Psychological and Situational Influences on Commuter-Transport-Mode Choice

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PSYCHOLOGICAL AND SITUATIONAL INFLUENCES ON COMMUTER-TRANSPORT-MODE CHOICE

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ABSTRACT: The relative importance and relationship between psychological and situational factors in predicting commuter-transport-mode choice was tested by four hypotheses. First, the influence of individuals' values on commuter behavior is mediated by their corresponding beliefs about the environmental threat of cars (mediation hypothesis). Second, the influence of these beliefs on behavior is moderated by individual consideration of future consequences and control beliefs (moderation hypothesis). Third, cost, time, and access factors contribute to individuals' commuter choice (situational hypothesis). Fourth, situational and psychological factors jointly influence proenvironmental behavior (interaction hypothesis). A sample of 205 Australian university students completed a survey to measure these relationships. Regression analyses indicated support for the mediation, situational, and interaction hypotheses. It was concluded that to achieve a transport-mode shift to public transport, public policy strategies should focus on individuals' transport-related environmental beliefs (personal control and environmental effect of cars) and situations (access to public transport at reduced cost).

Keywords: *proenvironmental behavior; commuter choice; environmental values; environmental beliefs*

Transport choice for commuting is among the most environmentally significant decisions faced by individuals. Personal car use contributes to

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environmental pollution, decreased air quality, greenhouse gas emissions, and fossil fuel consumption (Mees, 2000). Public transport (PT) is the most viable alternative to commuter-car travel for most people. Psychological research has demonstrated that proenvironmental behavior depends on psychological and situational factors (Black, Stern, & Elworth, 1985; Guagnano, Stern, & Dietz, 1995). Understanding the specific psychological and situational factors that influence commuter-transport choice (as an example of proenvironmental behavior) is necessary for the development of effective public policy strategies for achieving a commuting-mode shift from cars to PT.

The relative importance of psychological versus situational factors in determining proenvironmental behavior is dependent on the particular behavior (Cameron, Brown, & Chapman, 1998; Corraliza & Berenguer, 2000). Black et al. (1985) and Guagnano et al. (1995) found that attitudinal factors were stronger predictors of low-constraint proenvironmental behaviors (i.e., cheap or easy behaviors) than of high-constraint behaviors (e.g., expensive or highly inconvenient behaviors). These findings suggest that the relationship between situational and psychological factors on commuter-mode choice is likely to be interactional in nature with environmental beliefs being affected by situational constraints.

Until recently, research of proenvironmental behavior utilized existing frameworks from general research in social and cognitive psychology. Examples include Geller's actively caring hypothesis (Allen & Ferrand, 1999), subjective expected utility (Ludemann, 1999), Kegan's model of ego development (Robbins & Greenwald, 1994), and theory of planned behavior (Cheung, Chan, & Wong, 1999). Theory of planned behavior predicts that behaviors are causally preceded by the relevant behavioral intention and this intention is determined by attitudes and beliefs regarding the behavior (Fishbein & Ajzen, 1975). This theory has been used to examine innumerable behaviors in the social, environmental, and health psychology fields. In a similar way Schwartz (1973) proposed that helping norms are activated when individuals are aware that they can effect positive consequences for the helpee and ascribe responsibility to themselves to help. Much subsequent proenviromental study was based on Schwartz's norm activation model of altruistic behavior.

Following a broad survey of the early research on proenvironmental behavior, Stern (1992) began to work toward developing a model specifically to explain proenvironmental behavior. They argued that proenvironmental behaviors differ substantially from behaviors traditionally explained by existing frameworks in that proenvironmental behaviors affect not only people but also ecosystems. Thus, nonhomocentric values also need inclusion in

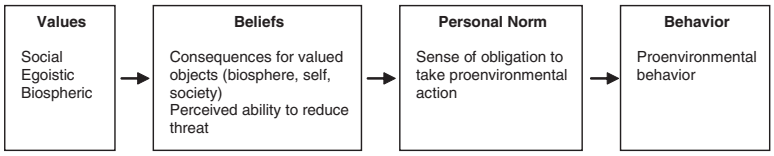

Figure 1: The Value-Belief-Norm (VBN) Model of Environment-Directed Behavior (Based on the Model of Stern, Dietz, Abel, Guagnano, & Kalof, 1999)

modeling the determinants of proenvironmental behavior. Stern, Dietz, Abel, Guagnano, and Kalof (1999) constructed the value-belief-norm (VBN) model of environmentalism (see Figure 1). The model proposes a direct link between an individual's values and environmental beliefs. These beliefs, in turn, determine an individual's personal proenvironmental norms, which bear directly on the individual's environmental directed behavior (Stern, 2000). This model encompasses much of the earlier frameworks while applying the principles more specifically to environment-directed behaviors.

