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The call of the road: factors predicting students' car travelling intentions and behaviour

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Abstract

The most common daily trip for employed persons and students is the commute to and from work and/or place of study. Though there are clear environmental, health and safety benefits from using public transport instead of private vehicles for these trips, a high proportion of commuters still choose private vehicles to get to work or study. This study reports an investigation of psychological factors influencing students' travel choices from the perspective of the Theory of Planned Behaviour (TPB). Students from 3 different university campuses (n= 186) completed a cross-sectional survey on their car commuting behaviour. Particular focus was given to whether car commuting habits could add to understanding of commuting behaviour over and above behavioural intentions. Results indicated that, as expected, behavioural intention to travel by car was the strongest TPB predictor of car commuting behaviour. Further, general car commuting habits explained additional variance over and above TPB constructs, though the contribution was modest. No relationship between habit and intentions was found. Overall results suggest that, although student car commuting behaviour is habitual in nature, it is predominantly guided by reasoned action. Implications of these findings are that in order to alter the use of private vehicles, the factors influencing commuters' intentions to travel by car must be addressed. Specifically, interventions should target the perceived high levels of both the acceptability of commuting by car and the perceived control over the choice to commute by car.

The call of the road: factors predicting university students' car travelling intentions and behaviour

The most common daily trip for employed persons and students is the commute to and from work or place of study (Australian Bureau of Statistics, 1996; Doyle, 1998). When commuting, individuals may choose between public (eg. bus, train, or ferry) and private modes of transport (eg. automobile, bicycle or walking). Of all travel options, the private car, has dominated commuters' choice (Doyle, 1998). This preference has resulted in a number of negative effects. Commuters' heavy reliance on private cars has been linked with increases in travel time due to roadway congestion as well as with causing adverse environmental impact through production of noxious and greenhouse gases (Australian Government Department of Environment and Heritage, 2005; Fujii and Kitamura, 2003). In population centres where there are large tertiary institutions, students' travel to and from campus often comprises a substantial proportion of all commuting. Safety is also affected as the incidence and severity of road crashes involving private cars far outweigh those involving public commuting options (Australian Transport Safety Bureau, 2005).

There are many factors that may influence the choice of travel mode, including infrastructure (eg. availability of public transport options), economics and psychological factors (eg. perceptions of safety). With the clear environmental and community advantages

that public transport holds over private vehicle use we need to understand better why most commuters, including students prefer to drive their own cars (Daley and Martin, 1998). This information is vital to discouraging commuters from using private vehicles and encouraging increased patronage of public travel modes.

Investigation of psychological factors underlying commuter travel-mode choice has been dominated by attitude behaviour models such as the Theory of Planned Behaviour (TPB) and models of habitual behaviour. Supporters of TPB contend that behaviour is reason-based and best predicted by an individual's intentions (the subjective probability of performing the behaviour). This probability is based on the individual's attitudes (overall subjective evaluation of a particular behaviour), subjective norms (belief that influential others will support behaviour) and perceived behavioural control (perception of ease or difficulty in performing behaviour).

The efficacy of the TPB has been empirically demonstrated with a range of studies indicating that the model can be successfully applied to an array of behaviours such as the adoption of healthy behaviours (Rhodes and Courneya, 2003), volunteering (Greenslade and White, 2005), developing road safety initiatives (Elliott, Armitage and Baughan, 2003) and predicting intentions to speed in a work vehicle (Newnam, Watson and Murray, 2004). When specifically applied to predicting commuters' travel mode preferences researchers have found that each element of the TPB, that is, attitudes (Hanna and Drea 1998), subjective

norms (Daily and Martin 1988) and perceived behavioural control (PBC) (Davidov, Schmidt and Bamberg, 2003) has a significant influence over commuter travel-mode choice. Further when the entire model has been explored, behavioural intentions consistently emerge as the most significant predictor of commuting behaviour (Bamberg, Ajzen and Schmidt, 2003; Bamberg, Rolle and Weber, 2003).

