CrossMark

Lessons learned from a personalized travel planning (PTP) research program to reduce car dependence

Italo Meloni[1] · Benedetta Sanjust di Teulada[1] ·
Erika Spissu[1]

Abstract Voluntary travel behavior change programs have been implemented worldwide since the late 1990s at a personal and community level. Most of the now completed programs were commissioned by local authorities to commercial firms, in an attempt to reduce private car use. In this context, the evaluation and review of the reliability of these policy measures have been at the core of most of the debates and studies in this field. In this paper, we describe the lessons learned from a research program funded by the Sardinian Government (Italy), aimed at testing a soft transport policy measure for reducing car dependence. In particular, the work reviews in detail the methodological approach and participants' feedback on a personalized travel plan (PTP). After implementation of the soft measure, the PTP participants were divided into two groups depending on whether they had reduced car use or not, and separate analyses were conducted to highlight the factors underlying different behavior change decisions. General conclusions regarding the effectiveness of the PTP are beyond the scope of the present study.

Keywords Voluntary travel behavior change · Personalized travel plans · Quantitative feedback

---

✉ Italo Meloni
  imeloni@unica.it

  Benedetta Sanjust di Teulada
  b.sanjust@gmail.com

  Erika Spissu
  espissu@unica.it

[1] CRiMM - Center of Research on Mobility Models, University of Cagliari, Via San Giorgio 12, 09124 Cagliari, Italy

Introduction

Breaking the daily routine associated with personal car use demands a greater effort than most people are prepared to make. Daily car use behavior is usually automatically triggered over time (habit) and less by deliberate decision-making, as the choice has already been made by past experience (Kahneman 2011). Researchers of human behavior sciences agree that providing on-hand information about other alternatives could be more effective than expecting drivers to find better solutions on their own (ESRC 2008).

Worldwide, the transport sector is responsible for 22.5 % of global CO_2 emissions (25 % in Europe-27) (IEA 2013). In particular, in Europe-27, road vehicles (private cars and heavy vehicles) account for 94 % of total emissions (840 m t of CO_2 of the 891.5 m t of CO_2 produced by transport) (IEA 2013).

A new culture for urban mobility is needed in order to deliver integrated and sustainable transport planning (European Commission 2011). The challenge is to devise appropriate strategies that provide effective alternatives to the car and that entice drivers to adopt more responsible mobility styles. Indeed, people need assistance to make better judgments and better decisions (Kahneman 2011) and in some cases policy and institutions can provide that help (Thaler and Sunstein 2008; Ampt 2003).

In this context, the so-called soft transport policy measures (Gärling and Fujii 2009; Loukopoulos 2007) can play an important role. Also named "voluntary travel behavior change—VTBC programs", soft measures are informational campaigns designed to motivate and educate individuals to voluntarily change their travel behavior to more sustainable transport modes (Cairns et al. 2008; Moser and Bamberg 2008; Fujii and Taniguchi 2006; Taylor and Ampt 2003). VTBCs use information and communication to act on the different cognitive and motivational factors influencing people's travel choices. As reported by various studies, the benefits of soft measures rely on a broad range of impacts, in particular, lower total investments and longer-term effects compared to hard measures contribute to make VTBC programs highly cost-effective (Richter et al. 2011; Brög et al. 2009; Loukopoulos 2007). The cost-effectiveness of soft measures is also improved as the scale of implementation is increased (Parker et al. 2007).

The provision of information makes individuals aware of their car-free alternatives (Lyons 2006), revealing the true impedance of different travel choices. Often, people are not fully aware of either unchosen or chosen trip attributes (Schwanen and Lucas 2011; Gaker and Walker 2011), especially in terms of time and cost. Car drivers generally have a distorted perception of the characteristics of car-free alternatives. For example, they tend to overestimate travel time by public transport (Fujii et al. 2001). The same can be said for the quantification of the external costs of private car use (social costs such as congestion and accidents for instance), particularly the negative environmental externalities (damage and pollution) (Arnott and Small 1994; Parry et al. 2007).

However, empirical evidence has shown that a mere increase in knowledge through information provision alone might be insufficient to promote sustainable behavior (Hines et al. 1987; Hornik et al. 1995; Chorus et al. 2006; Adger et al. 2009). In this regard, social psychology and social marketing research on pro-environmental behavior (Thøgersen 2014) have shown that specific persuasion techniques can help to achieve behavior change. Seethaler and Rose (2006) were the first to use specific persuasion techniques in a VTBC program (TravelSmart project) underpinning the positive effect, especially during the recruitment phase (Taylor 2007).

In this paper, we present the results of a research program involving the design and implementation of a voluntary travel behavior change program (and in particular of personalized travel planning, PTP) to reduce car dependence in Sardinia (Italy). The project, funded by the Sardinian Government (Italy), aimed to explore a soft policy measure that integrates persuasion techniques into the information approach. In particular, the objective of the research program was to focus on the participants' perspective of the measure, step by step, identifying the most appropriate ways to intercept and involve them and to analyze the implications of personal and societal factors on behavior change. As PTP can be considered a relatively new transport strategy tool, there are a number of barriers to its effective and successful implementation and development, such as general skepticism over the validity and acceptance by policy makers, concerning the potential shift to sustainable modes (Parker et al. 2007).

In particular, this work reviews in detail the methodological approach (targeting and selection, PTPs definition, meeting the participants), and the lessons learned in terms of responses, unobserved unwillingness to change, motivators for change and participants' perception of persuasion techniques applied, including the corresponding implications on travel behavior change. To this end, the PTP participants were divided into two groups depending on whether, at the end of the program, they had reduced car use or not. Separate analyses were conducted to highlight the factors underlying the different behavior change decisions. General conclusions regarding the effectiveness of the PTP were beyond the scope of the present study.

The proposed PTP was implemented in Sardinia (Italy), from February 2011 to June 2012, offering personalized information about the negative effects of daily car use and the benefits of an existing sustainable mode. The 109 participants involved in the research program were selected among car drivers along the most congested corridor in Sardinia, between Cagliari and Quartu Sant'Elena (first and third most populated cities respectively), where a competitive but underutilized light rail had been operating along the same corridor for about 2 years. In addition, only those drivers available for a continuous two-week observation of their activity-travel patterns, and for a number of face-to face interviews at different stages of the project, were included in the project.

The rest of the paper is organized as follows. The next section reviews the literature on personalized travel behavior change programs and persuasion techniques for enhancing their effectiveness. "Methodology" section describes the methodology employed in terms of conceptual and operational framework of the overall approach. "The application" section describes the application details, while "Lessons learned" section presents the lessons learned from the PTP program implementation. Lastly, "Conclusions" section presents the conclusions.

