Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 160 (2014) 625 – 633

Procedia Social and Behavioral Sciences

XI Congreso de Ingeniería del Transporte (CIT 2014)

Variations on timing decisions after participating in Travel Behavior Change Programs

Tomás Ruiz* and Pablo García-Garcés

Universitat Politècnica de València, Camino de Vera s/n, 46022, Spain

Abstract

Travel Behavior Change Programs (TBCP) based on psychological principles of persuasions, were implemented to habitual drivers in Valencia (Spain) with the objective of convincing them to reduce car use. Participants in TBCP were selected from those involved in a two-wave activity scheduling process panel survey, which collected weekly pre-planned and executed activity-travel agendas. Actions included in TBCP were implemented between the two panel survey waves, so it is possible to analyze the effect of such actions comparing the way panelists involved in TBCP pre-planned and executed activities and travels in the second survey wave with panelists not involved in TBCP.

It is argued that the influences of TBCP extends to the way people pre-plan and re-schedule activities and travels. The desire to reduce car use may drive them to modify the starting time of specific activities, facilitating to share a car or to use alternative transportation modes. In this paper, variations on timing decisions after participating in TBCP are studied. Participants in TBCP pre-planned and executed more morning activities and less night activities than non-participants. Demographic and socioeconomic factors and characteristics of activity and travel episodes are significant to explain those changes as well. Practical implications of the findings in terms of operational modeling and transportation policy are described.

Peer-review under responsibility of CIT 2014.

Keywords: Activity Scheduling Process; Travel Behavior Change Programs

* Corresponding author. Tel.: (+34) 96387 73 76; Fax:+ 34 96 387 73 79.
E-mail address: truizsa@tra.upv.es

Peer-review under responsibility of CIT 2014.
doi:10.1016/j.sbspro.2014.12.176

1. Introduction

Travel Behavior Change Programs (TBCP), also known as Voluntary Behavior Change Programs, aimed to reduce car use in the attempt to diminish greenhouse gas emissions, energy and accidents. Although TBCP have been used more frequently over the past decade, only in the past five years or so has increased scrutiny been given to the techniques used to evaluate their impacts (Chatterjee and Bonsall, 2009). Some early programs used research methods that did not allow statistical inferences to be drawn from their results. In particular, many programs did not use control groups to evaluate travel behavior change. These studies relied solely on pre- and post-program reports of driving behavior from those who participated in the program (Moser and Bamberg, 2008; Fuji et al. 2009). Experimental designs such as these cannot account for changes in travel behavior that may occur in the general population, for example due to changes in season, travel or fuel costs, public transportation service, or roadway construction.

Socialdata America (2007) and Brög et al. (2009) reviewed studies of TBCP applications which did include control groups in their evaluations. In addition, the meta-analysis of Moser and Bamberg (2008) attempted to address some of the methodological shortcomings of earlier evaluations by examining pooled effect sizes. The results of these studies appear to indicate that household vehicle miles traveled (VMT) is generally reduced by an average of 5 to 8 percent among those who participate in TBCP. Results from the Sloman et al. (2010) evaluation and Moser and Bamberg (2008) meta-analysis, appear to indicate that the effects of TBCP persist when self-selection is accounted for, though the size of the effects may be somewhat smaller. Both studies found driving trip reductions of 5 to 7 percent, which agrees with the effect size found in other studies.

In this paper we argued that the influences of TBCP extends to the way people pre-plan and re-schedule activities and travels. The desire to reduce car use may drive them to modify the starting time of specific activities, facilitating to share a car or to use alternative transportation modes. In this paper, variations on timing decisions after participating in TBCP are studied using exploratory methods. The next section includes a description of the data used. Section 3 presents an exploratory analysis of the information. And the paper ends with some Conclusions in Section 4.

2. Data description

2.1. Activity Scheduling Process Panel Survey

A two wave activity-travel panel survey was conducted over a period of two years in the city of Valencia (Spain). The main purpose of this panel survey were both to achieve a better acknowledge of the travel mode choice and to study the potential effect of Travel Behavior Change Programs (TBCP) on both the scheduling process decisions and activity-travel behavior. First and second wave took place during autumn of 2010 and 2011 respectively. Part of the respondents received a set of TBCP between both waves.

