

TRAVEL FEEDBACK PROGRAMS: COMMUNICATIVE MOBILITY MANAGEMENT MEASURES FOR CHANGING TRAVEL BEHAVIOR

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Abstract: This paper reviews the literature on travel feedback programs (TFPs). These constitute soft measures, involving psychological and behavioral strategies, designed to change travel behavior, mainly, from automobile to a non-automobile travel, in Mobility Management (MM). We classified TFPs according to place, technique, procedure, and communication media. Then, we reviewed the effectiveness of ten TFPs implemented in Japan. We found that the TFPs in Japan reduced CO₂ emissions by about 19%, and car use by about 12%, while increasing the use of public transport by about 50%. The size of these effects did not differ much from those observed in Western countries including European countries and Australia. In addition, we found that TFP's effectiveness increased when participants were asked to make behavioral plans to change their travel behavior.

Key Words: travel feedback program, mobility management, sustainable transportation mode

1. INTRODUCTION

Automobile use has many negative social consequences, such as air pollution, traffic congestion, suburbanization, and a reduction in the number of railroad and bus users, which may lead, in turn, to discontinued railroad or bus services. Consequently, transportation planners in Europe, Australia, and Japan recognize the importance of changing individual travel behavior from automobile use to a sustainable transportation mode, such as buses, trains, bicycles, or walking. Mobility Management (MM) is management that offers a viable, effective transportation measure, one that is expected to solve transportation and traffic problems. MM constitutes, in the main, an attempt to change travel behavior by communication; it also aims to manage transportation and traffic systems.

The communicative measures for travel behavior modification used in MM are called "soft measures" (c.f. Jones, 2003) or "psychological and behavioral strategies" (c.f. Fujii, 2002; Taniguchi et al. 2003); they include the provision of specific information on public transport, travel campaigns, and travel education. Personalized communication is more effective for changing travel behavior than non-personalized mass communications. Examples of personalized communication include individualized marketing (Brög, 1998), travel blending (Ampt & Rooney, 1999; Rose & Ampt, 2001), personalized travel plans (Department for Transport, UK, 2004), and other personalized communication, such as that implemented in Sapporo (Taniguchi et al., 2003). Here, we refer to forms of personalized communication aimed at changing travel behavior from car use to non-auto transport (such as public transport, bicycles, or walking) as travel feedback programs (TFPs).

The travel feedback programs mentioned above differ in many ways, but they all share a common feature: the participants in each program receive information that is designed to modify behavior. Such feedback may be effective because it induces 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).

This paper reviews reported TFPs to evaluate the effectiveness of TFPs, while considering their type and the situations in which they have been implemented, to suggest determinants for increasing the effectiveness of TFPs in terms of behavioral change.

2. TYPES OF TRAVEL FEEDBACK PROGRAMS

Before reviewing examples of TFPs, we describe parameters that may be useful for classifying TFPs: (1) locations, (2) techniques for travel behavioral change, (3) procedures, and (4) communication media.

2.1 Location

TFPs can be implemented in three basic settings: schools, workplaces, and residential areas. The targets of TFPs implemented in residential areas are household members. Examples of this target type can be found in Ampt & Rooney (1999), Brög (1998), the Department of Transport, Western Australia (2000), Rose & Ampt (2001), Taniguchi et al. (2003), and the Department for Transport, UK (2004). In such cases, all daily car use behavior can constitute a target of the program.

For TFPs implemented in the workplace, the target individuals are office workers and the target behavior is commuting travel. Such TFPs can also target all car use. Examples of this type of TFP have been implemented in Toyonaka (Daito et al., 2004) and Kanazawa (Hashimoto et al., 2002), Japan.

Finally, for TFPs in schools, the target individuals include students and the students' families. Again, the target behavior is all daily car use. Commuting travel to school can also be targeted. Examples have been reported in Taniguchi et al. (2002, 2003) and Fujii and Taniguchi (2003).