Literature review

Under various names and forms, VTBC programs have been implemented, mainly at a personal and community level (mass communication), in different countries, especially in Australia, UK, Japan, Germany, and Austria (Richter et al. 2011). As opposed to mass communication, personal-level VTBC programs, defined as PTP, aim to provide individuals with tailored travel-related information based specifically on their daily needs, observed through activity-travel data collection. The importance of using a personalized approach lies in recognizing the potential for greater efficacy in travel behavior change with respect to mass communication, also because this type of communication cannot be

easily disregarded by the car-user (Gärling and Fujii 2009). A detailed review of different PTP approaches is beyond the scope of this work. However the interested reader may find the most representative examples of PTP in Bróg (1998) (IndiMark), Rose and Ampt (2001) and Taylor and Ampt (2003) (Travel Blending), Fujii and Taniguchi (2006) (Travel Feedback Programs), Halden (2008) (Personal Journey Plans), Parker et al. (2007) (Personal Travel Planning), Bróg et al. (2009) (TravelSmart) and Friman et al. (2013) (PTP in Sweden).

All the PTPs mentioned above are based on three main groups of behavioral theories and methods: to (1) *Models of behavior* TPB Theory of Planned Behaviour (Ajzen 1991), NAM norm activation model (Schwartz 1977), VBN value-belief-norm (Stern 2000), TIB Theory of interpersonal behaviour (Triandis 1977), theories re-elaborated in the transportation field by Bamberg and Schmidt (2003), Bamberg et al. (2007), Bamberg and Moser (2007), Gärling and Fujii (2009); (2) *Theories of change* TTM transtheoretical model (Prochaska and DiClemente 1982; Prochaska and Velicer 1997), SRT Self-regulated Theories (Carver and Scheier 1998), implementation intention (Gollwitzer 1999), theories re-elaborated and integrated with models of behavior in the transportation field by Bamberg et al. (2011), Bamberg (2012; 2013), and (3) *Social marketing and persuasion techniques* (Defra 2008; Cialdini 2001).

Models of behavior identify the underlying factors of specific choice events or a specific behavior, as opposed to theories of change that attempt to detect how behavior changes over time and in a stepwise manner. In this perspective the second approach is more pragmatic because it aims to promote and encourage behavior change. Despite these differences, there are many overlaps between the two bodies of theories and they can be considered complementary; understanding both is necessary in order to develop effective approaches to behavior change (Darnton 2008). In addition to these theories, a number of policy measures have been implemented by Governments to incentivize a change in travel behavior towards existing sustainable alternatives. Social marketing is often used to involve the community in behavior change programs, in particular to achieve relevant social objectives in terms of health (Gardner and Stern 1996) environment (Defra 2008) and transport (Cairns et al. 2008).

On the other hand, persuasion techniques aim at helping people to overcome the external and internal barriers to change and in particular the habitual nature of car use (Seethaler and Rose 2003). Indeed, it has been empirically demonstrated that simply raising people's awareness through marketing campaigns alone is insufficient to promote sustainable behavior (Hines et al. 1987; Hornik et al. 1995; Adger et al. 2009; Chorus et al. 2006). Without participatory involvement, information campaigns by themselves may not produce the desired effects (McKenzie and Moor 2002). Recently, behavioral economists have emphasized the need to include persuasion techniques in VTBC programs aimed at changing individual travel behavior (Avineri 2009, 2012; Metcalfe and Dolan 2012; Dolan et al. 2012; Bamberg 2014), in an attempt to raise awareness about the importance of the negative impact of private vehicle use, such as emissions and climate change, and to break down barriers and facilitate appropriate behavior.

In this context, social marketing techniques for pro-environmental behavior adopted in VTBC programs usually rely on six specific persuasion techniques regularly used as "heuristic rules" to help people to decide whether or not to yield to a request (Groves et al. 1992; Cialdini 1993; McKenzie-Moor et al. 1999; Cialdini 2001; Booth-Butterfield 2002). Persuasion principles (Cialdini 2001) are particularly useful where there is little personal involvement as in daily travel decisions, where information is processed routinely and effortlessly. These six principles include: (1) *Reciprocation*: an incentive, given

unconditionally, leaves participants with the perception of having been asked a genuine favor. The reciprocation principle actually combines two norms: the obligation to receive, that is non-refusal of a gift, and the obligation to return a favor; (2) *Commitment and consistency*: if the participants take on an initial commitment, it will guide their subsequent actions. People try to be, or at least to appear to be *consistent* with their public and reciprocative *commitments*; (3) *Social proof*: choosing peer groups for the program increases the willingness to participate. In fact individuals are influenced by what other people are doing; (4) *Liking*: people are strongly influenced by those conveying the message and increasingly inclined to yield to a request from someone they like, so materials should be designed and presented in an attractive fashion; (5) *Authority*: when making a decision, it is common to seek expert advice from an acknowledged source; (6) *Scarcity*: the principle of scarcity reflects the fact that as opportunities become scarcer, they are perceived as more valuable.

Methodology

The conceptual framework of the PTP presented in this work is founded on various models of behavior and theories of change reported in the literature review section, and in particular to the theories re-elaborated and integrated into the transportation field (Bamberg et al. 2011; Bamberg 2012, 2013). On the other hand, the operational framework strictly follow the six persuasion principles (Cialdini 2001; Seethaler and Rose 2003, 2006; Meloni et al. 2011).

The overall methodological approach involved three steps (1) targeting and selection of participants, (2) promotion of behavior change, and (3) evaluation and monitoring of behavior change (see Fig. 1).

The targeted and selected participants were identified by exploring the travel habits of current light rail users (survey called "Who uses Metrocagliari?") and of car drivers along the same corridor (survey "What are your travel habits?"). This initial step was crucial to the success of the project, as it allowed the different corridor users to be identified in accordance with the alternative promoted (current users of the light rail or not), and the target audience (car drivers as prospective users) to be intercepted, as suggested in Davies (2012), Steg and Vlek (2009), Avineri (2009), Parker et al. (2007) and Anable (2005).

The promotion of behavior change involved three sub-phases, including three face to face meetings with participants. During the first sub-phase (1 week), activity-travel data reflecting current travel habits were collected using an active logger delivered to the participants during the first meeting (the Activity Locator, AL). Then during the second sub-phase, a PTP was created and delivered to each participant as a tailored pamphlet (second face to face meeting). Ultimately, participants were invited to follow the personalized suggestions, and a second round of Activity Locator data collection supported the observation of post-measure behavior (third sub-phase). The promotion of behavior change phase places the emphasis on a personalized approach, through real-time observation of activity-travel behavior before and after implementation of the strategy using technological tools and the type of information provided, as recommended by Stopher (2005) and Taniguchi et al. (2003).