Both survey waves followed three phases. First phase was a preliminary face-to-face interview to generate a pre-planned activity–travel agenda for the following week starting the day after the interview. Respondents were asked to define all activities and travels already decided to be carried out, giving as much details as possible. Demographic and socioeconomic information was collected as well. Before finishing this interview, respondents received a mobile phone with an activity-travel diary implemented and a cash incentive (30 euro). Second phase was developed during the research week, since respondents had to complete the activity-travel diary to collect characteristics (initial time, duration, location, etc.) of activities and travels as they were executed. Information was sent in real time to the research group, who compared pre-planned agenda and observed activities and travels. Third phase consisted in an in-depth telephone interview to inquire about the differences found.

For the first wave, car users were recruited at parking slots located throughout the city of Valencia (Spain). Those who admitted using car for most of their journeys and accepted to participate in the study were subsequently

interviewed face-to-face at their home or other place agreed. So willing to change was not a criterion to accept their participation. A total of 165 respondents successfully completed the first panel wave.

Between both survey waves, 47 respondents abandoned the panel due to change of residence outside the study area, transfers abroad for work or just decisions to not continue participating in the survey. In order to complete sample size in the second wave, remaining respondents were asked to inform about friends, family and colleagues who would be interested in participating. New respondents were selected as similar as possible, in terms of demographic and socioeconomic characteristics, as those who dropped out.

Finally, 166 respondents participated in the second wave. Those who participated in both survey waves were 118 individuals. After screening, data from one participant was removed, so the data description and the exploratory analysis presented in this paper includes information from 117 individuals.

2.2. Travel Behavior Change Programs

After first survey wave, a short questionnaire was elaborated and sent to all respondents by postal and electronic mail in order to identify their internal barriers to modify travel behavior. Different question formats were used depending on the type of information to be collected. Self-identity and status, instrumental and affective attitudes towards car and alternative travel modes, and perceived behavioral control were evaluated. Response rate was 80 percent. Respondents who did not return this questionnaire but followed taking part in second wave were assigned to the Control Group, which also contained those respondents recruited between both waves.

TBCP were designed based on results obtained in the questionnaire. Three different actions based on psychological principles of persuasion (Cialdini, 1984) were designed. First, applying persuasion principles of reciprocity and scarcity, some respondents received an envelope by postal mail including detailed description on alternatives to car on some of their usual journeys, and information about the effects in economic and environmental terms of not using the proposed alternative and keep on using car. Secondly, applying persuasion principle of authority, some respondents were invited to attend a talk given by a cardiologist and a sport trainer about the relation between health and physical activity and how walking and biking more can improve our health condition. Finally, applying persuasion principle of social proof and liking, some respondents were invited to watch a video session where people who recently had reduced their use of the car were interviewed on street about why they had decided to do so (Ruiz and García-Garcés, 2014).

72 out of 117 panelists participated in TBCP, whereas the rest formed the Control Group. Each participant received at least two of the previous actions to motivate them to reduce their car use.

2.3. Data characteristics

Demographics and socioeconomics in both waves were similar (Table 1). The sample was well distributed among gender and activity status. But older people were underrepresented in both survey waves.

Table 1 Sample Demographic and Socioeconomic Distribution

	1st wave	*2nd wave*	Panelists
Women	49.1%	51.2%	48.7%
Men	50.9%	48.8%	51.3%
Employed	69.8%	65.7%	70.1%
Students	24.6%	23.5%	20.5%
Other	5.6%	10.8%	9.4%
Aged <30	37.4%	40,0%	37,2%
Aged 30-39	32.4%	33,9%	34,9%
Aged 40-49	17.9%	18,2%	17,4%
Aged 50-59	10.6%	7,9%	10,5%
Aged 60+	1.7%	0,0%	0,0%

The percentage of total activity-travel episodes pre-planned and executed by participants in both survey waves decrease from morning to night (Table 1). It is observed an increase of morning pre-planned episodes in wave 2, and a slightly increase of evening pre-planned episodes in wave 2. Afternoon and night pre-planned episodes decreases in wave 2. On the other hand, timing distribution of executed activities in both survey waves are more similar than their pre-planned counterpart. Only slightly reductions of morning and afternoon executed activities, and slightly increases of evening and night executed episodes, are observed.

