Reducing Family Car Use by Providing Travel Advice or by Requesting Behavioral Plans:

An Experimental Analysis of Travel Feedback Programs

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Reducing Family Car Use by Providing Travel Advice or by Requesting Behavioral Plans: An Experimental Analysis of Travel Feedback Programs

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Abstract

A field experiment was conducted to investigate the effectiveness of a travel feedback program for reducing family car use. The experiment focused on a travel feedback program that urged participants to make behavioral plans, and compared it to a program that provided individualized information. Results are used to discuss the psychological process of behavioral modification, theoretically effective interventions, and policy implications for implementing effective travel feedback programs.

Keywords

Car-Use Reduction, Travel-Demand Management, Travel-Feedback Programs, Implementation Intention

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1. Introduction

To ease traffic congestion in urban areas and to reduce environmental problems resulting from automobile emissions, transport policy makers have begun to implement travel demand management (TDM) schemes. Such schemes have included toll roads, traffic restrictions, and reduced transportation fees. Fujii *et al.* (2001) labeled these schemes "*structural strategies*" for behavioral modification because they change the environmental structure surrounding travel behavior, *e.g.*, the service availability of various travel modes and systems that regulate travel behavior. Fujii *et al.* also discussed "*psychological and behavioral strategies*". These strategies influence individual awareness and various psychological factors in order to encourage voluntary behavior change. Psychological and behavioral strategies include providing specific information on public transport, travel campaigns, and travel education. Consider the following as a case in point. In one program, participants report their travel behavior, and feedback information is provided, including information on the CO2 emissions their car produced, advice on how to reduce car use, and individualized information on public transport that may have been used as an alternative. Examples of such programs include Individualized Marketing (Brög, 1998; Socialdata, 1998), Travel Smart (Department of Transport, Western Australia, 2000), Travel Blending (Ampt & Rooney, 1999; Rose & Ampt, 2001), and the Travel Feedback Program (Taniguchi, 2002, 2003). We will refer to these behavior modification programs (*i.e.*, programs that give participants feedback based on reported travel behavior) in our discussion as *travel feedback programs*.

The travel feedback programs mentioned above differ among themselves in many ways, but they all share a common feature: the participants in each program receive information that is designed to modify behavior, according to the reported behavior. Such feedback may be effective by inducing behavioral awareness – an essential element in modification (Dahlstrand & Biel, 1997). This feedback may also prompt participants to increase their knowledge of specific methods for modifying their travel behavior (Verplanken *et al*., 1997).

Unfortunately, there are a number of practical flaws with such strategies, and they may actually be less than effective because they are inconsistent with psychological theory. Feedback-based programs are expensive, and despite the fact that a number of cost/benefit analyses have indicated that program benefits exceed costs (*e.g.*, Brög, 1998), the search continues for more cost-effective methods.

Some studies imply that participants fail to develop behavioral plans that would lead to a reduction in car use, contradicting the theory behind these strategies. Such plans are necessary to the development of *implementation intention* (Gollwitzer, 1993, 1996; Gärling *et al.*, 1998; Gärling & Fujii, 1999; Gillholm *et al.*, 2000), which is, in turn, necessary for the implementation of new behavior (Gärling & Fujii, 2002). People often fail to implement new behaviors, even when they have developed such intentions and are, to some extent, motivated to change. To actually implement a desired behavior however, implementation intention is essential.

Unlike behavioral intention (Fishbein & Ajzen, 1975) or goal intention (Gollwitzer, 1993, 1996), which is merely an intention to implement a behavior without any behavioral plan, implementation intention is an intention that includes information on when, where, and how the behavior will be implemented. A behavioral plan made prior to actual implementation of the behavior is more effective in increasing the implementation intention, as well as increasing the probability that the behavioral intention will actually be implemented (Gärling & Fujii, 2002). Thus, a strategy that provides individual information may not always stimulate participants to make behavioral plans. A more effective way to modify travel behavior would be to ask participants, directly, to devise a plan on how to modify their behavior, rather than merely providing individualized information (Bamberg, 2002a, 2002b; Gillholm, *et al*. 1999, 2000; Gollwitzer & Brandstätter, 1997; Orbell *et al*., 1997). A strategy that encourages participants to make behavioral plans would probably prove less costly than one that merely provides information based on reported behavior.

In this paper, we describe a field experiment that compares a travel-feedback program that asks participants to make *behavioral plans*, with a more conventional travel feedback program, i.e., one that merely provides individualized information (Ampt & Rooney, 1999; Brög, 1998; Department of Transport, Western Australia, 2000; Rose & Ampt, 2001; Socialdata, 1998; Taniguchi, 2002a, 2002b).