During participant targeting and selection and during the first face to face meeting, the levers activated by the program have a direct influence on the psychological, motivational and situational factors that characterize behavior (attitudes, preferences, awareness, social norms, moral obligation, perceived behavior control, habits, in line with the theories), in addition to those elements of the choice context (alternatives, services, infrastructure). What is activated at this stage is intended to trigger the intention to achieve new and
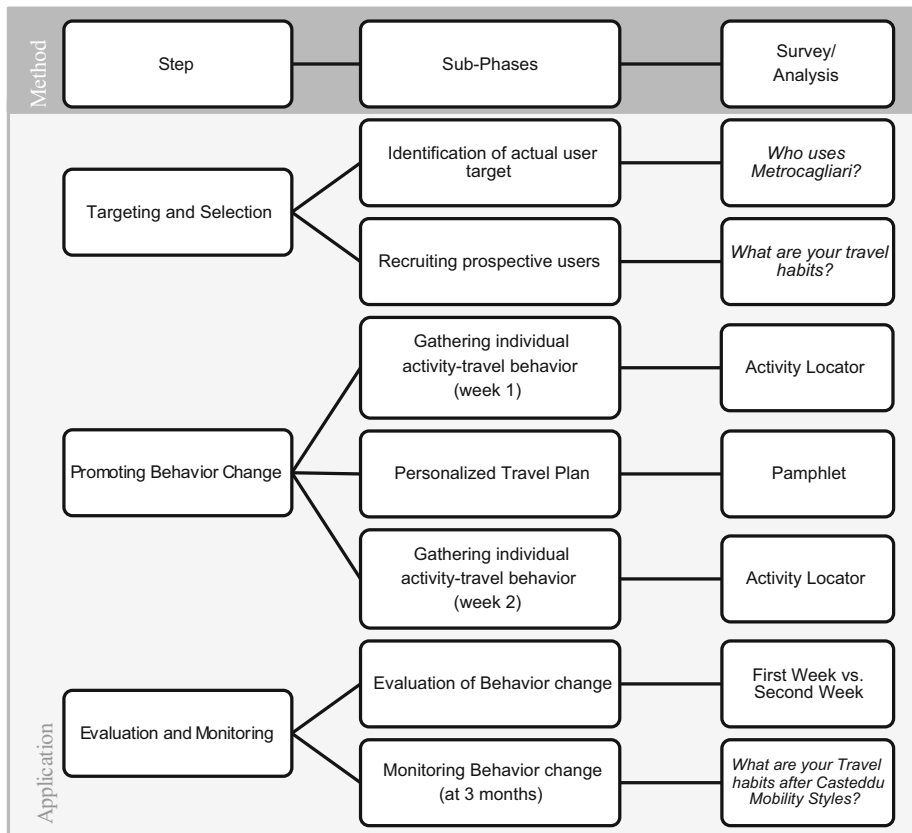
Fig. 1 The VTBC methodological framework

different objectives and in particular to actively participate in the VTBC program (Bamberg 2012, 2013).

Evaluating travel behavior change consisted in identifying any changes between pre and post-PTP sub-phases, as a dynamic evolutionary process (real time continuous observation of activity-travel patterns) rather than as a static event (aggregated mode shares before and after policy), in line with traditional VTBC programs evaluation methods. At the end of the program participants were requested, in the third one-on-one meeting, to give their impressions about the program, and state whether they intended to change their travel behavior in the weeks to come.

The monitoring phase aimed to track behavior change after completion of the program (Parker et al. 2007), and to accompany the dynamic process of change. This phase also served as a strengthening action (as IndiMark). Monitoring was performed 3 months after the end of the program through a web survey. Determining the right time lapse for the post-survey is not a simple task. Indeed the interval should be long enough to allow behavior change to stabilize, but not too long so as to avoid radical changes in the choice context (cost or availability of alternative options).

Regarding the operational aspects, which are based on the six persuasion principles (Cialdini 2001), the *Reciprocation* principle (1) was applied by lending smartphones to participants for data collection that included an all-inclusive weekly phone plan for surfing

the internet, as well as through free gifts (a bag and other gadgets). *Commitment* and *consistency* (2) were integrated involving participants in the data collection, informing them of the importance of pro-environmental behavior and providing them with a personalized plan that involved personal benefits. Thus, former car users, who had voluntarily changed their travel behavior switching to the light rail, were recruited as participants in the program, as an application of the *Social Proof* principle of persuasion (3). Indeed, the experience of car drivers who had actually switched to the light rail reduced prospective light rail users' uncertainty about travel mode options. The *Liking* principle (4) was taken into account presenting the promotional campaign with a general positive attitude while handing out a kit to each participant with a fashionable bag, a smartphone, and gadgets, etc. In addition, the chance to use a latest generation smartphone with an innovative easy-to-use technological data collection method, less demanding than compiling a paper diary, was also part of the liking principle. The whole project was managed by the University of Cagliari and a face to face meeting between participants and the head of department was planned before starting the survey (principle of *Authority* (5)). Finally, the quantitative feedback provided in the PTP showed the real personal costs of current behavior (travel time, travel cost and CO_2 emitted) (principle of *Scarcity* (6)).

The application

The program proposed in this work, named Casteddu mobility styles (CMS), was conducted by the University of Cagliari (Italy) between February 2011 and June 2012, in the attempt to satisfy a request by the Sardinian Government to explore a soft transport policy measure for reducing car dependence in Cagliari (*Casteddu* is the old name for Cagliari, capital of the Sardinia region) (Sanjust et al. 2015).

One of the fundamental features of this specific travel behavior change program is to promote a mode of transport that can compete with the private car (Friman et al. 2012). To this end, a well-defined study context was identified in the most congested corridor in Sardinia (7 km, traveled during a typical workday in around 25 min), which connects Cagliari (the island's first most populated city) to six other towns in the suburbs, including Quartu Sant'Elena (third most populated city), with 150,000 round trips/day. This area is of particular interest as a short light railway "Metrocagliari" went into operation in 2008, connecting the corridor in less than 18 min. At the time, only 5000 passengers/day used the light rail, about 75 % below its capacity. This context offered the opportunity for promoting the use of an existing sustainable mode and therefore for reducing the amount of car trips along the corridor. The 6.4 km long light railway has 9 stops and free parking areas at 5 stations for a total of 700 parking places. The characteristics of the high frequency light rail make it a convenient and reliable means of transportation compared to the private car. Indeed, one of the stations is located in an area in the city center with a very high concentration of work and discretionary activities, where car users not only waste a considerable amount of time looking for a parking space (up to 40 min), but it is also costly as no free parking is available in the area (between 1.00 and 1.20 € per hour)

Targeting and selection

The identification of the target and recruiting of participants for the VTBC program (first step in Fig. 1) involved two surveys: among current (*"Who uses Metrocagliari?"*) and

potential ("*What are your travel habits?*") light rail users. Both surveys– though at different levels—were accompanied by a broader promotional campaign using traditional mass communication tools, including press conferences, web, media, social network and a dedicated website (see Sanjust et al. 2015 for the promotional campaign material)[1] .

The objective of the first survey was mainly to profile different types of light rail users and identify any former car users who had already switched to this mode. To achieve this goal, researchers from the University of Cagliari intercepted light rail users onboard over a period of 2 months, inviting them to participate in a survey for determining their main characteristics (socio-economic characteristics, attitudes, travel experience, past travel choice before the light rail came into operation). In total, 1250 postcards containing a link to a web-survey were delivered. Among the different users, an interesting group for the purpose of this study emerged from analysis of the questionnaires: "Convinced park and riders (P&Rs)" who despite owning their own car, preferred to use Metrocagliari on a daily basis. Considering the above and the fact that it would not be necessary to give up the car completely, the park-and-ride characteristics were used to profile *prospective* park and riders (PP&Rs): car owner/drivers, who could conveniently (total travel time car + light rail shorter or equal to total travel time by car + parking time) reach work/study or discretionary locations traveling by car to the station car park, and then taking the light rail to the final destination.