Schwartz (1992) defined values as "the criteria people use to select and justify actions and to evaluate people (including self) and events" (p. 1). Stern, Dietz, Abel, et al. (1999) proposed three value types relevant to environment-directed behavior: social or altruistic (the environment is valued because of its value to society); egoistic (the environment is valued because of its benefits to oneself); and biospheric (nature is valued in and of itself, regardless of its value to humans). Social values and altruism have been widely studied in proenvironmental behavior research. Heberlein (1972) claimed proenvironmental behavior could be considered altruistic because environmental damage negatively affects others. Egoistic values (e.g., valuing personal comfort, security, and wealth) are usually linked to negative environmental behaviors. In general, egoistic values and pro-self-orientations correlate negatively with proenvironmental attitudes and behaviors (Cameron et al., 1998; Karp, 1996; Schultz & Zelezny, 1999; Van Vugt, Meertens, & Van Lange, 1995; Van Vugt, Van Lange, & Meertens, 1996). However, it is also argued (De Young, 2000) that egoistic values can be powerful and enduring motivators of proenvironmental behavior. For example, money-saving proenvironmental behaviors such as installing energy efficient appliances or using cheap PT may stem from an individual's egoistic values.

Much of the existing proenvironmental behavior research distinguishes only prosocial and proself value orientations. These resemble Stern, Dietz, Abel, et al.'s (1999) social and egoistic values, respectively. Researchers typically assess prosocial and proself value orientations by observing behavior of two or more players in a game requiring decisions to be made about

resource allocation. Each player is faced with a conflict between his or her own interests and the common interest, that is, each player is faced with a social dilemma (Kuhlman & Wimberley, 1976; Messick & McClintock, 1968). The evidence points to a stable difference between individuals in the extent to which they ascribe importance to the collective and individual outcomes of their behavior (Kramer, McClintock, & Messick, 1986; Liebrand & Van Run, 1985). Individuals who tend to act for the collective good in social dilemma situations are identified as prosocial in orientation. Individuals who act to maximize their own interests are classified as proself in orientation.

Prosocial versus proself orientations have been demonstrated to influence proenvironmental behavior. Cameron et al. (1998) tested participants for value orientation and then gave them an opportunity to send letters supporting or opposing a pollution reduction program. Proselfs were more likely to send letters of opposition and prosocials more likely to send letters of support. This study also demonstrates that value orientation can predict proenvironmental behavior in a natural setting. In commuter-behavior studies, Van Vugt, Meertens et al. (1995) and Van Vugt, Van Lange, and Meertens (1996) asked participants how they would behave in hypothetical commuting scenarios. Prosocials demonstrated a stronger preference for PT than proselfs. Extrapolating from these hypothetical scenario studies and Cameron et al.'s (1998) letter study, it is likely that in a real-life situation, prosocial compared with proself individuals will have a stronger preference for commuting by PT.

The idea of a distinct set of biospheric values that apply to the earth, separate from values relating to the human life per se, has emerged (Lockwood, 1997). Most empirical studies have chosen to investigate biospheric values in combination with social values. This is because in factor analyses of the scales commonly used, biospheric and social values tend to load on the same factor (Stern, Dietz, & Guagnano, 1998). However, some initial support for the importance of a separate biospheric value has been found (Grendstad & Wollebaek, 1998; Thogerson & Grunert-Beckmann, 1997). It is possible that distinct biospheric values are crystallizing in the population, as the urgency of environmental crises becomes more apparent.

Other studies have shown that environmental values influence individuals' beliefs. For instance, Schultz and Zelezny (1999) demonstrated 15% of variance in individuals' environmental beliefs was accounted for by their environmental values. In general, although values have been consistently demonstrated to be important in predicting proenvironmental behavior, their effect is small and may be misrepresented if the contribution of environmental beliefs is not also measured.

Individuals may perceive an environmental threat as a threat to self, to the biosphere, to society, or to any combination of these. Stern, Dietz, and Kalof (1993) found individuals' proenvironmental action related to their beliefs in these three domains. According to their VBN model, proenvironmental behavior is predicted by beliefs mediating values in the three separate domains: social, egoistic, and biospheric. These relationships have not yet been tested in the published literature.

Perceived control is also emerging as an important factor in proenvironmental behavior. Individuals' belief that their actions can benefit the environment has been shown to relate to their proenvironmental behaviors (Allen & Ferrand, 1999). Steg and Sievers (2000) reported that individuals who believed they could have an effect on the environment by reducing their car use used other modes of transport more often than those who believed such efforts are futile. It is plausible that an individual's perceived control beliefs moderate the influence of the relationship between the individual's environmental beliefs on proenvironmental behavior, with high perceived control being related to a stronger relationship between an individual's beliefs and behavior.

The other psychological construct examined in the current study was consideration of future consequences. In facing environmental crises, an important question is the following: "To what degree should present security, comfort, and wealth be restrained in order to safeguard future survival conditions?" (Vlek & Keren, 1992, p. 250). At an individual level, consideration of future consequences is a relatively stable personality construct (Strathman, Gleicher, Boninger, & Edwards, 1994). Differences in college students' levels of consideration of future consequences have been reported to affect their attitudes toward offshore oil drilling and to account for some variance in proenvironmental behavior (Joireman, Lasane, Bennett, Richards, & Solaimani, 2001; Strathman et al., 1994). As proenvironmental behaviors typically involve making sacrifices now to achieve future outcomes, individuals' levels of consideration of future consequences may act as a moderating influence on the relationship between their beliefs and behavior. There is likely to be a stronger link between proenvironmental beliefs and behavior, for individuals with high levels of consideration of future consequences.

