

## **Changing Travel Behavior in Environmental Strategies: A New Research Approach**

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### ***Abstract***

*While there is consensus that present patterns of auto dependence are inconsistent with established goals for sustainability and climate change, there is little agreement on which policies and actions could lower overall auto dependence. This paper concerns the relationship between new mobility products/services and the propensity to change travel behavior. In a survey of 501 respondents, the Theory of Planned Behavior was first applied to establish base case conditions for key variables. Respondents were exposed to seven possible improvements to transit services. A follow-up application of the theory was undertaken to look for shifts in key attitudes. New products/services may influence 1) the traveler's personal inclination to change modal behavior, 2) her belief that a change in modal behavior would be socially acceptable, and 3) her belief that she actually could change the behavior. These three attitudinal categories were examined for four market segments for changed travel behavior. Research results suggest that new products and technologies dealing with a latent fear of being lost, abandoned or needing more information might contribute to an increased social acceptance of a lifestyle more dependent on transit and walking.*

**Keys-words:** *travel behavioral change, Theory of Planned Behavior, environmental strategies*

### **Introduction**

It has been well documented in the professional literature that making significant changes in people's travel behavior in the direction of a more sustainable pattern will be difficult (Garling, 2005). A recent study undertaken in the United States by the Transit Cooperative Research Program (TCRP) addressed the issue of potential change in modal behavior in two innovative ways (TranSystems *et. al.*, 2006). First, the study examined the factors which influence one's choice of neighborhood in the same research project as the factors which influence the choice of mode once the neighborhood is held constant. Second, the study utilized research methods previously not applied to the issue of changed travel behavior in the United States. The project called for the use

of theories developed largely in the field of public health intervention to be applied to the questions of selection of residential location supportive of walking and transit, and the alteration of existing modal patterns for less reliance on the private automobile. The theory applied, The Theory of Planned Behavior, is a widely accepted method for understanding the path from beliefs to attitudes, to intent, and finally to behavior (Bamberg, Aizen & Schmidt, 2004).

A program to lower dependence on the private automobile will require a wide variety of strategies. This paper examines the question of what products and services designed to improve non-auto related mobility might be most effective as part of an over-arching strategy for lowering of Vehicle Kilometers of Travel, and increasing the role of walking and transit.

## **1. Method: The Theory of Planned Behavior**

As part of a larger research plan, the project conducted a survey of 501 participants to explore the factors influencing modal choice once the residential location decision had been made. All of the participants were from metropolitan areas with transit service who either had recently made a residential decision, or were contemplating a residential location decision in the near future. Respondents were drawn from existing samples of individuals who had previously responded to questions about transportation via an Internet-based panel (Adler *et al.*). The sample represents this group of potential transit users, and was not designed to reflect the broader American population.

The Theory of Planned Behavior posits that the immediate antecedent of behavior is intent, as modified by the perceived ability of the subject to undertake the change in behavior. Intent is influenced by three levels of considerations. The Attitude toward the Behavior reflects the subject's inclination to want or not want to undertake the behavior, based on assessments that the new behavior might be desirable, pleasurable or interesting. The Subjective Norm reflects the influence of the subject's immediate personal network of family, friends, and other sources of peer influence. The Perceived Behavioral Control reflects the judgment of the subject about how difficult (or easy) it will be to undertake the new behavior, representing the factor of self efficacy (Stradling, 2004). In the surveying process, the participant is asked a series of questions designed to bring out the latent forces influencing the formation of an intent, in this case the intent to alter one's lifestyle to have greater reliance on transit and walking, and less dependence on the private automobile.

The survey instrument was constructed with three clearly definable phases. First, a "pre-intervention" application of the full Theory of Planned Behavior was undertaken concerning a subject's initial intention to change personal transportation patterns. Second, an "intervention" was undertaken in which the respondents were exposed to different messages and to candidate products and services that might improve the acceptability of the alternative transportation lifestyle. In the third phase of the survey, a second application of the theory was undertaken to allow the documentation of any shifting in scalings which occurred by the end of the survey. That study design is illustrated in Figure 1.