A dedicated promotional campaign then launched a second web survey "*What are your travel habits?*", using direct and simple messages drawn from those aspects that motivated current P&Rs to reduce car use. In this second survey the promotional campaign was more articulated and made greater use of web-based tools to intercept car-users (car-users along a corridor were in fact more difficult to intercept compared to light rail users) (see Sanjust et al. 2015 for details about "*Who uses Metrocagliari?*" and "*What are your travel habits?*"). All the people depicted in the message had smiling faces, to help build a sense of *liking* (see Sanjust et al. 2015 for the promotional campaign material). Also in this second survey a total of 1250 postcards containing a link to a web survey were handed out to as many car drivers.

At the end of the first step 86 PP&Rs were recruited for the personalized promotion of behavior change[2]. 23 P&Rs were also included in the analysis as comparison group (persuasion by social proof). All participants were informed of the experimental nature of the project, therefore they were prepared to undertake additional effort, such as continuous monitoring in real time of activity-travel patterns, various face-to-face interviews at different stages of the project. The 109 participants were then involved in a group created ad hoc on facebook, thus creating a network between current and prospective light rail users.

The PTP

As reported in previous studies (Stopher 2005), the high variability involved in daily activity-travel patterns—and especially in the context of soft transport policy measures—can be captured using advanced tools such as GPS-based devices and collecting data over repeated observations (i.e. 1 week).

---

[1] Each respondent had the chance to win a prize in a lottery (one IPhone 4 and 10 100euro gift cards).

[2] Along with 86 PP&Rs involved in the PTP, 44 individuals were selected from the respondents to "*What are your travel habits?*" with the same daily travel pattern characteristics as the selected PP&Rs, but for the entire duration of the project they were only involved in the general marketing campaign.

The device used in this study for daily activity-travel data collection, the Activity Locator—AL- (Meloni et al. 2011; Meloni and Sanjust 2014), is an active logger—smart phone with built-in GPS and activity diary application ("Gathering individual activity-travel behavior week 1, week 2" sub-phase in Fig. 1).[3]

Each of the 109 participants received the Activity Locator in a one-on-one- meeting with a mobility advisor (a young university researcher) and was provided with a kit (smartphone, bag, battery charger, all-inclusive weekly phone plan for surfing the internet, and gadgets; *reciprocation*). The mobility advisor explained the objectives of the project promoted by the University of Cagliari, instructed participants how to use the AL and agreed when they were to be contacted.

In the first week, data on existing activity-travel behavior were collected and used to analyze and determine actual travel attributes and then to design the PTPs.

The design of the PTP involved: (1) analysis of actual individual information and activity travel behavior, (2) devising alternative travel scenarios and simulation of the PTP to be proposed with feedback. In particular, the feedback included weekly time spent driving, money spent, CO_2 emitted, and calories burned [4] (factors underlying the current P&Rs decision to reduce car use).

Firstly, personal information contained in the survey questionnaires, information gathered through contacts with tutors and one-week activity-travel data (Activity Locator), were analyzed. In particular spatial analysis implemented on a GIS platform in conjunction with activity based analysis were used to determine a series of attributes and obtain feedback about the current trip (*observed Feedback*) useful, together with other observations, for identifying a set of tours for each participant that could have been conveniently traveled by light rail (prospective P&Rs). Secondly, for each tour identified, the alternative scenarios (including light rail use) were identified (for a detailed review of the design of PTP see Sanjust et al. 2015).[5] Each scenario was simulated to obtain new travel attributes and new feedback (*simulated feedback*) to be included in the PTP. Finally, the comparison between car mode and park and ride mode led to the definition of a *quantitative comparative feedback*.

Each PTP was presented and delivered to the participants in a pocket-size pamphlet during a meeting with the mobility advisor. The tutor, after analyzing with each participant his/her activity-travel pattern observed through the AL (in terms of travel time, travel cost, etc.), presented a personalized alternative (with no obligation) for adopting sustainable behavior using the light rail in park-and-ride mode, explaining the prospective travel behavior (time spent driving to the LR stop, travel time with the light rail, walking time to destination, fare, etc.).

In the second week, after provision of the PTP, activity-travel patterns were monitored with the Activity Locator to detect any behavior changes. The change in travel behavior encouraged by the proposed PTP program was evaluated at the end of the survey (first sub-phase, see Fig. 1) and 3 months after the end of the program (second sub-phase). The first sub-phase was carried out by (1) comparing the behavior detected in the first (before PTP provision) and second week (after PTP provision), in terms of distance traveled and

---

[3] A review of the differences between active and passive data collection, in terms of quality of data can be found in Meloni and Sanjust 2014.

[4] In this study, walking at 5 km/h allows to burn 3.30 kcal/min (Passmore and Durnin 1955).

[5] Note that the PTP was created for both PP&Rs and P&Rs, though for the latter the PTP was intended only to support the decision already made to use the Metro, showing a comparison between current and past (car use) travel behavior.

number of trips made by car as driver and by light rail, and by (2) a final face to face meeting between each participant and the mobility advisor, at the end of the second week. In this meeting each prospective park and rider stated his/her intention to change travel behavior, i.e. whether he/she had actually changed in the second week (had started to use the light rail), was willing to change in the weeks to come or had decided not to change at all. In addition, after completion of the program, for the monitoring phase (second sub-phase in Fig. 1), a third survey called "*What are your travel habits after Casteddu Mobility Styles?*" was conducted. In order to avoid the risk of receiving socially-acceptable responses, participants were required to complete an anonymous web-survey. The questionnaire was designed such that the participants could re-call the answers given in previous surveys, and then change them relatively to the current frequency of light rail use (nothing has changed, I use the Metro more, I use the Metro less), with the corresponding motivations.[6]

Meet the participants

During the program, each participant was involved in three face to face meetings with the mobility tutor. In general, the three meetings aimed to actively involve participants in the program trying to make them more aware of their role in achieving its objectives, for themselves and for the community. The meetings also served to emphasize some of the persuasive principles used in the program, to reinforce the message and to stimulate the commitment to change behavior.

Lessons learned

Response

Table 1 shows the response rates for the targeting and selection phase. The high response and participation rates are testimony to the success of the promotional campaigns on board the light rail (targeting) and in different parts of the corridor (selection). The personal contact between the research team and the light rail users, the individual invitation to participate in the program, the possibility of contributing to a more livable city, and ultimately also the chance to win a prize in a lottery, are all factors that contributed to the overall 49 % final participation rate. In addition, to intercept a representative sample—including those with no access to the Internet—users were offered the option of completing the survey on board with paper questionnaires (especially elderly riders). *This result highlights the importance of personal involvement and the value of being recognized as an individual in policy measures of this type (1*st *lesson).*

Table 2 shows the average feedback presented to 86 PP&Rs (first block), and to 23 P&Rs (second block). In particular, the feedback concerned: (1) current behavior (*observed* feedback, i.e. car mode for PP&Rs and park and ride mode for current P&Rs), (2) alternative behavior (*simulated* feedback, i.e. park and ride mode for PP&Rs and car mode for current P&Rs), and (3) their comparison (*comparative* feedback, i.e. the difference between park and ride and car mode).