Proenvironmental behavior is also dependent on situational factors. Financial cost of different transport options consistently has been found to be a factor in commuters' decisions (Bamberg & Schmidt, 1998; Flannelly & McLeod, 1989; Flannelly, McLeod, Behnke, & Flannelly, 1990). Travel time is also critical in commuter-choice decisions (Flannelly et al., 1990; Mees, 2000). Van Vugt, Van Lange, and Meertens (1996) found a hypothetical decrease in PT travel time resulted in a significant increase in participants'

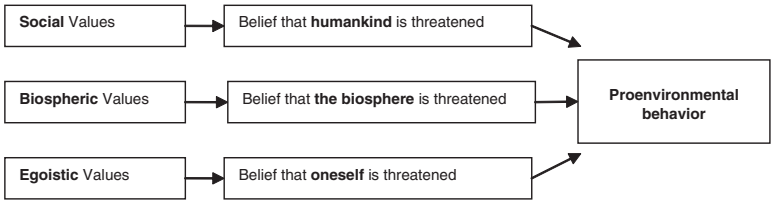

Figure 2: Mediation Model of Proenvironmental Behavior (Adapted From Stern, Dietz, Abel, Guagnano, & Kalof, 1999)

preference for PT. Situational factors are likely to be another moderating factor in determining the relationship of environmental values, beliefs, and behaviors, with behavior reflecting proenvironmental values and beliefs in situations that facilitate PT use.

In summary, the current study was designed to examine factors thought to affect commuter-transport-mode choice and the influence of psychological (individuals' values, beliefs about environmental threat, perceived control, consideration of future consequences) and situational (access, cost, time) factors. Based on the literature reviewed, four hypotheses were tested: mediation, moderation, situational, and interaction. Baron and Kenny's (1986) definitions of mediator and moderator variables were adopted, with a *mediator* being defined as an explanatory variable that accounts for the relation between predictor and criterion, and a *moderator* is "a qualitative . . . or quantitative . . . variable that affects the direction and/or strength of the relation between an independent or predictor variable and dependent or criterion variable" (Baron & Kenny, 1986, p. 1174).

Mediation Hypothesis. The effects of individuals' values on proenvironmental behavior are mediated by corresponding beliefs. Thus, social beliefs mediate the effect of social values on behavior, biospheric beliefs mediate the effect of biospheric values on commuter behavior, and egoistic beliefs mediate the effect of egoistic values on behavior. These relationships are illustrated in Figure 2.

Moderation Hypothesis. The relationship between environmental beliefs and proenvironmental behavior (PT commuting-mode choice) is moderated by an individual's perceived control beliefs and consideration of future consequences beliefs. Individuals who believe the environment is threatened are more likely to behave proenvironmentally if they believe their behavior can make a difference and/or if they have a high level of concern about the future.

Situational Hypothesis. Proenvironmental behavior (PT commuting-mode choice) is demonstrated in favorable situations, that is, when PT is relatively accessible, cost-effective, and fast.

Interaction Hypothesis. Situational factors (access, cost, and time) moderate the influence of psychological factors (beliefs) on proenvironmental behavior (PT commuting-mode choice).

METHOD

PARTICIPANTS

A total of 600 survey forms were handed out to students at campuses of two Australian universities in Melbourne: 300 at University of Melbourne (Carlton-Parkville) and 300 at Deakin University (Burwood) campuses. Of these, 205 surveys were returned (91 from Deakin University and 114 from Melbourne University) yielding a reply rate of 34.5%. Participants were 102 male respondents, 100 female respondents, and 3 gender-unspecified respondents; with an age range from 18 to 58 years and a median age of 20 years. The participants were volunteers who were not paid for their participation and were treated in accordance with the "Ethical Principles of Psychologists and Code of Conduct" (American Psychological Association, 2002).

PROCEDURE

Participants were approached in campus cafeterias and asked to participate in a study on how people commute to university. Those who agreed were given a survey form, an explanatory statement, and a reply-paid envelope. The survey included a games task, questions about commuter behavior and beliefs about the environmental impact of cars and values, Strathman et al.'s (1994) Consideration of Future Consequences Scale, and a question asking what factors would make participants change from their current commuter mode. Participants completed the survey at their leisure and returned it in the envelope provided. As the study was anonymous, no attempt was made to contact nonresponders.

MATERIALS

Prosocial and proself value orientations were assessed using a set of nine three-alternative decomposed games offering points to self and other such as those used in previous studies (J. A. Joireman, personal communication, April 2, 2001). Stern, Dietz, and Guagnano's (1998) Brief Inventory of Values was used to assess participants' biospheric, social, and egoistic values.