Though empirically supported, the notion that travel-mode choices are reason-based is not without challenge (Verplanken, Aarts and van Knippenberg, 1997). The proponents of theories of habitual behaviour maintain that successful past behaviour will automatically continue until it no longer attains an individual's goals, rather than reason directing each behavioural instance (Oullette and Wood, 1998). In this regard, Verplanken and colleagues (1997) demonstrated the habitual nature of commuter travel-mode choices using an information search task. Participants with strong and weak car-travel habits were given information about hypothetical trips and required to make a travel-mode choice. Those participants who reported strong car-habits searched for significantly less trip information than participants who reported weak car habits, suggesting that trip choice is based on habit. That is, people's travel mode choices are strongly influenced by past trip behaviour. Overall, the results of Verplanken and colleagues' study indicate that travel-mode habits explained significant variability within commuter travel-mode choice over and above behavioural intentions across multiple modes of travel.

Proponents of TPB note that an individual's tendency to continually replicate previous behaviour may not necessarily reflect habit; rather it may demonstrate general stability in the various factors influencing intentions and behaviour. Bamberg, Rolle and Weber (2003) tested this rationale in an experiment designed to influence the TPB factors relating to commuters' travel-mode choice. Contextual factors influencing the commuting decision were manipulated by offering a free public transportation pass, maps and information about the public transit system to experimental participants. It was reasoned that claims that commuter travel-mode choices are habitually guided could only be supported if commuting behaviour remained uninfluenced by such changes which were designed to increase commuters' sense of control (ie. PBC) over their modes of commuting and thus affect their actual choices (Bamberg, Rolle and Weber, 2003). Results supported this contention: a comparison between commuters subject to the contextual manipulation and a control group demonstrated significantly greater levels of public transport use by the experimental group. In addition, the only significant predictors of travel mode behavior in the experimental group were found to be the TPB factors.

Critics (Aarts, Verplanken and Von Kippenberg, 1997; Verplanken, et al., 1997) argue that Bamberg and colleagues' approach is flawed, as once an individual is made consciously aware of alternative travel options (due to contextual changes) then previously held habits may be broken as the individual's thought processes are no longer automatic (the

fundamental requirement of habitual behaviour). This then explains the null effect of habit (Verplanken, et al., 1997).

The differences between the reasoned-action and habitual perspectives of commuter travel-mode choices may be reconciled by a habit × intention interaction model proposed by Triandis in 1977 (cited in Verplanken et al., 1997). Within this model it is asserted that habit interacts with intention so that when habits are strong, intentions will only represent a weak predictor of behavior. However, when habits are weak, intention becomes a stronger predictor of behavior. Studies by Verplanken and colleagues (1997; 1998) and more recently by Garvill, Marell and Nordlund (2003) have demonstrated that when habit is strong it is a significantly better predictor of travel-mode choice than intention, suggesting that a habit × intention interactive perspective may offer a better explanation of behaviour under some circumstances.

In an effort to advance our understanding of commuters' travel-mode choice the present study aimed to examine the predictive ability of TPB in determining students' car commuting behaviour. Particular focus was given to reconciling previous research by investigating whether car commuting habit and the interaction between habitual and intentional car use could explain additional variability in car commuting behaviour over and above behavioural intentions. In light of the previous research, it was hypothesised that:

1. Participants' intentions to travel by car would be a significant predictor of their car

commuting behaviour.

2. Car commuting habits would interact with behavioural intentions to explain significant variability within travel mode-choice behaviour, over and above behavioural intentions alone.

Method

Participants

A convenience sample of university students from three geographically separate campuses of the same university (Queensland University of Technology in Brisbane) were approached to participate in the study. An advantage of this group is that the different locations of the campuses within the same city mean that a range of public transport modes are available to students of each campus and thus they would be likely to use a wider variety than many other groups of commuters (eg office workers). Initially, 198 participants were recruited from the three Brisbane campuses of the. There were two eligibility criteria: at least minimal access to a car for commuting purposes; and holding a current Provisional or Open car driver's licence. It was assumed that by meeting these criteria participants would have some choice about whether to commute by car, and that this choice would not be restricted by car availability or licensing restrictions. A total of 189 participants (73% female) met these criteria (9 were excluded due to lack of access to a car).