---

[6] 44 individuals intercepted with the first survey, but not involved in the PTP program, were asked to respond to the monitoring survey in order to identify differences in behavior change due to a mass communication approach rather than a personalized approach.

Table 1 Targeting and selection response rates

	Targeting who uses MetroCagliari?	Selection what are your travel habits?	All
Intercepted (postcards only)	1250	1250	2500
Filled in surveys (surveys/postcards)	692 (55 %)	1579 (131 %)	2271 (90 %)
Complete (complete/filled in)	576 (83 %)	1094 (69 %)	1670 (74 %)
Targeted (targeted/complete)	98 (17 %)	507 (46 %)	605 (36 %)
Invited (invited/targeted)	59 (60 %)	176 (35 %)	235 (39 %)
Final participants (final/invited)	23 (39 %)	86 (49 %)	109 (46 %)

On the one hand, the prospective benefits to be gained from the switch to park and ride mode for PP&Rs seem to confirm the success of the recruitment sub-phase in intercepting actual potential users who were not able to identify by themselves the light rail as an alternative. The less significant annual savings for PP&Rs (last three rows of each block) compared to P&Rs is primarily due to having simulated for them only a small number of light rail trips. On the other hand, the comparative feedback shows greater reductions for the park and riders (first four rows of each block), who had in fact already decided to give up using the car when the light rail came into service. *This result suggests that the extent of the benefits may be an important trigger for an autonomous behavior change (2nd lesson).*

With regard to the evaluation phase, during the second week, 30 % of the prospective P&Rs switched from car-only to park-and ride mode (26 out of 86 individuals). Three months after the conclusion of the pilot test, the survey "*What are your travel habits after Casteddu Mobility Style?*" indicated an increase in individual behavior change. In particular, 36 % of the PP&R subsample had decided to change their travel behavior (31 individuals), whereas the remainder had not.[7] The large percentage of participants who had changed their travel behavior is not surprising considering the high participation rate achieved as a result of the successful targeting and selection phase. Therefore, *the initial selection of those commuters eligible to use the promoted alternative mode is crucial to the success of the program (3rd lesson learned).*

Unobserved unwillingness to change

Table 3 shows the average quantitative feedback after PTP provision for the sub-groups of prospective P&Rs namely those who had changed during the second week, those who did not intend to change and those willing to change in the weeks to come.

The results obtained in terms of behavior change seem to confirm that generally the greater the benefits the greater the propensity to change (comparison between individuals who decided to switch to park-and ride mode—first block- and participants who stated their intention to change in the weeks to come- third block). In this regard, some participants stated: $< …I$ *am willing to change if there are benefits to be gained.. >*, $< …nowadays, with the crisis the economic aspect is of major relevance >$, $< …until now I had not considered the damage in terms of the environment >$.

---

[7] Regarding the 44 individuals, the monitoring survey "*What are you travel habits after Casteddu Mobility Styles?*" assessed the behavior change of those who had stated their actual behavior in "*What are your travel habits?*". These individuals were intercepted by the mass communication approach and had received general information about Metrocagliari through the web site. Three months after the "What are your travel habits?" survey, of the 44 participants in the post survey 9 % had changed their travel behavior.

Table 2 Quantitative feedback presented in the PTP

	Car-only mode[a]	Park and ride mode[b]	Comparative	
			diff.	%
Prospective P&R (86 individuals)				
Weekly travel time by car (h:min)	2:30	1:05	−1:25	−57
Weekly travel cost (car use, car insurance cost[c] and metro) (Euros)	25.7	15.5	−10.2	−40
Weekly CO_2 emitted (kg)	9.6	5.3	−4.3	−45
Weekly calories consumed (Cal)	115.7	157.6	+41.9	+36
Annual savings with park and ride (Euros)	–	–	534	–
Annual savings with park and ride and car pooling (Euros)	–	–	835	–
Annual CO_2 reduction with park and ride (kg)	–	–	227	–
P&Rs (23 individuals)				
Weekly travel time by car (h:min)	4:11	1:50	−2:21	−56
Weekly travel cost (car use, car insurance cost and metro) (euro)	45.2	21.1	−24.1	−53
Weekly CO_2 emitted (kg)	13.1	6.5	−6.6	−50
Weekly calories consumed (Cal)	150.7	280.8	+130.1	+86
Annual savings with park and ride (Euros)	–	–	1,256	–
Annual savings with park and ride and car pooling (Euros)	–	–	1,647	–
Annual CO_2 reduction with park and ride (kg)	–	–	345	–

[a] Simulated for current park and riders and observed during the first week for current car users as driver

[b] Simulated for current car users as driver (prospective park and riders) and observed during the first week for current Park and Riders

[c] The car insurance cost per km has been drawn from the official Italian car usage website www.aci.it (in Italian)

On the other hand the results in Table 3 also indicate the presence of an unwillingness to change even when the suggested alternative is very advantageous (8 individuals who decided not to change their travel behavior would have received practically similar benefits as the 26 individuals who did). In this regard, some participants stated: < *I have not changed despite a saving of more than 1,000 euro per year, I like to drive my car and don't want to give it up* > and < *I have little confidence in Cagliari's public transport system (bus)* >, which as expected confirms how drivers very loyal to their cars may not be an appropriate target for this type of policy measure. *Therefore, future PTPs and models of behavior change need to include the existence of unobserved factors that reduce the individual utility to change, such as for example the above mentioned loyalty to cars* (4th lesson).

Motivators for change

Individuals who had switched to park-and ride mode indicated "reduced stress from driving in heavy traffic and searching for a parking place" (94 %), "the positive effects on the environment" (87 %), "time savings" (70 %) and "monetary savings" (65 %) as the most relevant reasons for switching. Further, they indicated also that "the objective of Casteddu Mobility Styles" was important for the decision to change (90 %). Conversely, those who decided not to change their travel behavior indicated the following reasons for continuing to use the private car: personal travel patterns poorly suited to light rail route

Table 3 Quantitative feedback after PTP provision (only PP&R)

