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Measuring soft measures within a stated preference survey: the effect of pollution and traffic stress on mode choice

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Abstract

The objective of this research is to study the extent to which information on pollution and individual stress has on the choice to shift from private car to Park and Ride. A Stated Preference experiment was built where the reduction of CO_2 and stress are attributes of the experimental design. Results showed that the utility to Park and Ride increases with the level of awareness, 2) the more individuals consider receiving information about stress useful, the more they tend to behave sustainably, 3) aspects associated with stress appear to have a greater influence on travel choice than environmental aspects.

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Keywords: Soft measures; Behaviour; Stated Preference; Traffic Stress; Images; Latent variables.

1. Introduction

Several actions and measures have been developed in an attempt to mitigate the harmful emissions produced by the transport sector and in particular by road traffic. These mostly refer to vehicle technology (greater efficiency in terms of both consumption and production of polluting emissions), type of fuel (bio-fuel, hydrogen, and electricity), economic tools and institutional controls (pricing policies, incentives, taxes, *etc*.), and information and communication technologies. Although powerful, these measures have not proven sufficient to solve the problem (Schwanen *et al*., 2011).

Thus, in recent years, research has increasingly focused the attention on measures and policies that affect individuals' behaviour and in particular what motivates their decisions. Information provision is the most common

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measure used to promote behaviour change (Abrahamse and Matthies, 2012): "A person who has an attitude that suggests that it would be consistent for him or her to use the car less cannot bring about behaviour change if that person does not know how to change" (Ampt, 2003). It has been observed that measures that increase individual awareness can produce enduring changes, as a result of mindful decisions. This forms the basis of the concept of "soft measures", also referred to as "Voluntary Travel Behaviour Change" (VTBC) programmes (Ampt, 2003) or "Smarter Choices" (Cairns *et al*., 2004), *i.e*. programmes aimed at motivating the voluntary reduction of car use. The underpinning assumption is that people ignore what environmental problems their travel behaviour produces, or they are unaware of what they could do to conserve the environment (Schultz, 2002). VTBC programmes thus typically provide information about: a) the negative (mainly environmental) effects of current behaviour and b) how individuals can change their current behaviour to mitigate its negative effects.

Under various names and forms VTBC programmes have been implemented mainly at a personal or community level (such as mass communication), especially in Australia, UK, Japan, Germany, and Austria among others (Ritcher *et al*., 2011). The advantage of using a personalised approach (the so called "Personalised Travel Planning" (PTP)) instead of mass communication lies in the fact that tailored information directed to each single individual cannot be easily disregarded by the car-user (Gärling and Fujii, 2009). Personalisation is the most effective means of reducing or eliminating barriers to obtaining information and of promoting behaviour change (Gärling and Fujii, 2009). The greater the level of customisation of a PTP programme (and the longer the data-collection period), the more effective it will be.

IndiMark (TravelSmart) and Travel Blending are two well-known examples of PTP approaches. Both target individuals and households and are based on providing information on how to travel in a more sustainable way, reducing car use (Bonsall *et al*., 2007). IndiMark is a social marketing approach aimed at improving knowledge of the transport system. It is an "individualised" programme because it addresses individuals, but not quite "customised" (Stopher, 2005) inasmuch as participants are only asked if they are interested in reducing car use and they are then provided with a package of general information. This allows the programme to be implemented on a large scale. In the first TravelSmart implemented in 2000 in South Perth, Australia, more than 15,300 households were contacted and around 6,000 participated. After this, other projects were conducted in various parts of the world including Australia, Sweden, Germany, UK, USA. The Travel Blending approach instead aims to reduce the number of car journeys providing individuals with specific suggestions that consist of a mix or a "blend" of their travel choices based on their activity patterns. Therefore it is an individual customised programme. Since the Travel Blending approach provides quantitative feedback tailored to each individual's trips, the scale is much smaller than in the Travel Smart programmes. The studies carried out in Australia (Rose and Ampt, 2001; Richter *et al*., 2011) with 1,000 households, are the largest. Studies conducted in Japan (Taniguchi *et al*., 2003; Fujii and Taniguchi, 2005) on similar programmes use samples of around 200 households, while those carried out in Nottingham and Leeds are based on a sample of approximately 100 households. Lastly the study conducted in Italy uses a sample of 109 individuals (Sanjust *et al*., 2014).