Table 2. Average of timing distribution of panelists' episodes.

	pre-planned		executed	
	wave 1	wave 2	wave 1	wave 2
morning	32.6%	35.2%	32.6%	32.2%
afternoon	30.3%	29.1%	30.2%	29.8%
evening	25.0%	25.4%	25.9%	26.4%
night	12.1%	10.3%	11.4%	11.6%

Figure 1 presents averages of timing distributions of panelists' pre-planned and executed activity-travel episodes considering gender. Males reduce morning pre-planned and executed episodes in wave two while females increases them. On the other hand, males increase afternoon and night executed episodes and females reduce them in wave 2.

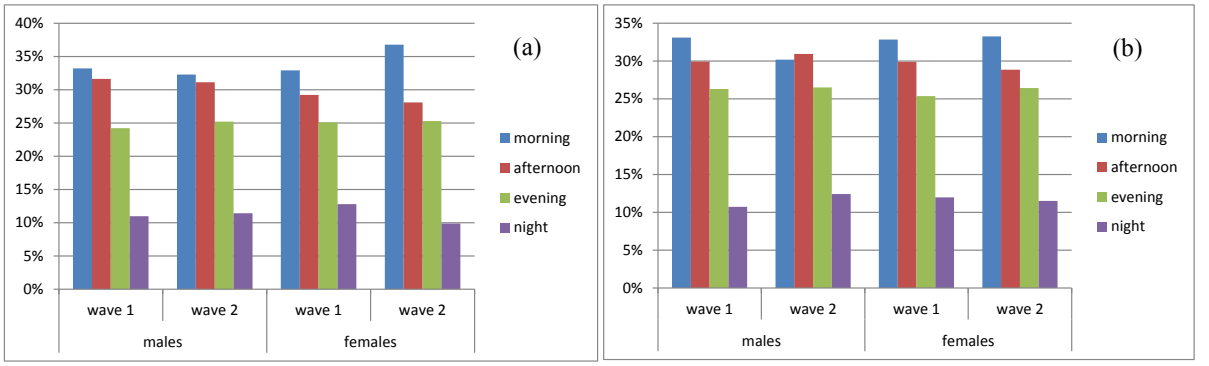

Fig. 1. Average timing distribution of (a) pre-planned and (b) executed episodes by gender

Figure 2 presents averages of timing distributions of panelists' pre-planned and executed activities-travel episodes considering age. In wave 2, younger respondents reduce pre-planned and executed morning episodes while older than 30 increase them. But younger respondents increase pre-planned night episodes while older than 30 reduce them.

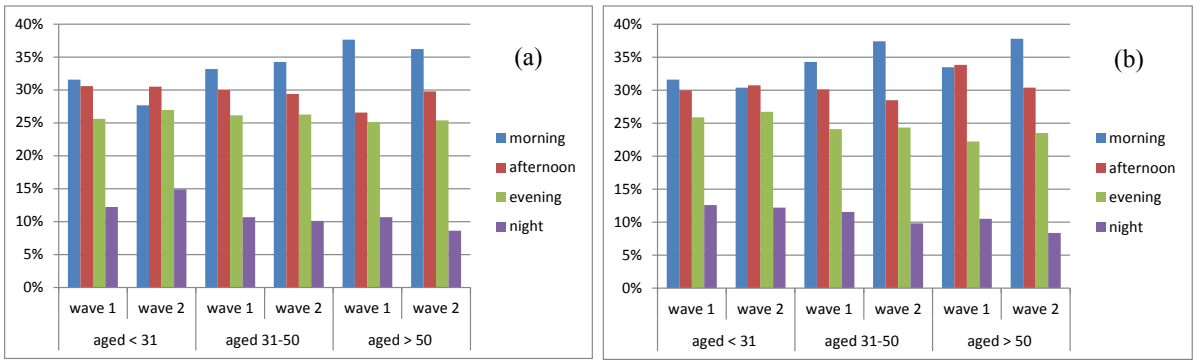

Fig. 2. Average timing distribution of (a) pre-planned and (b) executed episodes by age