Design

A cross-sectional, self-report survey design was utilised. Independent variables included direct measures of participant car commuting behavioural intention and the three constructs within the TPB (attitude, subjective norm, and PBC) as well as a measure of participants' general car commuting habit.

Two distinct measures of car commuting behaviour were collected: car commuting behaviour on the day of survey, and car commuting behaviour during the preceding week.

In line with analysis of the TPB, behavioural intention was treated as both an independent variable (hypothesised to predict behaviour) and as a dependant variable (hypothesised to be predicted by attitude, subjective norm, and PBC) (Ajzen,1991). Additionally basic socio-demographic variables as well as access to a car for commuting *("Never" = 1, "Seldom" = 2, "Occasionally" = 3, "Often" = 4, "Always" = 5*) and licence type were collected.

Habit was measured using a modified version of the *Response Frequency* measure (Verplanken et al., 1997).

Materials

The study utilised a self-report paper and pencil questionnaire. Consistent with the usual method of direct measurement of Attitude within the TPB, attitudes towards four different travel modes (bus, train, car, ferry) were assessed using 6 items consisting of

evaluative word pairs (eg. convenient-inconvenient) (Francis et al. 2004). Five of these items related to separate dimensions of travel (ie. convenience, reliability, comfort, security, pleasantness) and were rated on a seven point scale (eg. "For me to travel to my primary campus next time by bus would be…." 1 = *very unpleasant* to 7 = *very pleasant*). The sixth item related to travel overall (eg. "For me to travel to my primary campus next time by train would be…." 1 = *very bad* to 7 = *very good*). A reliability analysis was undertaken on these six items using Cronbach's alpha, which produced an acceptable alpha level of 0.66. Subjective norms and PBC for each travel mode were examined using 3 items each (eg. "Most people who are important to me would support my travelling by ferry next time I go to my primary campus"). Participants rated these statements on a 5 point Likert scale (1 = *very likely* to 5 = *very unlikely*). Behavioural intentions for each travel mode were measured by 2 items (eg. "I intend to take the car the next time I attend my primary campus"). In addition, participants were asked to indicate how often they had travelled by each of the four travel modes in the previous week (1 = *"Never"*, 2 = *"Seldom"*, 3 = *"Occasionally"*, 4 = *"Often"* and 5 = *"Always"*) and the responses for "car" were taken as the behavioural measure of car commuting in the past week. Items were adapted from similar research investigating the TPB in relation to commuter travel-mode (Bamberg, Rolle and Weber, 2003). High scores on item scales indicate agreement with the items. No items were reverse scored as it was believed that the nature of items would not foster self-report bias. Reliability for the

subjective norms, PBC and intentions scales was 0.79, 0.80 and 0.90 respectively (see Table 1).

As mentioned above, both car commuting behaviour on the day of the survey and behaviour during the previous week were collected. Although there was a significant correlation between these two measures, the value was not as high as anticipated ($r = .55$, $p < .001$). As a result, it was decided to use the previous week's behaviour as the main dependant variable in the analyses as this was considered to be more likely to be representative of the participants' general commuting behaviour.

Participants' general travel-mode habits were measured using a modified Verplanken and colleagues (1997) *response frequency* measure of general travel-mode habit. The original measure consists of a list of 14 globally described trips (eg. going to a movie) as well as a choice of 7 travel-modes to which participants respond by selecting the travel mode which they would utilise in each situation. Participants are instructed to choose their responses as quickly as possible in order to access habitual travel mode preferences. Verplanken and colleagues (1997) found a high correlation between the *response frequency* measure of general commuting habit and self-reported general car use ($r = .66$, $p < .001$), as well as a high test-retest reliability ($r = .92$, $p < .001$) for this measure. Three items were deleted for the purposes of this study as they were not relevant to local conditions (eg. going to ski), resulting in 11 items for the final instrument. Piloting of the measure resulted in some

wording changes to make them more consistent with current Australian idiom (eg. original: going for bathing in the sea, revised: going to the beach). The Cronbach's alpha for this scale was 0.84.