2. Method

Two hundreds and ninety two, fifth-grade students (10 and 11 years of age) from four homeroom classes in a Sapporo city elementary school, and the members of their families, were used as subjects. The experiment began in September and ended in November. One hundred and fifty five subjects from two classes received individualized information and advice on reducing family car use (referred to, from this point on, as the advice group). One hundred thirty seven subjects from the other two classes were asked to make behavioral plans with respect to methods of reducing car use (referred to as the planning group).

Six weeks prior to experimental intervention, all subjects, that is, the students and their families, answered a questionnaire that included questions on the frequency of car and public-transport use over three consecutive days (Sunday, Monday, and Tuesday). They were also asked the number of days the family car was used each month. Four weeks before intervention, all students were given lessons on the global warming issue, the role of CO_2 in this problem, and the level of CO_2 emission from car use.

Afterwards, all the families in the advice group, were asked to fill in a 3-day activity-travel diary. Subjects logged starting times, ending times, types and locations for all their activities, as well as the mode of transportation used to travel to and from these activities. After receiving their diaries, we made "diagnostic checklists" (c.f. Taniguchi et al., 2002, 2003) for each family, in which their 3-day activity-travel patterns were graphically presented as a diagram, together with comments, including proposals as to how the participant's activity-travel patterns might be modified to reduce CO_2 emissions. The diagnostic checklist was then given to the household as an intervention to reduce car use.

Each household in the planning group was asked to develop behavioral plans to modify their home-based car trip chains with the aim of reducing CO_2 emissions. They were instructed to develop behavioral plans to modify up to three of their car trip chains. A questionnaire asked the families to describe their planned departure time, arrival time and travel mode for each trip, and the location of each stop in their modified car trip chains. This intervention was on the same day as the intervention for the advice group.

One week after these interventions, subjects in both groups answered an exact duplicate of the original questionnaire.

3. Result

Table 1 shows the frequency of trips by length and total trip durations for the three days before and after the experimental interventions, for both groups. A two (group; advice vs. planning) by two (wave; before vs. after) analysis of variance (ANOVA) of total frequency of car use, with repeated measurement on the last factor, indicated that a group effect was significant $F(1, 290) = 4.24$, $p = .040$, and a wave effect was not, $F(1, 290) = .13$. The interaction effect was not significant, $F(1, 290) = .48$. This, in conjunction with Table 1, indicates that car trip frequency in the advice group was less than that in the planning group. The difference between values, before and after interventions, was not significant, and the results for the planning group did not differ from those of the advice group.

Table 1. Frequency of car trips by trip length, and total trip duration for three days prior to and three days after experimental intervention. Also shown: number of days of car use during the month.

		Advice group (n = 155)		Planning group (n=137)	
		M	(SD)	M	(SD)
Frequency of car trips					
Trip length ≤ 15 min.					
	3 days before	1.81	(2.56)	2.36	(2.99)
	3 days after	2.12	(2.72)	2.80	(3.38)
15 min. < Trip length ≤ 45					
	3 days before	1.55	(2.24)	1.74	(2.41)
	3 days after	1.32	(1.99)	1.56	(2.45)
Trip length > 45					
	3 days before	0.50	(1.31)	0.72	(1.29)
	3 days after	0.65	(1.53)	0.37	(0.95)
Total					
	3 days before	3.86	(3.48)	4.81	(3.83)
	3 days after	4.09	(3.66)	4.74	(4.29)
Estimated total duration of car trips for 3 days (min.)					
	3 days before	115.54	(201.27)	144.63	(137.73)
	3 days after	122.77	(178.80)	105.53	(125.22)

Parallel ANOVAs of car-use frequency for different trip lengths indicate that the interaction effect between group and wave was significant only for trips greater than 45 minutes, $F(1, 290) = 8.48$, $p = .004$. Table 1 shows that the frequency of trips longer than 45 minutes for the planning group decreased from 0.72 to 0.37 after intervention. Separate t-tests demonstrate that the difference in trip frequency was only significant for trips longer than 45 minutes in the planning group, $t\ (136) = 3.00$, $p = .003$. Trips longer than 45 minutes were significantly reduced only in this group, and the frequency changes were far more pronounced than in the advice group.

Table 1 also shows the estimated total duration of car trips over three days. This value was calculated based on the reported car trip frequency by different ranges of trip length, using the range's average trip length in the activity diary data used by Taniguchi (2002, 2003). Taniguchi's work was also done in Sapporo, Japan. Table 1 shows that the estimated total trip duration in the planning group fell, while in the advice group, it grew. The reduction in the planning group was significant, t(136) = 3.58, p < .001. The growth in the advice group, by contrast, was not, t(154) = -.437, *p* = .66. The reduction in the total estimated trip duration in the planning group was 27.0 % (from 144.63 minutes over three days, to 105.53 minutes). A two (group; advice vs. planning) by two (wave; before vs. after) ANOVA of total car-use duration, with repeated measurement on the last factor, indicated a non-significant group effect *F*(1, 290) = .35, as well as a non-significant wave effect, *F*(1, 290) = .65. The interaction effect, however, was significant, *F*(1, 290) = 7.02, p < .01. These results suggest that households in the planning group significantly reduced total trip duration, as compared to those in the advice group.