In each location, the TFPs have multiple objectives. The objectives of TFPs in residential areas may be to solve transportation problems, such as traffic congestion and air pollution, in those areas, while promoting public transport. The objectives of TFPs in workplaces may be to solve similar transportation problems and, more specifically, those that arise from commuting. Likewise, the objectives of TFPs in schools may be to solve similar transportation problems near the school. Another important objective of TFPs in schools is that of education with respect to the consequences of individual travel behaviors; these consequences include environmental problems, traffic congestion, and the level of service of public transportation. Classes instructing the public in the relationship between individual travel behaviors and a number of social problems should also help to educate people about socially desirable behavior in our society (c.f. Fujii, 2003). For this reason, a "school travel plan" has been implemented for all elementary and junior high schools in England since 2004, funded by the transport and education departments (Department for Transport, UK, 2004).

2.2 Techniques for Changing Travel Behavior

TFPs use many techniques to change travel behavior. These techniques differ in three main ways, according to the following questions:

- a) Do they motivate travel behavior change?
- b) Do they request a plan for changing travel behavior?
- c) Do they provide individualized information?

With respect to motivation, Individualized Marketing is a TFP without motivation support (Brög, 1998), while Travel Blending includes motivation support (Ampt & Rooney, 1999; Rose & Ampt, 2001). In an Individualized Marketing program, participants were asked whether they intended to change their travel behavior, but they received no messages aimed at motivating them to change their behavior. Participants who intended to change their behavior were then asked what kind of information was necessary in order to prompt a behavior change. This type of TFP program was implemented in Bristol and London, in the UK, in 2002 (Department for Transport, UK, 2004). By contrast, participants in a Travel Blending program received a booklet that described why an individual's travel behavior was important. This booklet was written to motivate participants to change their travel behaviors. In addition, they received another booklet that described how they could change their travel behavior. A TFP implemented in Sapporo, Japan, is an example of a program that supports motivation in this way.

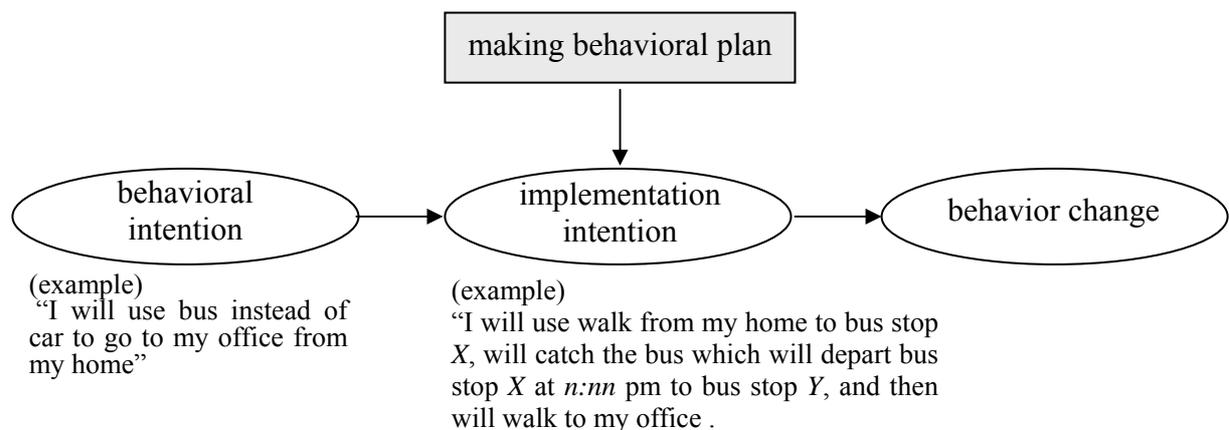


Figure 1. A Social Psychological Theory of Behavior Change Process and an Effect of Making a Behavioral Plan