Procedure

Participants were recruited by personal approach at one of the three campuses of QUT in the greater Brisbane area. The three campuses represent three reasonably distinct geographical areas covering the inner city, inner suburban and outer suburban areas of Brisbane. It was anticipated that this would provide a good cross section of travel patterns, particularly since each campus has different configurations of facilities (eg. Car parking facilities, proximity to public transport routes). The purpose of the study was explained and participants were asked to complete the questionnaire and return it to one of the researchers. Participation was voluntary and participants had the right to withdraw at any time without penalty. As incentive for participation, those participants who were enrolled in introductory psychology courses received half an hour course credit for their participation. Students in other disciplines did not receive an incentive. Ethical approval for the above procedure and materials was granted by the QUT Human Research Ethics Committee.

Statistical analyses

After screening the data to ensure its integrity and that the assumptions of parametric tests were upheld, composite scales were formed for each of the TPB variables by averaging

scores on individual items reflecting each construct (ie attitudes, subjective norm, PBC and intentions). Similarly, a composite scale for general car commuting habit was formed by averaging the number of times that participants selected "car" as the preferred travel mode from the *response frequency* measure. As already noted, reliability analyses were undertaken for the TPB scales and the habit scale using Cronbach's alpha. These values were acceptable and are reported in Table 1. Correlations and regressions procedures were used to analyse the data and for these, unless otherwise specified, α = .05.

Table 1: *Means, Range, Standard Deviations, Pearson Correlations and Cronbach's alpha for Attitudes, Subjective Norms, PBC, Intentions, Habit and Car Commuting Behaviour during Preceding Week*

Construct	Range	*Cronbach's alpha*	*M*	*SD*	1	2	3	4	5
1. Attitude	1-5	.66	4.28	.75					
2. Subjective Norm	1-5	.79	3.82	1.05	.524**				
3. PBC	1-5	.80	4.08	1.06	.542**	.677**			
4. Intention	1-5	.90	3.65	1.46	.446**	.704**	.756**		
5. Habit	0-1	.84	.76	.24	.296**	.383**	.416**	.464**	
6. Car Commuting Behaviour during Preceding Week	1-5	-	3.52	1.60	.388**	.538**	.602**	.715**	.462**

Note: *** $p < .001$, ** $p < .01$, * $p < .05$

Results

Participation across the three campuses was roughly even (32.8%; 37%, 30.2%).

Overall, participants had relatively high scores on the variables of attitude (M = 4.28),

subjective norm (M = 3.82), PBC (M = 4.08), and Habit (M = .76) (see Table 1) for the car travel mode, suggesting that participants had a very positive overall stance towards commuting by car. Thus most participants regarded commuting by car as convenient, reliable, comfortable, secure and pleasant. Moreover, participants reported a perception that those people who were important to them would support them commuting by car. Regardless of whether or not they actually travelled by car to university, participants also perceived commuting by car as something that was easy to do and within their control.

Hypotheses Testing

A standard multiple regression was performed to examine how well the constructs from the TPB predicted participants' intentions to use the car to commute to and from university (see Table 2). As can be seen, results were significant with the three variables together accounting for 64% of the variance in commuting intentions [F = (3, 183) 108.40, p < .001]. However, while subjective norm and PBC uniquely accounted for 6%, and 12% respectively of the variance within Intention, the effects of attitude on intention was non-significant.

Hierarchical multiple regression analysis was used to assess the predictive ability of TPB constructs in relation to actual car commuting behaviour in the previous week. The order that the variables were entered into the model reflected the conventional method of testing the TPB where direct influences on behaviour (Intentions and PBC) are entered first,

Table 2: *Multiple Regression Analysis Predicting Participant Car Travel Behavioural Intention* (*n* = 187)

Construct	*B*	Std. Error	*β*	*t*	*sr²*	*R²*	*Adj R²*
Attitude	-.04	.10	-.02	-.43			
Subjective Norm	.50	.08	.36	5.824***	.06		
PBC	.71	.08	.52	8.308***	.12		
						.64***	.63

Note: *** $p < .001$, ** $p < .01$, * $p < .05$

followed by the indirect influences (Attitude and Subjective norm). This analysis (see Table 3) revealed that the TPB variables have a strong positive correlation with car commuting behaviour during the preceding week (R=.72) accounting for 52% of the variance in behavior [F = (4, 181) 49.18, $p < .001$]. Intention was the only significant predictor of behavior in step 1, accounting for 13% of unique variability within participant car commuting behaviour during the preceding week. Consistent with the tenets of the TPB, after addition of attitudes and subjective norms, intention remained the only significant predictor [F = (2, 181) .29, p = *n.s.*] This confirms that the influence of attitudes and subjective norm on behaviour is mediated by intentions.