The kind of information provided in these studies on PTP mostly concerns: travel time, mileage travelled, travel cost, time spent in non-working activities, CO2 emitted, calories burned. These studies assess the overall effectiveness of the programme comparing the number of trips by car before and after implementation of a soft measure. However, none have analysed actually what information provided is the lever for behaviour change. Nor have they measured the relative importance of the soft measures compared to other improvements in the supply characteristics. Meloni *et al*. (2013) measured the effect of awareness on the increase in calories burned, but they use revealed preference data, where participants were given a personalised travel plan that included (i) information about the transport system, (ii) the recommended travel plan and (iii) a cost/benefits table with the monetary costs and calories burned for the current travel mode (car alone) and for the recommended travel plan (car + light rail). When several kinds of information are provided in a package, as typically happens in VTBC programmes, it is possible to measure the effect of the package as a whole, but not to disentangle the effect of the different information contained therein. Because the cost/benefits were computed for each individual based on the trips indicated, Meloni *et al*. (2013) were able to estimate separately the effect of the two kinds of information provided: monetary costs and calories burned. However, there might a confounding effect between these two measures and the other information provided in the PTP. Also a large sample is needed to estimate the effect of these two measures, because monetary costs and calories burned vary across respondents, but each respondent gets only one value for

them. It is instead easier to disentangle the effect of these measures if they are included as attributes in an SP experiment. Understanding to what extent specific soft measures contribute to shaping individuals' preferences, is crucial for defining the best policy for fostering change toward sustainable modes.

The objective of our study is to assess the specific effect of the soft measures in encouraging individuals to change toward more sustainable travel modes. In particular we focus on the effect of making people aware of the benefits of using Park and Ride (P&R) instead of the car and test the effect of the information provided on the negative environmental effects of their current behaviour and the information on the positive health effects of using the alternative mode (P&R).

Among the environmental effects, the information about the impact of the CO2 emitted is probably the most effective measure (and more understandable than other measures like for example PM10). People nowadays are more sensitive to environmental problems but, as shown by several researchers, they still "lack the necessary information and internal reference parameters to make informed mode choices based upon associated carbon dioxide emissions" (Brazil and Caulfield, 2014). The information on CO2 has often been used in PTPs, and it is widely recognised that individuals are less likely to adopt environmentally friendly behaviour if this information is not provided. However there are still few experiences that allow to disentangle its efficacy as a soft measure.

Of the information on health benefits, the typical measure tested in PTP programmes is calories burned. This is a relatively easy measure to test, because it is simple to quantify and individuals can easily associate with the effects on their health. However, the pertinent literature suggests that more than the calories burned, stress represents the real plague of modern society. Stress is an insidious (more difficult to detect) health risk. Several studies have focused the attention on the stress caused by driving. Koslowsky and Koslowsky (1993) for example found that stress in employees who drove to work was linked to commuting time and that stress mediates job satisfaction, commitment, and intention to leave. Hennessy and Wiesenthal (1999) examined driver stress in relation to traffic congestion and found that time urgency significantly influenced driver stress in both high and low congestion conditions. Lucas and Heady (2002) found that self-reported driving stress for commuters travelling to and from work was lower for those who had workplace flexitime arrangements and could avoid peak traffic hours. Congestion appears to be especially potent in eliciting anger and aggressive behaviour (Shinar and Compton, 2004). A study conducted by Wener *et al*. (2003) in New York suggests that also travelling by public transport can cause stress, due to low quality of service and too many transfers. However Wener *et al*. (2010) found also that car commuters showed significantly higher levels of reported stress and more negative moods compared to train commuters. None of these studies however assess the effect of information, *i.e*. to what extent being aware of the stress caused by driving has an impact on people's decision to change their travel mode.

The ability to perceive, or to be conscious of something and to react to it (*i.e*. awareness) can differ from one individual to another depending on their psychological status toward environment and stress. Many studies have accounted for the effect of attitude toward the environment mainly in mode choice or type of fuel-vehicle choice. However, other latent effects other than attitude are relevant. In particular, in the context of environmental awareness and information provided, personal norm measures a very interesting aspect of individual behaviour, because it evaluates the moral rule (and obligation) that brings individuals to behave or not in a pro-environmental way. How individuals perceive traffic related stress and the information about stress is particularly relevant for our study.