Each of the 12 items is a statement of a principle (e.g., "Respecting the earth, harmony with other species") that participants rate (on a scale of 0 to 5) in terms of its importance as a guiding principle in their life. The reported internal consistencies of the three subscales are acceptable (Cronbach's $\alpha_{biospheric} = .84$, $\alpha_{social} = .72$, $\alpha_{egoistic} = .70$). A scale was developed to measure individuals' beliefs about the environmental threat of cars for each domain: society, self, biosphere, and also personal control beliefs. Fourteen 7-point Likert-type scale (1 = *strongly disagree* to 7 = *strongly agree*) items were used. The Environmental Beliefs Scale contained four subscales. The Social Beliefs subscale measured beliefs about the environmental threat of cars for society generally (e.g., "Greenhouse gas emissions from cars affect people all over the world due to global warming"). The Egoistic Beliefs subscale measured beliefs about the environmental threat of cars on self (e.g., "The noise created by cars negatively affects me"). The Biospheric Beliefs subscale measured beliefs regarding the environmental threat of cars for the biosphere, independent of effects on humans (e.g., "Drilling for liquid petroleum and natural gas poses a threat to the environment"). See the appendix for the complete scale. The Control Beliefs subscale measured the extent to which participants feel they can make a difference to the environment (e.g., "Through my individual actions I can make a difference to the environment"). The internal consistency of the scale for the present sample was high (Cronbach's $\alpha = .82$).

Participants also completed Strathman et al.'s (1994) Consideration of Future Consequences Scale, a 12-item scale with items such as, "I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes." Participants rated each item as to how characteristic it is of them, using a 5-point Likert-type scale. The reported internal consistency of this scale is high (Cronbach's $\alpha = .86$).

Participants were asked to report how much it (would) cost them per day to travel to university by PT and how much it (would) cost them per day to travel to university by car. They were also asked how long the journey took using each of these options. University attended was used as a proxy measure of access to PT and cars for commuting. In addition, they responded on a 7-point Likert-type scale (1 = *strongly prefer car travel* to 7 = *strongly prefer public transport travel*) to the following question: "In general, considering all the relevant factors (e.g., cost, comfort, environmental considerations and so on), do you prefer to travel by car or public transport?" University affiliation was included as a variable in the study because it was assumed that students at University of Melbourne have greater access to PT (14 tram routes directly serve this university) but less access to car parking (no student car

parks are provided on this campus) than students at Deakin University (Deakin University is directly served by two bus routes and two tram routes; 2,174 car parks are made available to students on this campus, which corresponds to 0.2 car parks per student enrolled on this campus). The university campus group difference provided naturally occurring contexts in which to compare the influence of more advantageous access to PT over car use on individuals' use of PT for commuting. Students attending educational institutions in Melbourne are able to purchase a concession card, which entitles them to half-price travel on PT. This card costs approximately U.S.$50 per year. There is no subsidy of travel costs on the part of either Melbourne or Deakin Universities. On both campuses, classes are within 5 minutes walking time from car parks and bus and tram stops.

The final question of the survey asked participants what, if anything, would make them change the transport mode they used most frequently to commute to university. Participants were free to mention as many or as few factors as they wished.

RESULTS

A logistic regression analysis revealed that it was possible to predict transport mode choice (i.e., car vs. PT) with 75% accuracy from participants' preference for PT expressed on a 7-point Likert-type scale. On this basis, the preference for PT variable was considered a satisfactory measure of pro-environmental behavior for use as a dependent variable for the multiple regression analyses planned for the current study, in preference to participants' most frequently used commuter mode.

MEDIATION HYPOTHESIS

A series of five multiple regressions tested the prediction that the effect of environmental values on commuter behavior is mediated by the corresponding environmental beliefs. As shown in Table 1, in the first three regressions environmental beliefs in each domain were regressed onto the corresponding values. In a fourth regression, PT preference was regressed onto environmental values in the three domains. In the final regression, PT preference was regressed onto all of the environmental belief and value measures in the three domains. For the full mediation model to be supported, the relationships in the first four regressions should be significant; however, in the final regression the relationships observed in the fourth regression should no longer be

TABLE 1
Multiple Regressions for the Effect of Values and Beliefs on Preference for Public Transport

	b	β	p
Social beliefs			
Social values	.33	.19	.02
Biosphere values	.36	.24	.00
Egoistic values	–.10	–.07	.27
R^2 = .15, F(3, 199) = 11.30, p < .001			
Egoistic beliefs			
Social values	–.18	–.08	.33
Biosphere values	.94	.47	.00
Egoistic values	–.27	–.15	.03
R^2 = .20, F(3, 199) = 16.09, p < .001			
Biosphere beliefs			
Social values	.11	.06	.46
Biosphere values	.32	.22	.01
Egoistic values	–.17	–.13	.07
R^2 = .08, F(3, 199) = 5.81, p < .001			
Preference for public transport			
Social values	–.01	–.05	.52
Biosphere values	.02	.20	.02
Egoistic values	.00	–.17	.02
R^2 = .05, F(3, 199) = 3.65, p < .001			
Preference for public transport			
Social values	.00	–.01	.95
Biosphere values	.00	.02	.83
Egoistic values	–.01	–.02	.10
Social beliefs	.00	.02	.79
Egoistic beliefs	.03	.42	.00
Biosphere beliefs	–.01	–.09	.27
R^2 = .17, F(3, 199) = 13.17, p < .001			

significant. An analysis-wise p value of .1 (hence $\alpha = .033$ per value) was used.