However, it should be noted that the behavioural measure analysed within the present study was retrospective (ie. behaviour over the preceding week) rather than prospective or follow-up based which should ideally be used within TPB research. Therefore results regarding behaviour should be interpreted somewhat cautiously as the measurement of intentions and behaviour was undertaken at the same time rather than across different time periods.

Table 3: *Hierarchical Multiple Regression of TPB variables Predicting Participant Car Commuting Behaviour during the Preceding Week* (*n* = 186)

Construct	**B**	**Std. Error**	**B**	**t**	***sr²***	***R²***	***Adj R²***	**∆ *R²***
Step 1 Intention	.65	.09	.60	7.03***	.13			
PBC	.16	.12	.11	1.28	.00			
						.51***	.51	
Step 2 Attitude	.08	.13	.04	.21	.00			
Subjective Norm	.02	.12	.02	.65	.00			
						.52***	.51	.002

Note: *** $p < .001$, ** $p < .01$, * $p < .05$

A second hierarchical multiple regression analysis was conducted to examine whether an interaction between habit and behavioural intentions could explain additional significant variability within behaviour over and above behavioural intentions and habit alone. Behavioural intentions and habit were entered at step one, followed by the habit behavioural intention interaction at step 2 (Table 4).

Results indicated that together behavior intentions and habit explained 55% of the variance in behavior ($p < .001$), with intention and habit accounting for 36% and 10% respectively of the unique variance in behaviour. At step 2 of the analysis the addition of the Habit × Intention interaction was not significant [*Fchange* = (1, 168) .00, *p* = *n.s.*].

Table 4: *Hierarchical Multiple Regression of Behavioural Intention, General Car Travel Habit, and Habit × Intention Interaction Predicting Participant Car Commuting Behaviour during the Preceding Week (N= 172)*

Construct	**B**	**Std. Error**	**Beta**	**t**	***sr²***	***R²***	***Adj R²***	**∆ *R²***
Step 1								
Intention	.52	.05	.56	9.65***	.36			
Habit	.09	.02	.25	4.24***	.1			
						.55***	.55	.55***
Step 2								
Habit × Intention	.02	.02	.06	1.13 ns	.00			
						.56***	.55	.00 ns

Note: *** $p < .001$, ** $p < .01$, * $p < .05$

Exploratory Analysis

In order to explore whether there were any differences between regular car commuters and those who only occasionally (or less often) commuted by car in terms of TPB constructs a MANOVA procedure was conducted. For this, participants were categorised into two groups based on reported car commuting behaviour during the previous week. Regular car-commuters (n = 108) were those participants who reported “often” or “always” commuting by car during the previous week. Others (ie those who reported “never”, “seldom” or “occasionally” commuting by car) were classified as occasional car commuters (n= 78). The factors included were the TPB variables plus the habit variable (see Table 5).

An overall significant difference between the commuter types was detected (Wilk’s Λ = .49, F (5, 180)= 37.48, η^2 = .51), with further analysis revealing significant univariate differences (after Bonferroni correction) for the TPB constructs as well as general car commuting habit of the two groups were found. More particularly, significant mean

differences were found for attitudes ($F(1, 184) = 23.12$, $p < .01$, $\eta^2 = .11$), subjective norms ($F(1, 184) = 57.99$, $p < .01$, $\eta^2 = .24$, PBC $F(1, 184) = 78.75$, $p < .01$, $\eta^2 = .30$), intentions ($F(1, 184) = 176.66$, $p < .01$, $\eta^2 = .49$), and habit ($F(1, 184) = 45.85$, $p < .01$, $\eta^2 = .20$). Thus participants who regularly commuted by car reported significantly more positive attitudes towards doing so, believed that those close to them were likely to support this behaviour and were more likely to see themselves as having high levels of control over commuting by car than those who only occasionally or less often commuted by car. Moreover, regular car commuters had stronger intentions to commute by car, and significantly greater general car travel habits than participants who did not drive a car to university on the day of the survey (see Table 5).