During the intervention phase of the survey, the 501 respondents were exposed to seven separate concepts for making it easier to undertake a lifestyle with more dependence on transit and walking. They were asked to go through several exercises which forced them to make decisions about the mobility options offered. Those seven candidate products and services were:

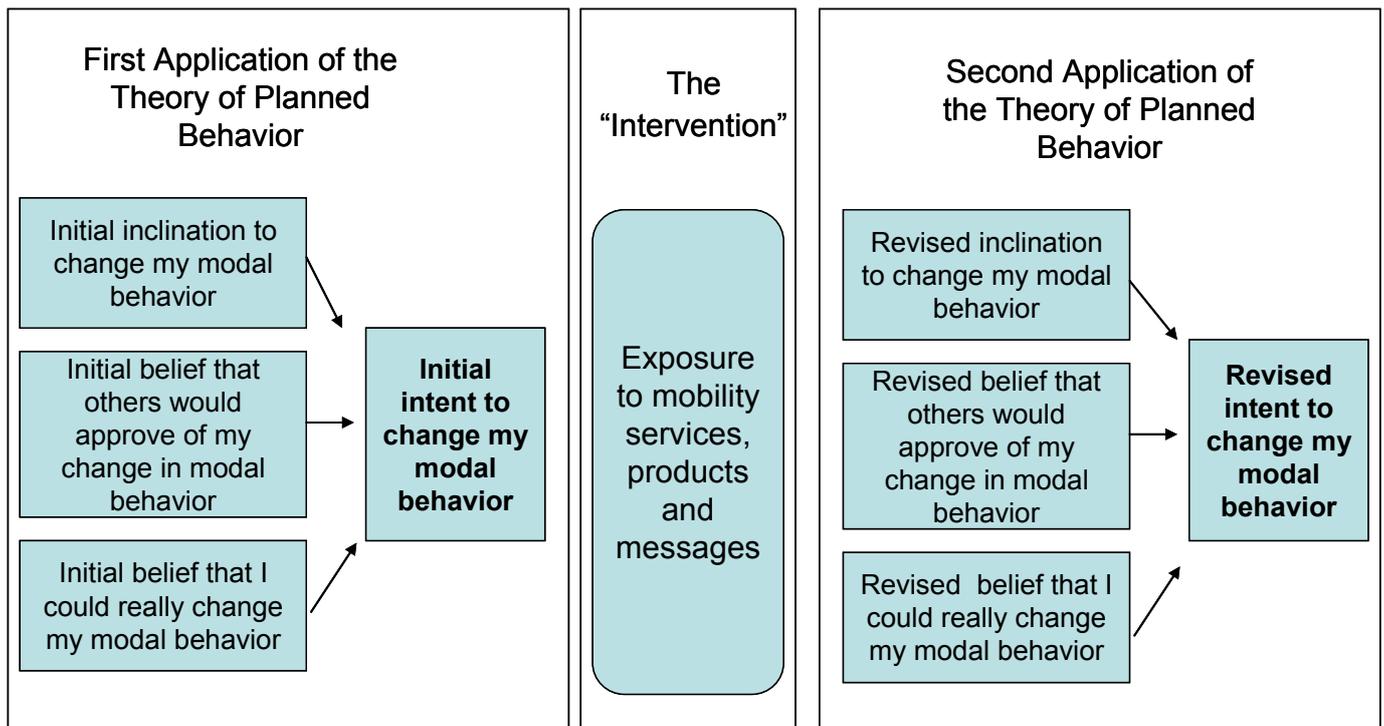


Figure 1: The Study Design

1. Better traditional service to the downtown
2. Better traditional service to the rest of the region
3. A 'Smart Card' to handle all payment requirements
4. A community shuttle bus for neighborhood trips
5. A community door to door shared taxi system for neighborhood trips
6. A car sharing vehicle available within the neighborhood
7. A 'Smart Phone' which would:
  - a. tell the user when the next bus would arrive
  - b. tell the user how to make a transit trip home from the actual location if she were lost
  - c. have a '911' button that would report her exact location to the police for any reason

The study design allowed for the documentation of the extent of shift in answers to key questions based on the construct of the Theory of Planned Behavior; this was undertaken for the full sample and for four separate market segments created in the project.