Figure 3 presents averages of timing distributions of panelists' pre-planned and executed activities-travel episodes considering main occupation. In this case, in wave 2 students reduces pre-planned morning and afternoon episodes while employed and others respondents increase such type of episodes. Regarding executed activity-travel episodes, in wave 2 others respondents increase morning episodes while students and employee reduce them. But other respondents reduce evening episodes while students and employee increase them in wave 2.

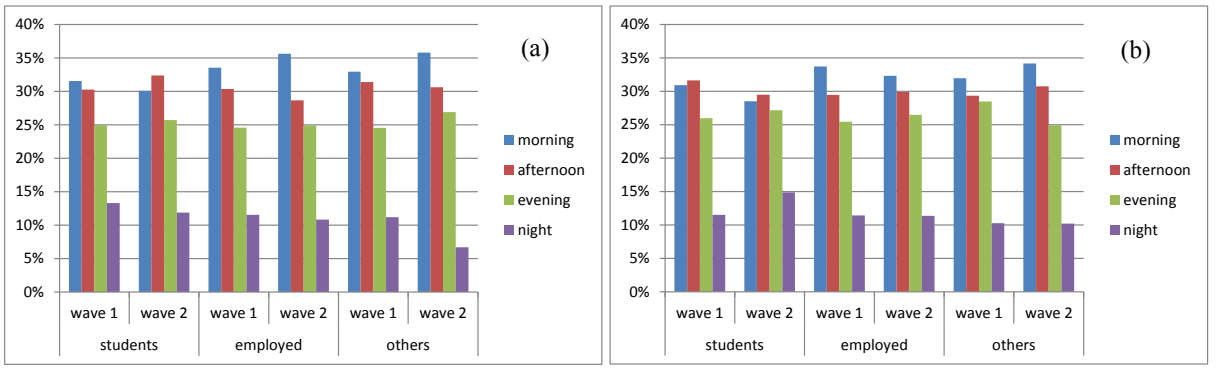

Fig. 3. Average timing distribution of (a) pre-planned and (b) executed episodes by main occupation

3. Exploratory analysis

Differences on average of timing distribution of episodes pre-planned by panelists considering if the participated or not in TBCP are presented in Table 2. Dependent two-sample t-tests show that differences on average of timing distribution between wave 1 and wave 2 in the participants group are not significant at 95%. Differences found on nightly pre-planned episodes have associated a probability of rejecting the null hypothesis of 14.7%

In contrast, we find statistically significant values in the Control Group at 95% level of confidence. Therefore, factors other than belonging to Participants or Control groups may be involved in explaining those variations. Differences found on nightly executed episodes have associated a probability of rejecting the null hypothesis much higher than their pre-planned counterpart. This result indicates that a higher sample size could improve the significance of the differences on average of nightly pre-planned activity-travel episodes by participants in TBCP.

Table 3. Differences on average of timing distribution of episodes pre-planned by panelists

	Participants (n = 72)					Control Group (n = 45)				
	wave 1	wave 2	wave 2- wave 1	t	Sig	wave 1	wave 2	wave 2- wave 1	t	Sig
morning	32.6%	34.4%	1.80%	1.158	0.251	33.8%	35.9%	2.04%	1.335	0.189
afternoon	31.2%	29.9%	-1.23%	-0.972	0.335	29.2%	32.5%	3.27%	2.372	0.022
evening	24.5%	25.2%	0.73%	0.632	0.529	25.0%	28.5%	3.58%	2.687	0.010
night	11.8%	10.5%	-1.30%	-1.466	0.147	12.0%	12.8%	0.81%	0.663	0.511

Differences on average of timing distribution of episodes executed by panelists considering if the participated or not in TBCP are presented in Table 3. In this case, dependent two-sample t-tests show that differences on average of timing distribution between wave 1 and wave 2 in the participants group are not significant at 95% as well. In contrast, we find one statistically significant value in the Control Group. Again, factors other than belonging to Participants or Control groups may be involved in explaining those differences.