Table 5: *Means and Standard Deviations for Attitudes, Subjective Norms, PBC, Intentions, and Habit relating to car use for regular car commuters and occasional car commuter*

	Regular Car Commuter (*n* = 108)		**Occasional Car Commuter (*n* = 78)**		**Sig level**
Construct	*M*	*SD*	*M*	*SD*	
Attitude	4.51	.55	4.00	.89	p< .01
Subjective Norm	4.26	.74	3.22	1.22	p< .01
PBC	4.59	.74	3.41	1.08	p< .01
Intention	4.52	.91	2.45	1.22	p< .01
Habit	.86	.14	.64.	.29	p< .01

Discussion

The results above indicate that commuters' use of private cars was most strongly predicted by their intentions to do so, thus supporting the first hypothesis. While car commuting habit added to the prediction of car use over and above intentions, this addition

was very modest (1.3%). Finally, there was no significant interactive influence detected for habit and intention.

Compared to commuters who regularly utilised other means of transport, those who reported often or always commuting by car perceived a greater level of support for their behaviour from influential others, felt significantly greater freedom and control of their commuting choice and reported significantly greater car commuting habits and intentions. This group also reported significantly more positive attitudes towards car travel than those who commuted by car only occasionally or less often, though it is noticeable that both groups were very positively disposed towards car commuting in general, seeing it as convenient, pleasant, comfortable, secure and reliable.

Theoretical Implications

Results of the present study confirmed the capacity of the TPB to predict participant's car commuting intentions. This provides further support for the robustness of the TPB as a model for predicting intentions towards a range of behaviours (Ajzen, 1991; Armitage and Conner, 2001; Bamberg, Rolle and Weber, 2003). In addition, the results reflect support for authors such as Bamberg and colleagues, (2003) who contend that commuters' car commuting behaviours are based on reasoned actions.

Consistent with previous research, the TPB construct of behavioural intentions emerged as the strongest predictor of actual behaviour in this study. Further, in alignment

with theoretical expectations, behavioural intentions to travel by car were determined by individual commuters' overall subjective evaluation of car travel (attitudes), perceptions of ease or difficulty (PBC) and subjective evaluations of social pressures associated with car travel (subjective norms). However, attitude was a non-significant predictor of behavioural intentions in this study.

Habit. The results of the present study tend to support assertions that stability within a commuter's travel-mode choice may not necessarily reflect habit but rather may indicate general stability in behavioural intentions (Bamberg, Ajzen and Schmidt, 2003; Bamberg, Rolle and Weber, 2003). Although general car travel habit contributed to the prediction of behaviour, this contribution was modest, with most variance within car commuting behaviour explained by behavioural intentions. Further, as the habit × intention interaction was not significant (indicating that participant car commuting behaviour does not vary as a function of habit and intention), these results do not support Triandis's (1977) habit × intention interactive perspective. However, it remains possible that our measure of habit was not as sensitive as it could have been. In particular, the response frequency measure is one of general travel mode choice and not commuting travel mode choice. It may be that these are indeed different and not captured in our study. Thus exploration of this concept should not necessarily be abandoned, though future studies should consider how best to match the measure with travel that is specifically related to commuting.