A TFP that involves planning includes a request that participants make plans with a view to changing their travel behavior. Fujii and Taniguchi (2003) proposed a TFP that asked participants to make a behavioral plan for changing their travel behavior; this has been implemented in Hyogo Prefecture (Doi et al. 2003), Neyagawa (Matsumura et al., 2003), and Obihiro (Taniguchi et al., 2005), Japan. A social psychological study of how behavioral intentions are actually implemented indicated that requesting a behavioral plan has a strong effect on actual behavioral change (Fujii, in press; Fujii and Taniguchi, 2003; Gärling & Fujii, 2002; Gollwitzer & Brandstätter1997). Figure 1 shows the social psychological theory of process of behavioral change (Fujii, in press; Gärling & Fujii, 2002). As can be seen in this figure, behavioral intention is actually implemented only when implementation intention (Gollwitzer & Brandstätter1997) is formed. A behavioral intention (or goal intention)

specifies a behavior to which people commit themselves; an implementation intention, however, entails a plan for when, where and how to implement the target behavior. Because implementation intention is formed as a result of making a behavioral plan, requesting a behavioral plan has a strong effect on actual behavioral change. For example, Fujii and Taniguchi (2003) showed that the behavior-changing effect of a TFP with a behavioral plan was significantly greater than that of a TFP without a behavioral plan.

Finally, does the TFP provide individualized information? For example, both Travel Blending and Individualized Marketing provide individualized information. In a Travel Blending program (Ampt & Rooney, 1999; Rose & Ampt, 2001), participants received individualized advice deemed helpful for changing travel behavior. These comments were based on a 1-week travel diary data provided by the participants. The TFPs reported in Fujii and Taniguchi (2003), Hashimoto et al. (2002), Matsumura et al. (2003), and Taniguchi et al. (2002, 2003) provided similar individualized information to participants. In an Individualized Marketing program (Brög, 1998), the participants received information that they had requested previously. A similar procedure was adopted in TFPs in the UK (Department for Transport, 2004).

By contrast, in a simple TFP implemented in Obihiro, Japan, the participants received non-individualized information on how to use a bus service, and were requested to make a behavioral plan on how to use the bus (Taniguchi et al., 2005). Although an important characteristic of a TFP is that it usually provides individualized information, this is not always necessary if the TFP includes an intervention requesting that participants make a behavioral plan. A TFP without individualized information actually had a strong effect (i.e., an ca. 100% increase in the frequency of bus use; see Taniguchi et al., 2005). Still, even in a TFP requesting a behavioral plan, individualized information is preferable.

2.3 Procedure

The procedures differ across TFPs. For example, Individualized Marketing involves two or three contacts:

- 1) to conduct a simple survey on behavior and the intention to change behavior,
- 2) to provide individualized information, and
- 3) to provide further individualized information if necessary (Brög, 1998).

Travel Blending involves four contacts (Ampt & Rooney, 1999; Rose & Ampt, 2001):

- 1) to provide information to motivate a behavior change and conduct a travel diary survey,
- 2) to provide individualized comments,
- 3) to conduct a travel diary survey, and
- 4) to provide additional individualized comments.

In the TFP reported in Fujii and Taniguchi (2003), there were four contacts:

- 1) to conduct a questionnaire survey about travel behavior,
- 2) to request a behavioral plan on how to change travel behavior,
- 3) to conduct a simple survey on travel behavior, and
- 4) to provide individualized information about the travel behavior change measured by means of two surveys.

In the TFP implemented in Hyogo Prefecture (Doi et al. 2003), some participants were contacted twice:

- 1) to conduct a questionnaire survey about travel behavior, and
- 2) to request a behavioral plan on how to change travel behavior.

The simplest TFP includes a single step. In TFPs in Obihiro (Taniguchi et al., 2005) and Suita (Matsumura, 2004), Japan, participants received a single questionnaire and non-individualized information. The questionnaire included questions requesting participants to make a behavioral plan on how to change their travel behavior.