## 2. Method: Four Market Segments for Modal Change

The research created a market segmentation to help explore the variety of beliefs and attitudes associated with the propensity to change modal behavior toward a greater reliance on walking/transit, and a decreased reliance on the private car, consistent with previous studies (Anable, 2005). Of the four market segments identified, two can be characterized as positive market segments, and two can be characterized as unlikely for change in modal behavior. The four

Four Market Segments	Number of cases	Initial Measure of Intent (Scale from 1- 7)	Revised Measure of Intent (Scale from 1-7)	Transit mode share to work	“For me to reduce pollution by using my car less would be IMPORTANT”	“For me to walk and take public transportation more would be DESIRABLE”
<i>Transit Loyalists</i>	68	<b>5.19</b>	<b>5.45</b>	<b>58.8%</b>	5.50	<b>5.50</b>
<i>Environmental Changers</i>	150	4.02	5.44	18.7%	<b>6.43</b>	5.09
<i>Happy Drivers</i>	132	3.71	4.30	25.0%	5.17	4.25
<i>Angry Negatives</i>	151	2.26	2.87	14.6%	4.28	2.93
Full Sample	501	3.57	4.36	24.6%	5.32	4.27

Table 1: Characteristics of the Four Market Segments for Mode Change (Highest Values Emphasized)

segments for change in modal behavior are summarized here, ranked from highest propensity to change to the lowest.

**1. The Transit Loyalists.** This group is characterized by their present use of, and understanding of, public transportation services. For them, issues such as the safety of transit services or fear of getting lost are not considered to be determinant, and therefore not important to be solved with new products and services. This group tends to have a very strong idea of what transit is, and how it can improve on doing what it presently does.

**2. The Environmental Mode Changers.** This group is characterized by their belief that, if certain conditions are improved, they could become transit users, even though transit does not now live up to their standards. They are further characterized by their belief in environmental causes as a motivation for a change in modal behavior.

**3. The Happy Drivers.** This group likes to drive, values its automobiles, and has no propensity to like the attributes of a transit oriented life. It should be considered as the moderately negative group.

**4. The Angry Negative Group.** This group is characterized by its low evaluation of just about every aspect of altering modal behavior, and by the radically low intent of its members to alter their own transportation behavior.

Each variable was structured on a seven point scale, with one as the lowest and seven as the highest scalings possible. The variation in scalings by market segment can be seen in Table 1. The experience of the respondent with actual transit service influences the nature of the attitudes held: Table 1 shows that the Environmental Changers have the highest potential to think that they *should* be driving less to reduce pollution, whereas the Transit Loyalists think that it might be *desirable* to rely more on walking and transit.

Four Market Segments	Increase in 'Intent' to change modal behavior	Increase in 'Attitude' (Personal inclination to want the change)	Increase in 'Perceived Behavioral Control' (Belief that I can change the behavior)	Increase in 'Subjective Norm' (Belief that others will approve and support change)
<i>Transit Loyalists</i>	0.26	0.17	0.11	1.38
<i>Environmental Mode Changers</i>	<b>1.42</b>	<b>0.28</b>	<b>0.96</b>	<b>2.34</b>
<i>Happy Drivers</i>	0.58	0.17	0.39	1.49
<i>Angry Negative Group</i>	0.61	0.01	0.42	1.30
Full Sample	0.80	0.16	0.53	1.67

Table 2: Increase in Intent and other Direct Measures, by Market Segment. (Change in Scalings from 1-7; Highest Values Emphasized)

On a scale from one to seven, the “Transit Loyalists” gave a scaling of 5.2 points to the Initial Measure of Intent to Change Modal Behavior, with the “Angry Negatives” registering on only 2.3 on the same scale. There was very little variation by income level over the four groups.