This paper describes the methodology we used to measure the effect on mode choice of raising awareness of the CO2 emissions and stress associated with car use. The methodology used includes a Stated Preferences (SP) survey where soft measures information was directly included as attributes in the SP tasks presented to the individuals, followed by a theory of planned behaviour (TPB) questionnaire (Ajzen, 1991) to specifically measure attitude towards the environment and perception of stress. To the best of our knowledge this is the first example of an SP survey that includes attributes of awareness. The only study we are aware of using SP to measure awareness is the work by Abdel-Aty *et al*. (1997) on route choice. But they focus on the awareness of alternative routes and the use of available traffic information either en-route and/or pre-trip. Finally, a hybrid choice model (HCM) is estimated to assess the effect of awareness and psychological aspects on the discrete choice between car and P&R.

The rest of the paper is organised as follows. Section 2 describes the main characteristics of the survey set up to collect the data. Section 3 focuses specifically on the Stated Preference (SP) experiment, and describes in detail the work done to define the soft measures, while Section 4 describes the questionnaire designed to measure the personal

norm regarding the environment and the perception of stress and information about stress. Section 5 describes the model used in this paper, and Section 6 summarises our main conclusions.

2. Survey characteristics

The context chosen for the experimental analysis is a corridor within the metropolitan area of Cagliari, which carries 150,000 round car trips/day. In 2008, a short light railway line (6.3 km and only 9 stops), named Metrocagliari, went into operation between the city centre of Cagliari and the town of Monserrato, located within the metropolitan area. The line operates from 6:00 to 23:00 and has a 10 minutes headway from 6:50 to 21:30 and 20 minutes at other times. Travel time along the entire line is 18 minutes. Unfortunately up to 2010 only 5,000 travellers/day used the service, about 75% below its capacity. Some preliminary studies showed that the reasons for this underutilisation were shortness of the line, lack of integration with bus services and lack of information. However, these studies also showed that many people were not aware of the existence of the light rail, and particularly of the P&R option, *i.e.* the possibility of parking their cars at the stations. Thus, this context was considered ideal for testing the effect of individualised social marketing techniques to promote the use of an existing sustainable mode: the rail as P&R option.

The methodology followed in our study was structured into three steps. In the first step a typical revealed preference survey was carried out mainly with the objective of building realistic SP cases, customised on the basis of the actual trips made by each respondent. Individuals were asked to describe the entire tour that includes the trip of interest in order to determine whether some other legs of the tour would prevent them from using the light rail as an alternative mode. In particular, respondents were asked to indicate:

- the characteristics of the trip: in-vehicle travel time, walking time to and from the parking space, time to find a parking space, duration of parking and costs;
- the characteristics of the activities performed at origin/destination of each leg;
- how often the same trip was made during the last month;
- which alternative modes were not available for that specific trip;
- whether the stops within the tour were habitual and mandatory and whether they could also have been made using means of transport other than the car;
- who took the decision to do that trip with those characteristics;
- the socio-economic characteristics of the respondent and her/his family;
- availability to participate in the SP experiment.

Upon completion of the RP survey, the data were carefully analysed and the individuals who could be identified as Prospective Park and Riders (PP&R) were contacted again to participate in the second step, the SP survey discussed in Section 3. The RP data were also carefully checked for the usual bias in the reported characteristics of the trips, especially travel times that were often unrealistic. These values were corrected whenever possible. Only a few cases were eliminated. In the third and final step individuals were asked to fill in the questionnaire for the psychological part of the survey (TPB), described in Section 4.

The survey was conducted via the Internet and was publicised in the web sites of all the municipalities within the metropolitan area of Cagliari. The survey is still in progress. The data analysed in this paper are those collected between July and August 2014. In this period 1,053 people visited the web-page. Since we were interested in individuals who travelled by car along the specific corridor of interest, the survey started with a couple of screening questions based on the frequency of the trips in the corridor and on the mode used for those trips. Bus users were also asked to fill in the RP questionnaire (*i.e.* included in the target for the RP survey), although for the SP survey

we were only interested in those travelling by car. Those who never travelled in the corridor or travelled by bike, motorcycle or a combination of more than two modes were only asked to describe their socio-economic characteristics, in order to conduct some descriptive analyses and to compare them with the sample gathered.