2.4 Communication Media

Forms of communication in TFPs include face-to-face communication, regular mail, telephone, and e-mail. For example, in Individualized Marketing (Brög, 1998), the first contact is usually via telephone, and communicators visit the target households for the second contact. For the TFP implemented in Hyogo Prefecture (Doi et al. 2003), all communication was effected through mail. In a TFP implemented in workplaces in Toyonaka (Daito et al. 2004), the first contact involved face-to-face communication in a group briefing, and subsequent communication was via e-mail and an Internet web site.

3. EFFECTIVENESS OF TFPs

To investigate the determinants of the effectiveness of TFPs, we focused on Japanese cases, as it was preferable to investigate the effects of different types of TFPs on travel behavior using cases from one country, thus avoiding problems caused by cultural differences that arise between different countries. Tables 1, 2, and 3 summarize the types and effectiveness of reported TFPs for residential areas, workplaces, and schools, respectively (Hashimoto et al., 2002; Taniguchi et al., 2002, 2003, 2005; Fujii and Taniguchi, 2003; Matsumura et al., 2003; Daito et al., 2004; Doi et al., 2004; Matsumura, 2004). The tables summarize the city and year, main objective, techniques, procedure, communication media, effect, and existence of a control group for each TFP. The effectiveness of the TFP was reported in different ways: some programs report a reduction in car use distance or CO₂ emissions; others report increased use of public transport. These differences were due to differences in the main objectives of the TFPs. Note that only some of the studies included a control group.

3.1 Effects of TFPs on CO₂ Emissions and Car Use

Changes in travel behavior reduced CO₂ emissions by 15 to 35% for studies in Sapporo, Ebetsu, Osaka, and Izumi. The most effective reduction, about 35%, occurred in Sapporo in 2002 (Fujii and Taniguchi, 2003). This reduction rate occurred in a group of participants requested to make a behavioral plan. Similar results occurred for a group in Osaka who received individualized information based on a 7-day travel diary (Matsumura et al., 2003). One TFP, without planning, produced no CO₂ reduction (Fujii and Taniguchi, 2003), although the authors argued that, since there was no control group, the TFP might have mitigated a possible increase in CO₂ emissions. Including this case, the simple average effectiveness of TFPs in reducing CO₂ emissions arising from travel behavior was 19% (SD = 12%). The example of Sapporo (2002) showed that requesting a behavioral plan had a significant effect in reducing CO₂ emissions (35% vs. no reduction for TFPs with and without a behavioral plan, respectively).

Matsumura et al. (2003) reported that the CO2 reduction arising from a TFP with individualized information based on a travel diary survey differed, according to whether 1- or 7-day travel diary surveys were used (20% vs. 35%, respectively). This implies that individualized comments based on more travel data were more effective with respect to travel behavior modification. Nevertheless, a 1-day travel diary was sufficient to reduce CO2 emissions.

Table 1. Summary of Residential Area TFPs Implemented in Japan

City (year)	Target	Main objective	Techniques	Procedure and communication media	Effect	Control group
1 Sapporo and Ebetsu (2000)	ca. 200 HHs	CO2 reduction	a) motivation b) no plan c) provide individualized information	1) travel diary survey with leaflet for motivation (mail) 2) provide personalized comments (mail) 3) travel diary survey (mail) 4) provide personalized comments (mail)	ca. 15% reduction in CO2	no
2 Osaka (2001)	ca. 100 HHs	reduce car use	a) motivation b) no plan c) provide individualized information	1) travel diary survey with leaflet for motivation (mail) 2) provide personalized comments (mail) 3) travel diary survey (mail) 4) provide personalized comments (mail)	ca. 35% reduction in CO2 (with 1-week travel diary), and ca. 20% reduction in CO2 (with 1-day travel diary)	yes
3 Suita (2002)	ca. 500 persons	promote PT	a) no motivation b) plan c) provide non-individualized information	1) provide non-personalized information on bus use with or without requesting a behavioral plan on how to use PT (mail)	bus use frequency increase: - 0% for frequent bus users - ca. 25% for non-bus users no behavioral plan, - ca. 60% for non-bus users with a behavioral plan, - ca. 50% for new residents no behavioral plan - ca. 90% for new residents with a beha	no
4 Kawanishi /Inagawa (2003)	ca. 700 persons	reduce car use and promote PT	a) motivation b) plan c) provide individualized information	1) questionnaire survey (mail) 2) request a behavioral plan on how to change travel behavior with personalized information on PT use (mail) 3) repeat first questionnaire survey (mail) 4) provide personalized comments (mail)	ca. 15% reduction in car use (2 steps, for PT users), ca. 25% reduction in car use (4 steps, for PT users), ca. 40% reduction in car use (4 steps and incentives to use PT, for non-PT users) [the average reduction in car use was ca. 25%]	yes
5 Obhiro (2003)	ca. 15,000 HHs	promote PT	a) no motivation b) plan c) provide non-individualized information	1) request behavioral plan on how to use PT with non-personalized information on bus use mail)	ca. 100% increase in bus use	yes