	Car mode[a]	Park and ride mode[b]	Comparative	
			Diff.	%
PP&R who changed (26 individuals)				
Weekly travel time by car (h:min)	2:49	1:08	−1:40	−59
Weekly travel cost (car use, car insurance cost and metro) (Euros)	29.5	16.6	−12.9	−44
Weekly CO_2 emitted (kg)	10.9	5.4	−5.6	−50
Weekly calories consumed (Cal)	89.8	189.8	100	111
Annual savings with park and ride (Euros)	–	–	672	–
Annual savings with park and ride and car pooling (Euros)	–	–	989	–
Annual CO_2 reduction with park and ride (kg)	–	–	286	–
PP&R who showed no interest in changing (8 individuals)				
Weekly travel time by car (h:min)	3:07	1:05	−2:02	−65
Weekly travel cost (car use, car insurance cost and metro) (euro)	28.1	15.2	12.9	−46
Weekly CO_2 emitted (kg)	9.5	4.5	−5	−53
Weekly calories consumed (Cal)	87.8	173.8	86	98
Annual savings with park and ride (Euros)	–	–	673	–
Annual savings with park and ride and car pooling (Euros)	–	–	948	–
Annual CO_2 reduction with park and ride (kg)	–	–	260	–
PP&R who will change in the weeks to come (52 individuals)				
Weekly travel time by car (h:min)	2:14	1:02	−1:12	−53
Weekly travel cost (car use, car insurance cost and metro) (euro)	23.5	14.9	−8.6	−36
Weekly CO_2 emitted (kg)	9.0	5.3	−3.7	−41
Weekly calories consumed (Cal)	132.9	139.1	6.2	5
Annual savings with park and ride (Euros)	–	–	444	–
Annual savings with park and ride and car pooling (Euros)	–	–	742	–
Annual CO_2 reduction with park and ride (kg)	–	–	193	–

[a] Observed during the first week

[b] Simulated and presented in the PTP

(92 %), long distance of train station parking facilities from their home (71 %), no perception of issues related to driving and parking their cars in the city center (50 %). Note also that all the activity-travel patterns selected were very similar to each other, therefore this result further confirms the existence of unobserved driver characteristics that affect behavior change.

Lastly, the personalization of the process, in terms of data collection (use of Activity Locator) and the relationship with the tutor was evaluated positively by the participants. Concerning the effort required, 61 % of participants stated that the system was not cumbersome. Further, 75 % stated that the technology was easy to use from the beginning. All participants (100 %) stated that the daily interaction with the supervisor was not a problem.

Participants' perception of persuasion techniques applied

Although it is difficult to isolate the effects of persuasion principles from those obtained by other activities, participants' feedback on the reasons for taking part in the program can

provide a good indication of the impact of the persuasion principles. It can be said that a program that includes features for triggering persuasive mechanisms is more likely to be effective in drawing attention to the possibility of changing travel behavior. In this regard, during the third face to face meeting, the participants indicated: < *I was pleased to get involved in a university research project and to give my personal contribution* > or < *I heard about the project in an academic conference and I felt it was important to participate* > (Authority).

Regarding the material provided, the participants appreciated < *the graphics of the website, that attracted my attention to the project* > < *postcards and posters with well chosen graphics* > and < *a young staff* > and < *the slogans used* > (Liking).

The presence of 23 actual park and riders in the sample seems to have worked as a social proof. In this regard, some participants stated: < *their positive experience made me rethink my travel choice* >.

In regard to other persuasion principles, some participants stated < *The information provided is clear and I am now aware of aspects that I ignored, such as CO2 emissions* > (*Reciprocation, Liking*) < *Now I know where to park my car and take the light rail* >, < *..before taking part in the program I did not know about the light rail service, but now I am aware there is an alternative for my trips* >, (*commitment*), < *It's unbelievable how much I can save with a small change* >, < *Making a choice requires a feedback on prospective results* > (*consistency and scarcity*).

Conclusions

This paper concerns the lessons learned from a research program, funded by the Sardinian Government (Italy) to explore a soft transport policy measure for reducing car dependence. In particular, the work describes in detail the methodological approach, and participants' feedback on a PTP. The conceptual framework of the PTP presented in this work is founded on various models of behavior and theories of change reported in the literature review, while the operational framework follows the six persuasion principles.

The main results indicate high participation rates when targeting and selection involve a certain degree of personalization. In particular the participants appreciate being considered indispensable for the project.

The exhaustive analysis of travel behavior relative to the travel alternative to be promoted ("*Who uses Metrocagliari?*"), made it possible to target certain behavior (park-and-ride), to recognize the motivational factors to be used for promoting behavior change and to intercept car-users who might be interested in an advantageous alternative ("*What are your travel habits?*"). This is an important aspect because it enables one to channel all efforts towards drivers who are more likely to change their travel behavior. It also suggests, for the large scale implementation, the need to preliminarily ascertain that prospective participants are at least slightly motivated, as otherwise they are unlikely to change their behavior (Fogg 2009, Bamberg et al. 2011, Bamberg 2012; 2014, Noblet et al. 2014).

Second, it appears that major benefits from changing travel behavior are more likely to encourage the switch to alternative modes. People will choose to change of their own free will if the benefits are very substantial. However, less significant benefits can still evoke a behavior change if they are highlighted by appropriate persuasion techniques.

Third, the study indicates the presence of an unwillingness to change even when the suggested alternative is very advantageous. This result highlights the presence of

unobserved effects underlying behavior change decisions. This aspect warrants further investigation both in terms of empirical research and model formulation.

Lastly, communication and personal contact between the team and participants is not perceived as intrusive, but rather a demonstration of the attention paid to getting to know participants better by analyzing their behavior so as to tailor the travel alternative to their specific needs.

Although this work did not intend to draw general conclusions about the efficacy of the PTP, the large percentage of participants who actually changed their travel behavior (36 %) is not surprising. It is in fact in line with the high participation rate, achieved in the targeting and selection phase, as the selection undeniably enabled us to intercept commuters with greater propensity to use the alternative mode being promoted. Clearly, we cannot claim that an efficient selection actually prevails over the effectiveness of the PTP itself, but the two certainly complement each other, in the sense that selecting the target audience was a necessary (as we were able to recommend a beneficial alternative) but not sufficient condition to achieve a change in behavior. It is rather difficult to determine to what extent each phase contributes to the program but undoubtedly segmenting the sample, as reported in numerous studies (Davies 2012) is a major key to the success of the program.

Thus, the effect of mass communication carried out throughout the duration of the program (15 months) emerged to some extent from a survey conducted by the public transport agency (independently of the Casteddu Mobility Styles program), during 2013 (one year after the program), which revealed that the number of light rail passengers had increased by 30 %. Since no improvements or promotional activities had been undertaken in the meantime by the PT agency, this result can be considered to be at least in part a consequence of the campaign proposed in this work. Further, although it is not possible to isolate the effects of persuasion principles from those obtained with other activities, participants' feedback seems to confirm that a program that includes features for triggering persuasive mechanisms is more likely to be effective in drawing attention to the possibility of changing travel behavior.

The effect of providing feedback and the PTP in general on behavior change was also evaluated by means of model estimation. Models showed how the information provided during the PTP program is significant in increasing the utility of the proposed alternative and in stimulating a change in behavior (Meloni et al. (2013) and highlighted how the individual context (socioeconomic characteristics, time use, and attitudes etc.) might alter the propensity to change (Sanjust et al. 2014).

Further developments of this work will involve extending the research program to explore the effects and implications of a PTP for promoting the entire range of active modes and public transport in the City of Cagliari.