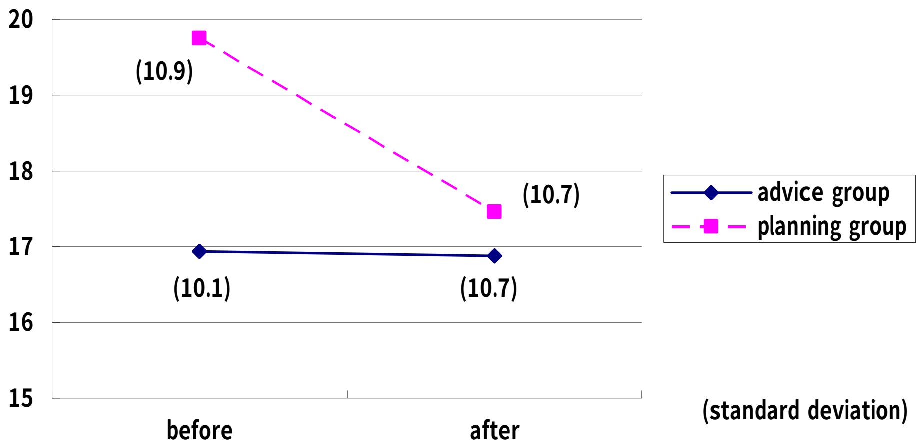

Figure 1. Number of days of car use during month

Figure 1 shows the number of days of car use before and after intervention for both groups. The total fell in both. The drop, however, was less pronounced in the advice group. T-tests indicated that the reduction was not significant, *t* (141) = 0.08. In the planning group, by contrast, total car-use days fell by more than two – from 19.75 to 17.46 (an 11.6 % reduction). This reduction proved significant using t-testing, *t* (123) = 2.63. Prior to intervention, total car-use in the planning group was greater than that in the advice group, for a number of reasons. The difference was significant, *t* (276) = 2.12; however, the difference between the two groups after intervention was not, *t* (278) = 0.21.

A two (group; advice vs. planning) by two (wave; before vs. after) ANOVA of total car-use days per month with repeated measurement on the last factor indicated that the group effect was not significant $F(1, 265) = 2.05$, $p = .15$, but that the wave effect was, $F(1, 265) = 4.54$, $p = .030$. The interaction effect was also significant, $F(1, 265) = 4.11$, $p = .040$. Thus we see that households in the planning group significantly reduced the number of days in which their cars were used, as compared to households in the advice group.

4. Discussion

Our experiment shows that subjects encouraged to make behavioral plans with respect to methods to reduce car use actually made such reductions. The actual reduction was estimated to be 27.7% in terms of total trip duration, and 11.6% in terms of car-use days. By contrast, households that merely received advice on how to reduce car use did not make similar changes. These findings differ in relation to those of some previous studies that have suggested that travel feedback programs significantly reduce car use (Ampt & Rooney, 1999; Brög, 1998; Department of Transport, Western Australia, 2000; Rose & Ampt, 2001; Socialdata, 1998; Taniguchi, 2002a, 2002b). The program used for the advice group in our experiment was identical to that described by Tanigichi (2002, 2003), which was found to have reduced car use by 15%. Possible differences in our findings might be a result of the effect of the reception of advice being mitigated by an increase of car use, due to a change of the other factors, such as season. The first wave of this experiment was carried out in September; and the second, in November. November's monthly average temperature was 4.3°C colder, which perhaps motivated people to use less air conditioning.

Findings imply that the reduction in trip duration for the planning group was principally a result of fewer long car trips. The difference of trip frequency was only significant for trips longer than 45 minutes. Subjects in the planning group may have done more planning with regard to longer car trips.

Our results bore out our theoretical prediction, which was grounded in the theory of implementation intention. Theories of implementation intention state that forming an intention to implement a behavioral plan (i.e., implementation intention) is essential in the actual implementation of a behavior. Providing advice may be *indirectly* useful for subjects in the formation of implementation intention, but encouraging individuals to make behavioral plans provides a more powerful incentive, by *directly* urging subjects to form implementation intentions.

This study empirically demonstrated that a travel feedback program urging users to make a behavioral plan to reduce car use is more effective than more conventional systems that provide advice, and that have been described in previous studies. These findings agreed with our predictions. Needless to say, using these systems can be more cost effective because they do not need to prepare and offer advice based on a travel diary. Thus, such systems are expected to offer administrators and researchers an effective travel demand management tool.

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