Practical Implications

Results of the present study have implications for public policy aimed at reducing the usage of cars as a means of commuting. The findings suggest that the most important predictor of car commuting behaviour is behavioural intentions, with individuals more likely to commute by car if they have strong behavioural intentions to do so. Accordingly, initiatives to alter car commuting behaviour should target individuals' car commuting intentions, aiming to weaken these or to strengthen intentions to use other modes of transport. Behavioural intentions can be modified by a variety of means. For example, a change in behavioural intentions may be brought about by reducing the social acceptability of commuting by car (eg. by reducing normative pressure to commute by car or alternatively increasing normative pressure to use other methods to commute). The strong positive attitudes towards commuting by car reported by these participants suggest that the social acceptability of commuting by car is generally high in Australia at least and we would suspect in many other highly motorised countries. Thus, introducing measures to decrease the social acceptability of commuting by car may prove difficult. However there is evidence within the health field that it is possible to decrease normative acceptability of a behaviour and instil normative pressure to adopt new behaviour . An example of this is smoking behaviour in Australia. In previous generations, smoking was not only an acceptable behaviour in Australian culture, but a widespread and dominant one, with more than 50% of men and 28% of women

claiming to smoke regularly in 1960 (Quit, 2008). These rates have steadily fallen to around 20% for men and 18% for women in 2008. Health arguments, restrictions on advertising of tobaccos products, legislation prohibiting smoking in public places (most notably the early ban on smoking on public transport including air travel) as well as public education appealing to the social desirability to become a non-smoker have assisted this trend. For the reduction of private car use for commuting, intervention at a social level would likely be most effective if it appealed to the desire to be "green" (environmentally friendly) or carbon neutral and encouraged the perception that important others would support reducing car use for commuting. Institutional and organisational rewards (for example recognition awards or financial or other incentives) could reinforce this message in the work and study environment. Though more drastic, legislation can also be used to restrict the use of private cars on particular days, in particular areas or by particular groups.

Based on the study's findings, a further feasible option to alter behavioural intentions may be to introduce either psychological or physical barriers designed to cause individuals to reassess their personal ability to commute by car (decreasing PBC). Introducing a series of tollways on major roads, for example, may prove an effective barrier in this respect. So too might increased levels of fees for parking private vehicles or reductions in the number of car parks available. Restricting particular precincts to pedestrians only may also prove effective where good public transport alternatives exist.

Strengths and Limitations

Strengths. The present study has examined an important contemporary issue utilising a strong theoretical basis. While the results are consistent with previous findings, they also highlight potential new directions for exploring commuters' car commuting behaviour. By examining the overall relationship between TPB variables and behaviour it was possible to identify the key variables which are important in determining behaviour. Further, by examining the TPB construct differences between car commuters and commuters utilising alternate transport means it was possible to identify the constructs that, if sufficiently altered, may bring about a desired change in behaviour. Finally, the study builds on previous research primarily centred in Europe, by examining the role that the TPB and habitual car commuting play in car commuting behaviour in an Australian context.

Limitations. Although offering a unique contribution to the study of commuting travel-mode preference behaviour, particularly car commuting behaviour, it is important to acknowledge the limitations of this study. As noted above, the theory of planned behaviour contends that current intentions predict future behaviours. Due to time limitations, it was not possible in the present study to employ a design that would allow the collection of participants' actual car commuting behaviour prospectively over an extended period of time, thus causal ordering of the variables has not been tested. Thus the findings need to be interpreted cautiously as car travel to university in the previous week may not be a good

measure of intentions to do so in the future. In addition, the results reported here must be viewed with some caution as the behavioural measures utilised were self reported, though future studies could overcome this by collecting more objective and prospective measures of participant travel-behaviour, for example by using travel diaries.

Directions for Further Study

One promising avenue for future research is to examine more closely the key factors that influence commuters' attitudes, subjective norms, and PBC regarding car commuting as this is one area where we found significant differences between car commuters and commuters utilising alternative travel methods. Identifying these factors may prove highly useful in designing interventions.

Concluding Remarks

Commuter travel-mode preference behaviour is an important contemporary issue, influencing such factors as traffic congestion, commuter safety, and pollution. The current study examined university students' car commuting intentions and behaviour utilising a strong theoretical basis provided by the TPB and models of habitual behaviour. Overall the results highlight that although car commuting behaviour may appear habitual in nature, in this study and interpretation that it is predominately guided by reasoned action is supported.

The results of the present study have implications for public policy aimed at reducing the number of car commuters. They suggest that the main strategy should be to focus on

reducing commuters' behavioural intentions to travel by car, specifically through attempting to reduce the perceived social acceptability of car commuting and the perceived high level of personal control that commuters report in relation to this behaviour.

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