¹ Taniguchi et al. (2003); ² Matsumura et al. (2003), ³ Matsumura (2004), ⁴ Doi et al. (2004), ⁵ Taniguchi et al. (2005)
HHs: households, PT: public transport.

Table 2. Summary of Workplace TFPs Implemented in Japan

City (year)	Target	Main objective	Techniques	Procedure and communication media	Effect	Control group
1 Kanazawa (2001)	ca. 50 HHs (100 persons) working in 10 companies	reduce car use	a) motivation b) no plan c) provide personalized information	1) travel diary survey with leaflet for motivation (mail, by hand) 2) provide personalized comments (mail, by hand) 3) travel diary survey (mail, by hand) 4) provide personalized comments (mail, by hand)	ca. 30% increase in bus use, ca. 50% increase in bicycle use, and no reduction in car use.	no
2 Toyonaka (2003)	100 workers in a company	reduce car use	a) motivation b) plan c) provide non-personalized information	1) questionnaire survey (e-mail) 2) request a behavioral plan on to change travel behavior (e-mail)	ca. 10 % reduction in car use	no

¹ Hashimoto (2002); ² Daito *et al.* (2004)
PT: public transport.

Table 3. Summary of School TFPs Implemented in Japan

City (year)	Target	Main objective	Techniques	Procedure and communication media	Effect	Control group
1 Sapporo	150 school students (5th grade) in an elementary school in Sapporo and their families.	CO2 reduction and environmental education	a) motivation b) no plan c) provide individualized information	1) travel survey with a class for motivation (in class) 2) provide personalized comments (in class) 3) travel diary survey (in class) 4) provide personalized comments (in class)	ca. 15% reduction of CO2	no
2 Sapporo	130 school students (5th grade) in an elementary school in Sapporo and their families.	CO2 reduction and environmental education	a) motivation b) no plan c) provide individualized information	1) travel survey with a class for motivation (in class) 2) provide personalized comments or request a behavioral plan (in class) 3) travel diary survey (in class) 4) provide personalized comments (in class)	ca. 35% reduction in CO2 with a behavioral plan, no reduction without a behavioral plan.	no
3 Izumi	200 school students (5th grade) in two elementary schools in Izumi and their families.	CO2 reduction and environmental education	a) motivation b) no plan c) provide individualized information	1) travel survey with a class for motivation (in class) 2) request behavioral plan (in class) 3) travel diary survey (in class) 4) provide personalized comments (in class)	ca. 15% reduction of CO2	no

¹ Taniguchi *et al.* (2002, 2003); ² Fujii and Taniguchi (2003); ³ Kinki Transport Agency (2004)
HHs: households, PT: public transport.

Three cases report car use reduction: Kawanishi/Inagawa, Kanazawa, and Osaka. The least effective was for Kanazawa (Hashimoto *et al.*, 2002), although there was no control group, as with Sapporo. The greatest effect was found in Kawanishi/Inagawa; car use decreased by about 25% as a result of the TFP, which requested that participants make a behavioral plan (Doi *et al.* 2004). The simple average car use reduction in these three cases was 12% (SD = 13).