In the first regression, environmental values explained 14.6% of the variance in social beliefs, $F(3, 199) = 11.30$, $p < .001$, with social and biospheric values contributing significantly at the .033 level. The environmental values explained 19.5% of the variance in egoistic beliefs, $F(2, 199) = 16.09$, $p < .001$, with biospheric and egoistic values contributing significantly to the regression equation. For biospheric beliefs, 8.1% of the variance was explained by the values, $F(3, 199) = 5.81$, $p = .001$, with biospheric values making a significant unique contribution. In the fourth regression, the envi-

ronmental values together explained 5.2% of the variance in PT preference, $F(3, 199) = 3.65$, $p = .01$. Biospheric and egoistic values contributed significantly to the equation whereas social values did not. In the final regression, with the inclusion of environmental values and beliefs as predictors of PT preference, each of the environmental values was reduced in significance compared to the environmental values on PT preference regression, with all now being nonsignificant predictors. Thus, the mediation hypothesis was supported for biospheric and egoistic values and beliefs, and in the social domain a similar trend was observed but at a statistically nonsignificant level. The final model explained 17.3% of the variance in transport-mode preference. The only factor that remained as a significant unique predictor of the dependent variable was egoistic beliefs. This suggests that individuals who believe car use has a highly negative impact on themselves are more likely to prefer to commute by PT.

This analysis was also conducted using the dichotomous dependent variable of self-reported most frequently used commuter mode (rather than the quasi-continuous preference variable). Although the reduced power of this analysis resulted in no significant unique effects for the individual values (regression four), the final regression (including all values and beliefs) was consistent with our analysis reported above, with only egoistic beliefs showing a unique contribution.

MODERATION HYPOTHESIS

Simple regressions indicated that perceived control beliefs accounted for 9.2% of the variance in preference for PT, $F(1, 203) = 20.66$, $p < .001$, and consideration of future consequences accounted for 5.4% of the variance in preference for PT, $F(1, 202) = 11.44$, $p = .001$. To test for a moderating influence of perceived control on the effect of beliefs on preference for PT, the beliefs and perceived control variables were entered in the first step of a hierarchical regression analysis. This model explained 21.1% of preference for PT, $F(4, 199) = 13.30$, $p < .001$. Perceived control and egoistic beliefs contributed significantly to this model ($p < .001$). In the second step, the interaction variables between each belief variable and perceived control were added. The new model explained 23.9% of the variance in preference for PT, $F(7, 196) = 8.79$, $p < .001$; however, the change in R between the two steps was statistically nonsignificant, $p = .07$.

The same statistical procedure was used to test for a moderating effect of consideration of future consequences (CFC) on the effect of environmental beliefs on preference for PT. The environmental beliefs and CFC variables explained 17.8% of the variance in preference for PT, $F(4, 199) = 10.78$, $p <$

.001. Egoistic beliefs ($p < .001$) contributed significantly (at $\alpha = .0125$) to this model. The second step added the interaction variables between each belief variable and CFC. The new model explained 18.3% of the variance in preference for PT, $F(7, 196) = 6.276$, $p < .001$, with the change in R in the second step being nonsignificant, $p = .750$.

When consideration of future consequences and perceived control beliefs were added to the model with the value and environmental belief variables, these psychological factors accounted for 23.0% of the total variance in preference for PT, $F(8, 194) = 7.25$, $p < .001$, with egoistic and control beliefs contributing significantly to the model. This represents a significant ($p = .001$) increase over the 17.3% of variance explained by the previous model with values and environmental beliefs alone as predictors. Thus, although the predicted moderation hypothesis was not supported, there was an additive relationship observed for the psychological variables in the prediction of proenvironmental behavior.

SITUATIONAL HYPOTHESIS

To check if there was a perceived difference in accessibility between the two universities, participants' ratings of car and PT access to their university and parking facilities were analyzed. The modal responses indicated that Deakin University has adequate PT access, adequate private car access, and poor parking facilities. Melbourne University was perceived as having good PT access, poor private car access, and very poor parking facilities. These responses indicate that the assumption that car and PT access differs between the two universities is justified.

Table 2 shows the outcome of independent t tests on the mean ratings for preference for PT across the three situational factors of access, cost, and time. The measures used for these were access (adequate or good PT per university affiliation), cost (cost of commuting by PT divided by cost of commuting by car), and time (i.e., PT travel time or car travel time).

There was a significant access effect, with participants with good PT access (University of Melbourne: $M = 4.04$) having higher PT preference ratings than participants with adequate PT (Deakin University: $M = 2.64$) $t(200) = 4.55$, $p < .001$. There was also a significant difference between the preference for PT ratings of those for whom PT travel cost was greater than, or equal to, the cost of traveling by car ($M = 2.13$) and those for whom PT is cheaper ($M = 4.09$), with those for whom PT was relatively cheaper having higher PT ratings, $t(200) = 8.56$, $p < .001$. There was not a significant difference in preference for PT between those for whom PT takes the same time or longer ($M = 3.32$) and those for whom PT is faster ($M = 3.92$). Because of the

TABLE 2
Independent *t* Tests of the Effect of Situational Factors on Preference for Public Transport

	n	M (SD)	*Significance*[a]
Public transport access			
Adequate	88	2.64 (2.19)	
Good	114	4.04 (2.23)	
$t(200) = 4.55$			$p < .001$
Cost			
Cost of PT ≥ cost of car	56	2.13 (1.78)	
Cost of PT < cost of car	106	4.09 (2.24)	
$t(200) = 8.56$			$p < .001$
Time			
PT travel time ≥ 1.25 × car travel time	156	3.08 (2.21)	
PT travel time < 1.25 × car travel time	30	4.80 (2.04)	
$t(200) = 4.03$			$p < .001$

NOTE: PT = Public transport.
a. Two-tailed test.