Table 4. Differences on average of timing distribution of episodes executed by panelists.

	Participants (n = 72)					Control Group (n = 45)				
	wave 1	wave 2	wave 2- wave 1	t	Sig	wave 1	wave 2	wave 2- wave 1	t	Sig
morning	32.9%	31.9%	-1.04%	-0.851	0.398	33.0%	31.3%	-1.64%	-1.171	0.248
afternoon	29.4%	30.1%	0.71%	0.843	0.402	30.7%	29.6%	-1.15%	-1.019	0.314
evening	26.7%	26.3%	-0.39%	-0.458	0.648	24.4%	26.7%	2.29%	1.970	0.055
night	10.9%	11.7%	0.72%	0.808	0.422	11.9%	12.4%	0.50%	0.486	0.629

Obviously, other factors may influence changes in pre-planning and executing activities and travels. In particular, modifications in demographic and socioeconomic variables could lead to variations in timing decisions. After controlling for several variables, car availability and household size reveal themselves to be important in explaining pre-planned and executed timing decisions, respectively.

Differences on average of timing distribution of episodes pre-planned by panelists who did not change their car availability and considering if the participated or not in TBCP are presented in Table 4. Dependent two-sample t-tests show that differences on average of timing distribution of nightly episodes between wave 1 and wave 2 in the participants group are significant at 95%. And differences on average of timing distribution of morning episodes between wave 1 and wave 2 in participants group are significant at 90%. Similar differences in the control group are not significant at all. Therefore, it is likely that TBCP had influence on the changes observed on morning and nightly timing decisions during the activity scheduling process.

Table 5. Differences on average of timing distribution of episodes pre-planned by panelists. No change in car availability

	Participants (n = 64)					Control Group (n = 37)				
	wave 1	wave 2	wave 2 - wave 1	t	Sig	wave 1	wave 2	wave 2 - wave 1	t	Sig
morning	32.3%	35.1%	2.8%	1.742	0.086	33.7%	33.5%	-0.2%	-0.127	0.900
afternoon	31.0%	29.7%	-1.3%	-1.072	0.288	27.5%	28.4%	0.9%	0.715	0.479
evening	24.5%	25.1%	0.6%	0.445	0.658	25.8%	26.5%	0.7%	0.565	0.576
night	12.1%	10.1%	-2.0%	-2.303	0.025	13.0%	11.6%	-1.5%	-1.237	0.224

Differences on average of timing distribution of episodes executed by panelists who did not change their household size and considering if the participated or not in TBCP are presented in Table 5. In this case, dependent two-sample t-tests show that differences on average of timing distribution of afternoon episodes between wave 1 and wave 2 in the participants group are significant at 90%. Similar difference in the control group is not significant at all. Therefore, it is likely that TBCP had influence on the changes observed on afternoon timing decisions of executed activity-travel episodes.

Table 6. Differences on average of timing distribution of episodes executed by panelists. No change in household size

	Participants (n = 53)					Control Group (n = 32)				
	wave 1	wave 2	wave 2 - wave 1	t	Sig	wave 1	wave 2	wave 2 - wave 1	t	Sig
morning	33.8%	32.3%	-1.4%	-1.002	0.321	33.5%	32.2%	-1.3%	-0.771	0.447
afternoon	28.6%	30.2%	1.7%	1.886	0.065	30.0%	29.7%	-0.4%	-0.285	0.778
evening	26.6%	26.5%	-0.2%	-0.165	0.870	24.7%	26.2%	1.5%	0.999	0.326
night	11.0%	11.0%	-0.1%	-0.073	0.942	11.8%	11.9%	0.2%	0.121	0.942

Cohen's d is an appropriate effect size ratio for the comparison between two means. It indicates the standardized difference between two means, and expresses this difference in standard deviation units. If we have dependent two-samples including a control group, the ratio can be calculated according to equation (1), proposed by Morris (2008).