### 3. Results: What Groups Shifted and Why?

Table 1 shows that at the commencement of the survey, the Transit Loyalists displayed the highest level of Measure of Intent to change their transportation behavior to become more reliant on transit and walking in the future. After the intervention was completed, and the Theory of Planned Behavior was again applied, the Environmental Mode Changers had shifted their level of Intent to the point where their stated Intent was about as strong as that of the Transit Loyalists.

Table 2 shows the extent of shift in Intent from the base case application of the Theory of Planned Behavior to the post-intervention application of the follow-up survey. This table shows that the Transit Loyalists showed the smallest level of increase in Intent of any of the four segments—smaller even than either of the two negative groups. By contrast, the Environmental Mode Changers showed by far the highest level of shift in Intent; they also showed the greatest increase in Perceived Behavioral Control, *i.e.* the belief that they could succeed in changing their behavior.

Table 2 shows that the most pronounced shift in attitudes concerned the belief that *others* would approve a change in one’s transportation behavior (Subjective Norm). Conversely, exposure to the new transit services had the least impact on one’s own propensity to believe that the proposed behavior was desirable, pleasurable or interesting (Attitude). Looking both at shift in Attitude and shift in Perceived Behavioral Control, it is clear that the Transit Loyalists were simply not impressed with the strategies offered to them. By comparison, looking at the shift in Attitude and PBC for the Environmental Mode Changers, they were more “moved” by the experience of the intervention, and their measure of Intent shifted accordingly.

The most dramatic shift, however, occurred in the change of ratings assigned to Subjective Norm, which looks at the impact of one’s personal social network in one’s formation of intent to change

Attributes	Attribute's Rank	Full Sample	<i>Environmental Changers</i>	<i>Transit Loyalists</i>
I would want to know exactly when the bus or train would arrive	Highest	6.05	6.56	6.01
I would want a transit pass so that I never had to worry about having cash	2	6.02	6.55	6.28
I would want to be able to walk to a nearby store or coffee shop	3	5.97	6.58	6.29
I would want transit service that connects me with the rest of the region	4	5.92	6.48	6.22
I would want to be sure that a taxi would come at any hour	5	5.37	5.95	5.35
I would want a shuttle service to take to activities within the neighborhood	6	5.37	6.07	5.57
I would want frequent transit service (rail or express bus) to the downtown	7	5.28	5.95	5.97
I would want a car on my block that I could rent by the hour (car-sharing)	Lowest	4.42	5.22	4.00

Table 3: Ranking of Attributes of New Products and Services

behavior. This pattern occurs for all four segments, but is most dominant for the Environmental Mode Changers segment where an increase in the measure of Subjective Norm of about 88% took place.

Using a sample of only members of the Environmental Mode Changers segment, correlations were calculated between Revised Subjective Norm and all candidate independent variables. The two variables with the highest correlation were “With the new services available, I would have less concern about being lost or stranded by missing the bus or train” and “If I were to use the new services, I would feel safer from crime and other disturbing behavior.” Regression equations were created to better understand the nature of the increase in the belief that others would approve of a personal change in modal behavior. The strongest explanatory power was provided by the same two variables, concerning fear of abandonment, and fear of crime.

#### 4. Results: Ranking the Desired Attributes and Products

After the completion of the initial Theory of Planned Behavior survey, the respondents were asked to think about an imaginary neighborhood that already had good sidewalks, and good destinations to walk to. A stated requirement of that imaginary neighborhood was living with fewer cars than at present. The survey question was:

“Thinking about this imaginary neighborhood, which transportation options would you need to live with fewer cars in your household?”

Table 3 presents the results from this set of questions, presenting the rank order of the attributes offered for the full sample, and the mean scalings given by each of the two most positive segments. In response to this question, the respondents gave the highest rating to: “I would want to know exactly when the bus or train would arrive.” The second most desired function was, “I would want a transit pass so that I never had to worry about having cash.” Ranking third among the list of

desired attributes was “I would want to be able to walk to a nearby store or coffee shop.” The least desired attribute was that describing the need for car-sharing.