TABLE 3
Multiple Regression of Preference for Public Transport on Situational Factors

	b	β	p
Preference for public transport			
Cost	–.21	–.36	.00
Time	–.03	–.01	.29
Access	.19	.19	.02
$R^2 = .27$, $F(3,156) = 19.58$, $p < .001$			

small size ($N = 12$) of the group for whom PT was faster than traveling by car, the *t* test was repeated using a 1.25 ratio as the cut point for the groups. This did produce a significant difference, $t(200) = 4.03$, $p < .001$. Participants for whom traveling by PT took 1.25 times as long as by car or longer showed significantly less preference for PT ($M = 3.08$) than those for whom PT took less than 1.25 times as long as car travel ($M = 4.80$).

Table 3 presents a summary of the results of a standard multiple regression procedure with preference for PT regressed onto the three situational factors.

Together the situational factors explain 27.3% of the variance in preference for PT, $F(3,156) = 19.58$, $p < .001$, with cost and access contributing significantly to the regression equation. (Likewise, a logistic regression analysis using transport mode most frequently used as the dependent variable also showed unique contributions by cost and access.) Adding these situational

TABLE 4
Multiple Regression of Preference for Public Transport on All Measured Factors

	b	β	p
Preference for public transport			
Social values	–.01	–.08	.33
Biospheric values	.00	–.01	.40
Egoistic values	–.01	–.12	.07
Social beliefs	.04	–.07	.43
Egoistic beliefs	–.01	.31	.00
Biospheric beliefs	.02	.01	.95
Consideration of future consequences	.02	.02	.18
Perceived control	.03	.20	.01
Cost	–.12	–.28	.00
Time	–.01	–.04	.62
Access	.14	.22	.00
$R^2 = .44$, $F(11, 146) = 10.57$, $p < .001$			

variables to the model with the psychological factors significantly improved the model (see Table 4). The complete model explains 44.3% of the variance in preference for PT, $F(11, 146) = 10.57$, $p < .001$. In this model, egoistic beliefs, perceived control, cost, and access remain significant predictors of commuter-mode preference. (The corresponding complete logistic regression is largely consistent here; however, only egoistic beliefs, cost, and access show up as unique predictors, and the unique effect of perceived control is not significant.)

INTERACTION HYPOTHESIS

The final analysis tested for a moderating effect of situational factors on the effect of environmental beliefs on proenvironmental behavior. A hierarchical multiple regression was conducted with preference for PT on the significant contributors to the complete model: two psychological variables (egoistic and control beliefs) and two situational factors (i.e., access and cost). The cost variable was dichotomized using a split at the point where the cost of commuting is equivalent for the two modes; thus, the two situational variables were dichotomous. The beliefs and situational variables were entered in the first step of the regression. The results are presented in Table 5.

This model explained 35.4% of the variance in preference for PT, $F(4, 159) = 21.78$, $p < .001$. In the second step, the interactions between belief and situational variables were included. The new model, $F(8,155) = 13.156$,

TABLE 5
Hierarchical Multiple Regression of Situational and Psychological Factors on Preference for Public Transport

	b	β	p
Preference for public transport			
Cost	–.10	–.25	.00
Access	.16	.25	.001
Egoistic beliefs	.02	.29	.00
Control beliefs	.03	.22	.001
$R^2 = .35$, $F(4, 159) = 21.78$, $p < .001$			
Preference for public transport			
Cost	–.03	–.08	.39
Access	–.08	–.11	.73
Egoistic beliefs	.03	.55	.00
Control beliefs	.01	.05	.69
Access × egoistic beliefs	–.01	–.14	.21
Access × control beliefs	.02	.31	.36
Cost × egoistic beliefs	–.02	–.56	.02
Cost × control beliefs	.02	.24	.28
$R^2 = .40$, $F(8,155) = 13.16$, $p < .001$			

$p < .001$, explained 40.4% of the variance in preference for PT. The change in R in the second step was significant at $\alpha = .05$ ($p = .013$). This result indicates that the relationship between access and cost and egoistic and control beliefs is interactive in nature. Comparable trends were seen in the logistic regression analysis using self-reported behavior rather than preference as the dependent variable. However, when preference was used as an outcome variable, the most important predictors were egoistic beliefs and the interaction between egoistic beliefs and cost. When most frequent commuter mode was used, egoistic beliefs and access were the most significant predictors.