$$d = \left(\frac{\left(Y_{wave2}^{Participants} - Y_{wave1}^{Participants}\right) - \left(Y_{wave2}^{Control} - Y_{wave1}^{Control}\right)}{S_{wave1}} \right) \left(1 - \frac{3}{4(n_1 + n_2) - 9} \right) \quad (1)$$

Cohen (1988) defined effect sizes as "small, d = .2," "medium, d = .5," and "large, d = .8". Table 6 includes Cohen's d values calculated using equation 1 for differences on average of distributions of morning and night pre-planned episodes and afternoon executed episodes. According to Cohen's classification, the estimated size effect of TBCP on the distribution of both pre-planned morning and executed afternoon episodes is between small and medium. And the estimated size effect of TBCP on the distribution of pre-planned night episodes is small.

Table 7. Cohen's d

pre-planned		executed
morning	night	afternoon
0,3327	-0,1026	0,3710

4. Conclusions

This paper presents an exploratory analysis of the effect of Travel Behavior Change Programs (TBCP) on the individual travel behavior. Specifically, we have analyzed variations on the distribution of timing decisions when pre-planning or executing activities or travels.

To evaluate the effect of TBCP, which were based on psychological principles of persuasion, a group of participants in a two-wave activity scheduling process panel survey were selected. The rest of the panelists were included in a control group. Differences on average of timing decisions distributions were observed when comparing both survey waves considering gender, age and main occupation. More importantly, when controlling for household size or car availability, some average differences observed between participants in TBCP and the Control Group are statistically significant.

Pre-planning of morning and night activity-travel episodes are more likely to be influenced by TBCP, although this effect seems to be weaker in the case of night episodes. On the other hand, only executed afternoon episodes are likely to be changed because of TBCP. Therefore, TBCM are likely to have a higher effect on the way people pre-planned the timing of activities and travels than in their execution. People may be considering more to change their travel-related habits, but they end executing less modifications than they would like, probably because of external determinants. It would be interesting to verify the stability of the behavior changes after several years. A shortcoming of this research is the small size of the sample. Therefore, in the future it would be desirable to replicate this research using a larger number of panelists.

Having a deeper knowledge about how TBCP impact on the characteristics of activities and associated travels will improve the design and application of future actions to promote reduction of car use. Using statistical models we expect to confirm and expand the exploratory results presented in this paper. Other facets of the activity scheduling process may be influenced by TBCP, which remains to be studied in the near future.

References

Brög, W., Erl, E., ker, I., Ryle, J. and Wall, R. (2009). Evaluation of voluntary travel behavior change: experiences from three continents. *Transport Policy*, 16(6), 281-292.

Chatterjee, K. and Bonsall, P. (2009). Special Issue on Evaluation of programs promoting voluntary change in travel behavior. *Transport Policy*, 16(6), 279-280.

Cialdini, R. B. (2001). "Harnessing the science of persuasion." *Harvard Business Review*, 7915, 71-80.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Moser, G. and Bamberg, S. (2008). The effectiveness of soft transport policy measures: A critical assessment and meta-analysis of empirical evidence. *Journal of Environmental Psychology*, 28, 10–26.

Fujii, S., Bamberg, S., Friman, M. and Gärling, T. (2009). Are effects of travel feedback programs correctly assessed? *Transportmetrica*, 5(1), 43-57.

Morris, S.B. (2008). Estimating effect sizes from pretests/posttests-control group designs. *Organizational Research Methods*, 11, 364-386.

Ruiz, T. and García-Garcés, P. (2014) Measuring the impact of travel behavior change programs on the activity-travel scheduling process. *Transportation Letters*. In press.

Sloman, L., S. Cairns, C. Newson, J. Anable, A. Pridmore, and P.Goodwin (2010). *The Effects of Smarter Choice Programmes in the Sustainable Travel Towns*: Summary Report, Report to the Department for Transport, London, February.

Socialdata America (2007). *Individual Transportation Options Pilot Project*. Final Report prepared for Oregon Department of Transportation. Accessed at July 14, 2010 at http://www.oregon.gov/ODOT/PT/PROGRAMS/TRANS_OPTIONS/TRAVEL_SMART/TravelSmartMar07Rpt.pdf.