the addition of the socio-demographic variables failed to increase the amount of variance explained ($F$ change = 0.75, NS). In the final regression equation, perceived behavioural control and self-identity emerged as significant independent predictors of behavioural intention. In total, 40% of the variance in intention to cross the busy residential road by nipping between parked cars was explained ($F(6,197) = 22.01, P < 0.0001$).

Discussion

The present study sought to identify some of the attitudinal and motivational factors underlying pedestrians' road crossing decisions in a number of potentially hazardous situations. The results highlight the potential utility of the TPB in this area. Overall, the TPB was able to explain between 37 and 49% of the variance in road crossing intentions in the three scenarios. In line with previous studies employing the TPB to examine road safety behaviour (Parker et al., 1992, 1995; Richard et al., 1994), the perceived behavioural control component of the TPB emerged as the strongest predictor of road crossing intentions in each scenario, with those who thought it would be easy to cross the road being more likely to intend to cross the road in the depicted manner. Thus, when the behaviour is seen to be easy to perform, the person is more likely to engage in a potentially hazardous road safety behaviour. Such a conclusion may be consistent with Rutter et al.'s (1995) study which found that motorcyclists were
Pedestrians' road crossing decisions

less likely to regard the risk of an accident as a barrier to performing unsafe riding behaviours, and as a result were more likely to have broken traffic laws and rules in the past. These findings suggest that there may be a link between perceptions of control and perceived risk inasmuch as those road crossing behaviours which are seen to be easy to perform may be associated with low perceptions of risk. This link was explored in more detail in the present study by correlating perceived behavioural control with a measure of risk taken from one of the behavioural beliefs used in the attitude measure. A moderate correlation was found between perceived risk and perceived behavioural control in each scenario (A, \( r = -0.15, P < 0.05 \); B, \( r = -0.24, P < 0.01 \); C, \( r = -0.22, P < 0.01 \)). Further regression analyses revealed that the addition of perceived risk failed to reduce the predictive utility of perceived behavioural control, suggesting that the strong relationship between perceived behavioural control and road crossing intentions in each scenario is not due to a third variable (i.e. perceived risk). Nevertheless, future research could examine the relationship between perceived behavioural control and perceived risk in more detail, especially as both variables were measured using single items in the present study.

In addition to perceived behavioural control, the attitude and subjective norm components of the TPB were also found to be significant predictors in two of the three scenarios, such that those who viewed the road crossing behaviours in a positive light and perceived a lack of social disapproval were more likely to intend to do so. The present results therefore coincide with research on driving violations (Parker et al., 1992), cycle helmet use (Quine and Rutter, 1998) and car seat belt use (Wittenbraker et al., 1983; Budd et al., 1984) which has highlighted both attitudinal and normative influences on road safety behaviour. The subjective norm component was found to have its strongest effect in Scenario B (crossing against the 'red man' at a pelican crossing). In this scenario two other people were seen to be waiting at the crossing. While this scenario was not perceived to attract any greater social disapproval than the other two scenarios, it is clear that it had an important role in determining pedestrians' intentions in this situation. In other words, the presence of two other pedestrians waiting for the 'green man' may have made these social considerations more salient when considering whether or not to cross against the 'red man'.

It is likely that the pressure of other pedestrians may also heighten the influence of more personal moral norms about the moral correctness of performing the behaviour. A number of researchers have argued that a distinction needs to be made between social norms (i.e. subjective norm) and internalized moral norms, as in Fishbein's (1967) original formulation of the TRA. This may be particularly relevant to behaviours that have a clear moral or ethical dimension (Gorsuch and Ortberg, 1983; Beck and Ajzen, 1991). A number of studies have found measures of moral norms to be predictive of a range of behaviours and behavioural intentions (e.g. Schwartz and Tessler, 1972; Sparks et al., 1995), including Parker et al.'s (1995) study examining intentions to commit motorway violations. It is clear that moral norms may have an important role to play in road safety behaviour, which future research should examine.

The present study also examined the role of self-identity. In two of the three scenarios the addition of self-identity led to small but significant increments in the amount of variance explained in road crossing intentions, thus supporting the addition of self-identity to the TPB. In line with expectations, those respondents who viewed themselves to be 'safe pedestrians' were less likely to intend to cross the road in the depicted manner. However, it may be the case that self-identity is a proxy for past behaviour, although a couple of studies have reported that the relationship between self-identity and intention remains even when past behaviour is controlled for (Granberg and Holmberg, 1990; Sparks and Shepherd, 1992). The present results suggest that respondents who view themselves as 'safe pedestrians' may be more conscious of the dangers involved in certain road crossing situations and, as a result, are less inclined to make potentially risky road crossing decisions.
It may be the case that responses to the road crossing scenarios used in the questionnaire reflect relatively habitual or generalized responses. Clearly, individuals are unlikely to go through a complex decision-making process every time they cross a road. Rather, they may have tendencies to make relatively safe or unsafe choices which are supported and reinforced by their beliefs and attitudes. As a result, their responses to the scenarios may reflect their typical road crossing behaviour. In support of this position, Parker (1997) found significant correlations between observations of car drivers' speeds along three sections of road and their intentions to speed when presented with scenarios. Similarly, Norman and Evans (1996) reported that school children who had been involved in road traffic accidents as pedestrians were more likely to intend to cross the road in the manner depicted in potentially hazardous scenarios. Such findings support the potential of the approach taken in the present study to assess the motivational determinants of road safety behaviour.

The TPB variables and self-identity were able to mediate the influence of the socio-demographic variables (i.e. age and sex). In fact, the addition of the socio-demographic variables led to a significant increment in the amount of variance explained in only one of the scenarios, explaining a further 2% of the variance in road crossing intentions in Scenario A. This again highlights the importance of focusing on the beliefs of pedestrians' beliefs when considering road safety behaviour.

In conclusion, the present results have a number of implications for those who seek to reduce pedestrian accidents and casualties. The results revealed perceived behavioural control to be the strongest predictor of road crossing intentions, thus indicating that attempts to influence perceptions of control in potentially dangerous road crossing situations may be an important avenue to pursue. According to Ajzen (1991), perceptions of control may be based on both external (e.g. opportunities, constraints) and internal (e.g. self-efficacy, skills) factors. In relation to the role of external factors, it may be possible to change the road environment through engineering interventions so that it becomes harder to cross the road in potentially dangerous situations and easier to use available road crossing facilities. However, such interventions may be counterproductive. Research suggests that while remedial treatment at accident blackspots reduces in the number of accidents at the treated site, there is often an increase in accidents in the surrounding area (Ebbecke and Shuster, 1977; Boyle and Wright, 1984). Instead, it may be more profitable to attempt to address pedestrians' attitudes towards road safety (Quimby and Drake, 1989) by focusing on internal control factors. This may involve making pedestrians more aware of the difficulty of, and risks associated with, crossing the road in potentially dangerous situations in comparison with the use of road crossing facilities. Such an approach may encourage safer road crossing behaviour and, given that self-identity is seen to be partly based on the repeated performance of behaviour (Charng et al., 1988), instil a more safety-conscious approach to road crossing.

References


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