References

Adger, W.N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D.R., Wreford, A.: Are there social limits to adaptation to climate change? Clim. Change **93**(3–4), 335–354 (2009)

Ajzen, I.: The theory of planned behavior. Organ. Behav. Hum. Decis. Process. **50**(2), 179–211 (1991)

Ampt, E.: Voluntary Household Travel Behaviour Change—Theory and Practice. Paper presented at the 10th International Association of Travel Behaviour Research Conference, Lucerne, Switzerland, 10–15 August (2003)

Anable, J.: 'Complacent car addicts' or 'aspiring environmentalists'? Identifying travel behaviour segments using attitude theory. Transp. Policy **12**(1), 65–78 (2005)

Arnott, R., Small, K.: The economics of traffic congestion. Am. Sci. **82**(5), 446–455 (1994)

Avineri, E.: Changing travel behaviour: lessons from 'behavioural economics'. *Transportation Professional*, 28–29 (2009)

Avineri, E.: On the use and potential of behavioural economics from the perspective of transport and climate change. J. Transp. Geogr. **24**, 512–521 (2012)

Bamberg, S.: Process of Change. In: Steg, L., Van Den Berg, A., De Groot, J. (eds.) Environment of Psychology. BPS Bleckwell, West Sussex (2012)

Bamberg, S.: Applying the stage model of self-regulated behavioral change in a car use reduction intervention. J. Environ. Psychol. **33**(68–75) Elsevier (2013)

Bamberg, S.: Psychological contributions to the development of car use reduction interventions. Handbook of Sustainable Travel, pp. 131–149. Springer, Berlin (2014)

Bamberg, S., Fujii, S., Friman, M., Gärling, T.: Behaviour theory and soft transport policy measures. Transp. Policy **18**(1), 228–235 (2011)

Bamberg, S., Hunecke, M., Blobaum, A.: Social context, morality, and the use of public transportation: results from two field studies. J. Environ. al Psychol. **27**, 190–203 (2007)

Bamberg, S., Möser, G.: Twenty years after Hines, Hungerford, and Tomera: a new meta-analysis of psycho-social determinants of pro-environmental behaviour. J. Environ Psychol. **27**(1), 14–25 (2007)

Bamberg, S., Schmidt, P.: Incentives, morality or habit? Predicting students car use for university routes with the models of Ajzen, Schwartz and Triandis. Environ. Behav. **35**, 264–285 (2003)

Booth-Butterfield, S.: Steve's Primer on Practical Influence. Booth-Butterfield, S (2002)

Brög, W.: Individualised marketing: Implications for TDM. In CD-ROM of the proceedings of the *77th Annual Meeting of Transportation Research Board*, Washington DC (1998)

Brög, W., Erl, E., Ker, I., Ryle, J., Wall, R.: Evaluation of voluntary travel behaviour change: experiences from three continents. Transp. Policy **16**(6), 281–292 (2009)

Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A., Goodwin, P.: Smarter choices: assessing the potential to achieve traffic reduction using 'soft measures'. Transport Reviews **28**(5), 593–618 (2008)

Carver, C.S., Scheier, M.F.: On the Self-Regulation of Behavior. Cambridge University Press, New York (1998)

Chorus, C.G., Molin, E.J., Van Wee, B.: Travel information as an instrument to change car-drivers' travel choices: a literature review. Eur. J. Transp. Infrastruct. Res. **6**(4), 335–364 (2006)

Cialdini, R.B.: Influence: Science and Practice. Harper Collins, New York (1993)

Cialdini, R.B.: Harnessing the science of persuasion. Harv. Bus. Rev. **7915**, 71–80 (2001)

Darnton, A.: Reference report: an overview of behaviour change models and their uses. Government Social Research Behaviour Change Knowledge Review, UK (2008)

Davies, N.: What are the ingredients of successful travel behavioural change campaigns? Transp. Policy **24**, 19–29 (2012)

Defra, A.: Framework for ProEnvironmental Behaviours. Department for Environment, Food and Rural Affairs, London (2008)

Dolan, P., Hallsworth, M., Halpern, D., King, D., Metcalfe, R., Vlaev, I.: Influencing behaviour: the mindspace way. J. Econ. Psychol. **33**(1), 264–277 (2012)

ESRC (2008) Human Behaviour to moving people more intelligently. Economic & Social Research Council. http://www.esrc.ac.uk/ESRCInfoCentre/Images/ESRC_PP_tran_systems_final_tcm6-29551.pdf

European Commission.: Roadmap to a Single European Transport Area—Towards a competitive and resource efficient transport system. In White Paper, European Commission, Brussels (2011)

Fogg, B.J.: A behavior model for persuasive design. In Proceedings of the 4th international Conference on Persuasive Technology (p. 40). ACM (2009)

Friman, M., Pedersen, T., Gärling, T.: Feasibility of Voluntary Reduction of Private Car Use. Technical paper, Karlstad University Studies, (2012) 2012:30. http://www.diva-portal.org/smash/get/diva2:530114/FULLTEXT02

Friman, M., Larhult, L., Gärling, T.: An analysis of soft transport policy measures implemented in Sweden to reduce private car use. Transportation **40**(1), 109–129 (2013)

Fujii, S., Gärling, T., Kitamura, R.: Changes in driver's perceptions and use of public transport during a freeway closure: effects of temporary structural change on cooperation in a real-life social dilemma. Environ. Behav., Sage Publ. Tucson **33**(6), 796–808 (2001)

Fujii, S., Taniguchi, A.: Determinants of the effectiveness of travel feedback programs—a review of communicative mobility management measures for changing travel behaviour in Japan. Transp. Policy **13**(5), 339–348 (2006)

Gaker, D., Walker, J.L.: Insights on Car-Use Behaviors from Behavioral Economics. Auto Motives: Understanding Car Use Behaviours, 107–120 (2011)

Gardner, G.T., Stern, P.C.: Environmental Problems and Human Behavior. Allyn and Bacon, Boston (1996)

Gärling, T., Fujii, S.: Travel behavior modification: theories, methods, and programs. In *The expanding sphere of travel behavior research*. Selected paper from the 11th International Conference on Travel Behaviour Research. Edited by Kitamura R, Yoshi T, Yamamoto, T, 97–128. Emerald Group Publishing, New York (2009)

Gollwitzer, P.M.: Implementation intentions: strong effects of simple plans. Am. Psychol. **54**(7), 493 (1999)

Groves, R.M., Cialdini, R.B., Couper, M.P.: Understanding the decision to participate in a survey. Public Opin. Q. **56**(4), 475–495 (1992)

Halden, D.: Personal Journey Plans—Raising the Benchmark in Travel Information and Provision. DHC, Edinburgh (2008)

Hines, J.M., Hungerford, H.R., Tomera, A.N.: Analysis and synthesis of research on responsible environmental behavior: a meta-analysis. J. Environ. Educ. **18**(2), 1–8 (1987)

Hornik, J., Cherian, J., Madansky, M., Narayana, C.: Determinants of recycling behavior: a synthesis of research results. J. Soc.-Econ. **24**(1), 105–127 (1995)