DISCUSSION

The current study examined the relationship of psychological and situational factors in the determination of commuter-mode preference. The results were generally consistent with the previous literature. Individuals' proenvironmental beliefs were found to mediate the effect of individuals' biospheric and egoistic values on proenvironmental behavior. Situational factors (relative cost, access, and time of PT and cars) affected proenvironmental behavior. There was also some evidence of an interactive relationship

between psychological and situational factors in predicting proenvironmental behavior.

The mediation hypothesis was supported by the findings of the current study for biospheric beliefs and egoistic beliefs but not social beliefs. A close look at the social beliefs data suggests that this anomaly may be due to a ceiling effect occurring in the social value variable. The modal score on social value was 15, which was the maximum possible score. This negative skewing of the social value data is probably due to two design elements of the current study. The first is the use of students as participants. Students are perhaps more susceptible than nonstudents to social desirability biases in a study such as this as there is a strong norm for liberal social justice views among students (Anderson & Bryjak, 1989). Second, high scores on the Social Value subscale may have been due to the voluntary nature of participation in the survey. Voluntary participation in psychological research is a prosocial behavior. McClintock and Allison (1989) found that when asked to participate in psychological research, prosocial students donated approximately twice as many subject hours as proself students. Given that just one third of the surveys were returned, individuals who did return the surveys are likely to have been substantially more prosocial in orientation than a truly representative sample would have been. This is likely to have restricted the variability in the responses for the measure of social value. For these reasons the results for the social values and beliefs measures should be treated with caution.

The effect of biospheric values on proenvironmental behavior was mediated by all three belief types. This could be due to participants' believing that because humans are part of the biosphere, valuing the biosphere calls for proenvironmental responses regardless of whether cars are believed to threaten the biosphere, humans generally, oneself, or all three domains. Qualitative support for this interpretation comes from the comment of one participant who wrote next to the "Unity with nature, fitting into nature" biospheric item on the values inventory, "This doesn't make sense, humans are already part of nature." These findings are consistent with the literature reviewed that indicates a general biospheric value factor is still emerging (Grendstad & Wollebaek, 1998; Thogerson & Grunert-Beckmann, 1997) and suggests that the value for the biosphere, independent of humans' relationship to and dependence on it, will not be detected in all samples.

An anonymous reviewer noted that the results of our mediation analysis indicate that biospheric values influence all three types of beliefs; however, that egoistic beliefs are the primary determinant of transport mode preference; that is, perhaps concern for the biosphere predisposes people to believe that things that are bad for the environment affect everything in it (i.e., self, others, and ecosystems). However, transport mode preference is primarily

driven by what our participants believe is the effect on themselves (rather than on others or on the environment itself) of their own and others' transport mode choices.

The relatively strong influence of egoistic beliefs on proenvironmental behavior in the current study is consistent with two recent articles (De Young, 2000; Kaplan, 2000) suggesting the possibility of proenvironmental behavior being motivated by egoistic values, beliefs, and attitudes. The Egoistic Beliefs subscale used in the current study is a measure of what participants believe is the cost to them personally of large-scale car use (e.g., noise, decreased air quality). The results provide empirical support for a positive relationship between these egoistic beliefs and proenvironmental behavior. These results suggest that education strategies may be effective if they are focused on individuals' beliefs that the environmental threats of cars affect them directly.

The moderation hypotheses for the effects of perceived control and consideration of the future on the relationship between beliefs and behavior were not supported. Nevertheless, perceived control was found to be a significant predictor in the final model and appears to have an additive influence on proenvironmental behavior. Perceived control repeatedly emerges in the literature as crucial to proenvironmental behavior (Kaplan, 2000). Interventions, such as programs in schools that focus on empowering children to see themselves as able to make a difference to the environment, may prove effective in encouraging proenvironmental behavior.

With regard to consideration of future consequences, the finding that this variable does not moderate the effect of beliefs on proenvironmental behavior is contrary to the preliminary findings of other researchers in the field (Joireman et al., 2001; Strathman et al., 1994). Further studies are needed to clarify how concerns about the future influence the relationship between proenvironmental beliefs and behavior.

The situational hypothesis was supported with cost and access factors being significant predictors of commuting preference. In the case of travel time, a split at PT time = 1.25 × Car Time gave rise to a significant difference between the groups. For all three variables, when the situation facilitated PT rather than car use, proenvironmental behavior was more evident. Analysis of the qualitative responses on the survey also suggests that increased services, improved facilities, and better connections between services would encourage many car commuters to change to using PT. As many as 70% of car commuters indicated that they would consider using PT for commuting if PT were faster than car travel. The qualitative data also support the impor-

tance of cost factors, with many PT commuters citing petrol, parking, and other costs as important in their decision to use PT. Furthermore, 50% of PT commuters indicated that they may choose to drive to university, at least sometimes, if the two commuter modes were equivalent in cost (i.e., if the cost of driving were lowered).

There was some support for the interaction hypothesis that the effect of psychological factors on behavior would be moderated by situational variables. In the current study, the interaction term that significantly predicted preference for PT was Cost × Egoistic Beliefs, indicating that if cost of PT is low relative to car travel then egoistic beliefs will have a strong influence on commuter behavior. The more expensive PT travel is, the less commuter choice is influenced by individuals' beliefs about the negative impact of mass car use on themselves. This interactive effect is consistent with past studies that suggest that the more difficult, expensive, or time-consuming a behavior is, the less the behavior is affected by attitudinal factors (Black et al., 1985; Guagnano et al., 1995).