3.2 EFFECT ON NON-AUTO TRANSPORT USE

Increased public transport use was reported for Suita, Kanazawa, and Obihiro, and averaged 51% (SD = 36%). While the main objective of the study in Kanazawa was to reduce car use, the main objective of the other studies was to promote public transport. The TFPs in the latter two studies produced a considerable increase in public transport use. The greatest increase was in Obihiro, and was about 100%. In this case, the TFP included a request to make a behavioral plan on how to use public transport.

Matsumura (2004) found that two factors influenced the effectiveness of the TFP for Suita: whether the residents were new or old (43% vs. 70% increase in public transport use, respectively), and whether the TFP included a behavioral plan (38% without a behavioral plan vs. 75% with a plan). The TFP was more effective when it targeted new residents and requested that participants make a behavioral plan on how to use public transport.

4. CONCLUSION

This paper reviews the literature on Japanese travel feedback programs (TFP), i.e., soft measures or use of psychological and behavioral strategies for the purpose of changing travel behavior from automobile to non-automobile use.

4.1 Overall Effectiveness

We classified TFPs by location, technique, procedure, and communication media. Of ten TFPs implemented in Japan, CO₂ emissions were reduced by about 19%, car use was reduced by about 12%, and public transport use increased by about 50%. These effects are similar to those reported in European and Australian cases (Ampt & Rooney, 1999; Brög, 1998; Department for Transport, UK, 2004; Jones, 2003; Rose & Ampt, 2001)

4.2 Importance of Requesting a Behavioral Plan

Although there have not been enough TFP cases in Japan to thoroughly consider all of the factors that determine the effectiveness of TFPs, our review implies that requesting a behavioral plan is a determinant of the effectiveness of a TFP. TFPs with a behavioral plan yielded the largest CO₂ reduction (35% reduction in Sapporo; Fujii and Taniguchi, 2003), the largest reduction in car use (25% reduction in Kawanishi/Inagawa; Doi et al., 2004), and the largest increase in public transport use (100% increase in Obihiro; Taniguchi et al., 2005).

The least effective TFP with a behavioral plan was in Toyonaka; Daito et al. (2003) reported that car use was only reduced by about 10%. This TFP differed from others with a behavioral plan in that the TFP for Toyonaka used only e-mail and a web page. Internet communication may influence participants' travel behavior less.

4.3 Quality of Information Provided

The quality of information provided to participants was an important factor determining the effectiveness of a TFP. Actually, Matsumura (2004) found that individualized information based on a 7-day travel diary was more effective than that based on a 1-day travel diary. This suggests that high-quality information is more effective than low-quality information in establishing behavioral change.

However, the effect of the difference between non-individualized and individualized information is not clear in our analysis, because only two TFPs provided non-individualized

information (Obihiro in 2003; Suita in 2002), and in both cases the main objective was to promote bus use. Therefore, it is difficult to isolate the effect of individualized information. Note that these two TFPs were very effective (100% increase in bus use in Obihiro and 25-90% increase in Suita). From a cognitive psychological perspective, individualized information should be more effective, since the cognitive cost (c.f. Gärling et al., 2001) of searching for information that is helpful in promoting a behavioral change is minimized. The data for Obihiro and Suita indicate that although individualized information helped with the behavior change, it is not always necessary for a behavior change.

4.4 Concluding Remarks

Given that we only reviewed ten TFPs, we cannot determine all the important determinants of the effectiveness of TFPs. Nevertheless, we found that if a TFP included the intervention of asking participants to make a behavioral plan in their travel behavior, the TFP's effectiveness in terms of behavior change significantly increased.

More importantly, we found that TFPs are effective soft measures for promoting travel behavior change in a non-Western country, i.e., Japan. Furthermore, the size of the effect in Japan did not differ from those found in Western countries. Transportation soft measures based on communication programs, such as TFPs, appear to be effective not only in Western countries, but also for in other cultures. To demonstrate the effectiveness of transportation soft measures, we need to examine more case studies, worldwide.

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