IEA (2013) CO2 EMISSIONS FROM FUEL COMBUSTION HIGHLIGHTS. www.iea.org/statistics/topics/co2emissions

Kahneman, D.: Thinking, Fast and Slow. Farrar, Straus and Giroux (2011)

Loukopoulos, P.: A classification of travel demand management measures. In: Gärling, T., Steg, L. (eds.) Threats to the Quality of Urban Life from Car Traffic: Problems, Causes, and Solutions, pp. 275–311. Elsevier, Amsterdam (2007)

Lyons, G.: The role of information in decision-making with regard to travel. In *Intelligent Transport Systems, IEE Proceedings 153, (3)*, pp. 199–212). IET (2006)

McKenzie-Moor, D.: *Guide to community-based social marketing*. McKenzie-Mohr (2002)

McKenzie-Moor, D., Smith, W.: Fostering sustainable behavior: An introduction to community-based social marketing. New Society Publishers, GabriolaIslands, B.C. (1999)

Meloni, I., Sanjust, B., Sottile, E., Cherchi, E.: Propensity for voluntary travel behavior changes: an experimental analysis. Procedia-Soc. Behav. Sci. **87**, 31–43 (2013)

Meloni, I., Spissu, E., Bhat, C.R.: The effect of personal cap-and-trade mileage policies on individual activity-travel patterns. The Activity Locator project. Transp. Lett. **3**, 293–307 (2011)

Meloni I., Sanjust di Teulada. B.: Using a GPS Active Logger to Implement Travel Behaviour Change Programs. In: Soora, R., Harry, T. (eds.) Mobile Technologies for Activity-Travel Data Collection & Analysis. pp. 325–340. IGI Global (2014)

Metcalfe, R., Dolan, P.: Behavioural economics and its implications for transport. J. Transp. Geogr. **24**, 503–511 (2012)

Moser, G., Bamberg, S.: The effectiveness of soft transport policy measures: a critical assessment and meta-analysis of empirical evidence. J. Environ. Psychol. **28**, 10–26 (2008)

Noblet, C.L., Thøgersen, J., Teisl, M.F.: Who attempts to drive less in New England? Transp. Res. Part F **23**, 69–80 (2014)

Parker, J., Harris, L., Chatterjee, K., Armitage, R., Cleary Stevens Consulting, Goodwin P.: *Making Personal Travel Planning Work*. Research Report, Department for Transport, dft.gov.uk (2007)

Parry, I., Harrington, W., Walls, M.: Automobile externalities and policies. J. Econ. Lit **45**(2), 373–400 (2007)

Passmore, R., Durnin, J.: Human energy expenditure. Physiol. Rev. **35**(4), 801–840 (1955)

Prochaska, J., DiClemente, C.: Transtheoretical therapy: toward a more integrative model of change. Psychotherapy **19**(3), 276–288 (1982)

Prochaska, J., Velicer, W.: The transtheoretical model of health behavior change. Am. J. Health Promot. **12**(1), 38–48 (1997)

Richter, J., Friman, M., Gärling, T.: Soft transport policy measures: gaps knowledge. Int. J. Sustain. Transp. **5**(4), 199–215 (2011)

Rose, G., Ampt, E.: Travel blending: an Australian travel awareness initiative. Transp. Res. Part D **6**, 95–110 (2001)

Sanjust, B., Bhat, C.R., Meloni, I.: Modeling the Propensity to Use a Sustainable Mode in the Context of a Voluntary Travel Behavior Change Program. Paper presented at the *93rd Transportation Research Board*. Washington D.C. (2014)

Sanjust, B., Meloni, I., Spissu, E.: An impact assessment of a travel behavior change program: a case study of a light rail service in Cagliari, Italy. Case Stud. Transp. Policy **1**(3), 12–22 (2015)

Schwanen, T., Lucas, K.: Understanding auto motives. In: Lucas, K., Blumenberg, E., Weinberger, R. (eds.) Auto Motives: understanding Car Use Behaviours. Emerald, Bradford (2011)

Schwartz, S.H.: Normative influences on altruism. In: Berkowitz, L. (ed.) Advances in Experimental Social Psychology 10, pp. 221–279. Academic Press, New York (1977)

Seethaler, R., Rose, G.: Application of psychological principles to promote travel behaviour change. Paper presented at the 26th *Australasian Transport Research Forum ATRF*, 1–3 October 2003, Wellington NZ (2003)

Seethaler, R., Rose, G.: Using the six principles of persuasion to promote travel behaviour change: findings of a TravelSmart pilot test. Road Transp. Res. **15**(2), 94–106 (2006)

Steg, L., Vlek, C.: Encouraging pro-environmental behaviour: an integrative review and research agenda. J. Environ. Psychol. **29**, 309–317 (2009)

Stern, P.C.: New environmental theories: toward a coherent theory of environmentally significant behavior. J. Soc. Issues **56**(3), 407–424 (2000)

Stopher, P.: Voluntary travel behaviour change. In: Button, K.J., Hensher, D.A. (eds.) Handbook of Transport Strategy, Policy and Institutions, vol. 6. Elsevier, New York (2005)

Taniguchi, A., Hara, F., Takano, S.E., Kagaya, S.I., Fujii, S.: Psychological and behavioral effects of travel feedback program for travel behavior modification. Transp. Res. Rec. **1839**(1), 182–190 (2003)

Taylor, M., Ampt, E.: Travelling smarter down under: policies for voluntary travel behaviour change in Australia. Transp. Policy **10**(3), 165–177 (2003)

Taylor, M.A.: Voluntary travel behavior change programs in Australia: the carrot rather than the stick in travel demand management. Int. J. Sustain. Transp. **1**(3), 173–192 (2007)

Thaler, R.H., Sunstein, C.R.: Nudge. Yale University Press, New Haven (2008)

Thøgersen, J.: Social marketing in travel demand management. In: Gärling, T., Ettema, D., Friman, M. (eds.) Handbook of Sustainable Travel, pp. 113–129. Springer, Berlin (2014)

Triandis, H.C.: Interpersonal Behaviour. Brooks/Cole Publishing Company, Monterey, CA (1977)

Italo Meloni Professor in Transport Planning at the Department of Civil & Environmental Engineering and Architecture, University of Cagliari, Italy. He is currently also director of CRiMM, the University centre for research on transport and mobility issues. His current research interests lies chiefly in promoting changes in travel behaviour for achieving more sustainable mobility, as well as in activity based and discrete choice modelling for travel demand forecasting.

Benedetta Sanjust di Teulada Ph.D. She is Research Assistant at University of Cagliari, Italy. From July 2010 to present collaborates with the Center of Research of Mobility Models (CRiMM) in Activity-Travel survey, Activity Based analysis, Demand Transportation models. Research activity mainly focuses on sustainable mobility policies and behavioural models.

Erika Spissu Civil and environmental engineer, Ph.D. in Transport Technique and Economics, over 10 years of academic and professional experience in travel behavior and modeling gained in Italy and in the United States. Her most recent work experience has been on toll roads, Market Research and truck route behavior.