Logistic regression analyses introduced to look for any differences between participants' preference for traveling by car and PT and their self-reported most frequent travel mode used showed that, on the whole, these two dependent measures are quite consistent, although, in some instances the lower power of the logistic analysis caused some effects to drop below statistical significance. A noteworthy difference between the preference and self-reported actual behavior is the role of perceived control, which seems to be only important for preference ratings and not for actual behavior suggesting that perhaps consideration of the "how much difference can I really make?" question is only relevant when the question is an abstract one, but for actual decisions on how to get to university, situational variables, and beliefs about the effect of cars on oneself are more influential. A further observation from our interaction analysis is that it appears that cost is more important to preference ratings than to actual behavior. Perhaps our participants do not generally think about the relative costs of the transport options available to them but rather about ease of access (i.e., will I be able to park my car? is there a direct bus/train/tram connection from my house?) but when presented with our questionnaire were forced to consider the relative costs of the two options, and so this may have played more of a role in their stated preferences than it had in their past behavior.

A graphical representation of the findings of the current study is presented in Figure 3. The model of commuting behavior shows the effects of situational and psychological factors with the mediation effect of beliefs on their

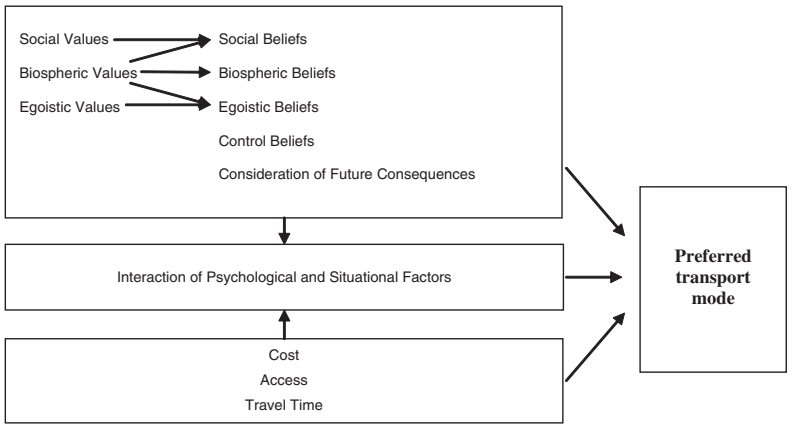

Figure 3: A Model of Commuter-Transport-Mode Choice

relevant values, the mediation of biospheric values by all three types of beliefs, and the interactional relationship between psychological and situational determinants.

In conclusion, the current study expands the empirical basis for understanding the determinants of proenvironmental behavior, specifically commuter-mode choice. The results allow for finer specification of the relationships operating between the values, beliefs and behaviors proposed in Stern, Dietz, Abel, et al.'s (1999) VBN model of environmentalism. The current study also adds weight to the body of evidence suggesting the effect of psychological and situational factors on proenvironmental behavior is partly interactional in nature and further specifies the nature of that interaction.

In light of the findings, public policy interventions should address situational and psychological factors in attempting to encourage a commuter-transport-mode shift toward more use of PT. Situational improvements in access and cost of PT relative to cars may be sufficient encouragement for individuals with prosocial environmental values and beliefs. For other individuals, effective public policy may need to include education and advertising campaigns that focus on raising awareness of the negative impacts of widespread car use on individuals and showing that individual proenvironmental behavior can make a difference.

APPENDIX
Environmental Beliefs Scale

Items 3, 11, 12, and 14 were reverse scored.

Control Beliefs subscale	Items 1 and 2	Cronbach's alpha:	.72
Social Beliefs subscale	Items 3, 4, 5, and 6		.53
Egoistic Beliefs subscale	Items 7, 8, 9, and 10		.76
Biospheric Beliefs subscale	Items 11, 12, 13, and 14		.57

Using a scale from 1 (*strongly disagree*) to 7 (*strongly agree*) please indicate the extent to which you agree with the following statements by placing a number in the space provided to the left of each statement.

1. Through my individual actions I can make a difference to the environment.
2. My individual actions have an impact on the environment when I choose which mode of transport to use to get to university.
3. The effect of air pollution from cars on public health is minimal.
4. It is necessary to conserve fossil fuels (such as petrol and natural gas) for future generations.
5. Greenhouse gas emissions from cars affect people all over the world due to global warming.
6. The noise created by cars negatively affects many people.
7. The noise created by cars negatively affects me.
8. This city would be a more pleasant place for me to live if there were fewer cars in it.
9. Car use has a negative effect on my health.
10. Today's car use will have a negative effect on me and my family in the future.
11. The environmental pollution due to cars is negligible compared to that due to industry.
12. The effects of cars on the ecosystem have been exaggerated.
13. Drilling for liquid petroleum and natural gas poses a threat to the environment.
14. Over the whole earth pollution from cars has a minimal impact on plant and animal life.

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