When a later exercise in the survey forced the respondents to choose between paired options, the full sample gave highest ratings to products providing traditional commuter services, with lower levels of interest in community taxi, community bus or car sharing. Interestingly, the “Smart Phone” product with both bus arrival information and a direct link to the police was ranked as lower priority than the actual improvement of services.

## 5. Discussion

The successive application of two iterations of the Theory of Planned Behavior to the question of the possible impact of new services and products revealed both attitudinal shift and lack of attitudinal shift. After the respondents completed the exercises in which they dealt with details of the new products and services, there was little change in the scalings describing their Attitude toward the Behavior, reflecting their assessment of the new behavior being desirable, pleasurable or interesting. However, for all market segments, the greatest shift occurred in the Subjective Norm, reflecting the belief that the transit lifestyle would be more accepted by others in one’s social network. If the new products and services could deal with certain underlying concerns about transit, a lifestyle with increased reliance on transit would become more socially acceptable.

The research results might suggest that the increased level of Subjective Norm experienced by the Environmental Mode Changers is associated with latent underlying concerns about crime and abandonment (being lost) on the public transportation system. Looking at the empirical data, we know that the scalings for the perceived beliefs of the *others* (wives, husbands, neighbors, etc.) improved significantly more than did one’s own personal rating of the same situation. Perhaps, it is possible that reporting that *others* would feel happier with a higher degree of safety reflects some latent concerns that one has about one’s own condition, but is reticent to admit.

The results of the ranking of candidate products and services suggest that further research may be needed. On the one hand, the market research clearly reveals a direct interest in learning about the arrival time of the next bus, as well as a latent underlying concern about being lost on the system, and being exposed to crime or unpleasant behavior. At the same time, when confronted with a specific product designed to deal with these same concerns, the respondents ranked it lower than improvements to conventional services. In terms of priorities, the respondents wanted actual improvements to services first, and information about those services (or gadgets providing information) second.

Future packages of mobility services designed to support a lifestyle with lowered auto dependence will probably include neighborhood-based buses, shared taxis and car sharing (Coogan, 2003). It is clear from this research, however, that concepts which provide services different from the well understood commuter work trip will need to be carefully explained to population. The respondents in the study were given the *opportunity* to reveal a preference for neighborhood-based services, with locally managed shuttle buses augmented by community shared-ride taxis. However, the respondents in our sample gave highest ranking to the products which they knew best (traditional commuter services), and lowest to those with which they were not familiar (car-sharing.)

It can be argued that the community shuttle bus and the community shared ride taxi represent a more radical departure from present modal behavior than the most favored options, and thus were less popular. In the US experience transit gets a high mode share for the work trip, but is simply *not* the mode of choice for getting to the community center, to the doctor, or the neighborhood shopping center. When asked about what they would like to be offered, the respondents showed

little interests in options that would alter their basic patterns of modal choice. Evaluations (rankings) were highest for services about which they had actual experience and actual knowledge. Further research in this area could examine the influence of age, specifically old age, on the attitudes towards locally oriented services

Attributes describing the need for new products and services were nearly always valued higher by the environmentally motivated group than by the group with an existing experience base with transit. New products designed to deal with fear of being lost and fear of crime were of higher interest to the group which felt that transit was important, but needed to be improved to their standards before a behavioral change could take place.

This study has revealed an underlying concern for the feeling of being lost, abandoned or not knowing when a bus or train will arrive. We believe that new services and products can be designed to deal with this revealed deficiency, but understand that the potential market will have to be convinced that new services and products can be effective. As mobility planners address this issue, they must be prepared to acknowledge the separate attitudes and beliefs of separate market segments. Products and services designed to deal with these latent concerns will need to be introduced with some care, perhaps through a staged process of implementation.

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