Of the individuals within the RP target, 47% completed the RP questionnaire. Unfortunately, given the way the survey was announced, it was not possible to send reminders. As an incentive, it was announced that those who completed the RP questionnaire would take part in a final draw that offered prizes including an iPad, an annual public transport season ticket and shopping vouchers.

Of the 486 RP questionnaires completed, 197 were invited to participate in the SP, the remaining 289 were not considered: 166 because they travelled by bus; 106 because (i) the trips described, although in the corridor of interest, ended in an area outside the city centre (*i.e.* that could not be feasibly reached by means of transport other than car); or (ii) the travel time by car calculated between the origin of the trip and the nearest railway station was greater than the travel time by car declared between the origin and final destination. The response rate of those we contacted for the SP survey (*i.e.* the Potential Park and Riders), was not very high (47%), though to these respondents we were able to send many reminders. 92 individuals completed the SP survey. Of these, 30 were used for the pilot test and 62 for the final SP questionnaire. The latter also completed the TPB questionnaire. Table 1 summarises the characteristics of the recruitment process.

Table 1: Recruitment process

	N.	% with respect to	
		RP Target	Invited to the SP
People who entered the survey	1,236	-	
People in the target for the RP survey	1,053	-	
RP Questionnaire completed	486	46.15	
Did not agree to be contacted again	6	0.57	
Trips made by car as driver	303	28.77	
Did not pass the check on trips	106	10.07	
Individuals invited to answer to SP survey	197	18.71	-
Respondents SP questionnaire	92	8.74	0.47
Respondents used for the SP pilot	30	2.85	0.15
Respondents for the final SP pilot	62	5.89	0.31

The final sample of the 62 individuals who responded to the three surveys (RP+SP+TPB) is equally distributed between males and females. The majority (43.55%) of the sample is between 41 and 60 years old, followed by 31-40 year-olds (37.10%). All users have at least secondary school education while 38.71% have a bachelor or higher degree and 17.74% are postgraduates. In accordance with age and education, the largest part of the sample worked, mostly as employees (64.52%). Unemployed represents less than 10%, while the percentage of students is even lower, due to the fact that the youngest age group accounts for a small percentage of the users. Almost half of the respondents (48.39%) has children, the average number of household members is 2.79 with on average 2.1 cars per household.

Lastly, note that, since the sample of respondents who completed the three surveys (RP+SP+TPB) was small (62 individuals), we analysed the information reported in 4 different RP surveys conducted over the last few years in the area of Cagliari and selected 1,449 individuals who were willing to be contacted again but did not fulfil the criteria

to participate in the SP survey. These individuals were asked to fill in the TPB questionnaire. In this way we had more data to better understand the attitude/behaviour/intention of the residents in Cagliari with respect to our topics (public transport, P&R, traffic stress, environmental, and so on). The analysis conducted on both samples showed that the psychological profile of the sample of 303 individuals who were not potential park and riders (and completed only the TPB questionnaire) and the sample of 62 individuals who filled in all three questionnaires (RP+SP+TPB) did not differ significantly.

3. Stated Preference Survey

The stated preference experiment consisted of a mode choice between the status quo (car) and the P&R alternative. The experiment included 4 *level-of-service* (LOS) attributes, with 3 levels each and 2 *information* (I) attributes, each with 2 levels. The *level-of-service* attributes included are travel time, parking time, parking costs and headway. The *information* attributes included are CO_2 reduction and stress reduction. Information attributes will be described in detail in the following section.

The travel time by car was defined as the in-vehicle travel time from the origin to the final destination (excluding time spent looking for parking). The travel time by Park&Ride was defined as the in-vehicle travel time by car from the origin to the railway station plus the travel time by light rail from the station to the final destination (excluding time spent looking for parking at the station). The parking cost was defined as the cost for the total duration of the activity. In the P&R alternative it was specified that the cost of parking at the light railway station also included the fare for the rail trip. Figure 1 gives an example of choice task and how the attributes were defined.

	CAR	P&R
Parking Cost	**4 €**	**3 €**
Travel Time	**12 min**	**18 min**
Parking Time	**12 min**	**2 min**
Headway	**-**	**5 min**
If you use P&R instead of car as driver:	  **It reduces traffic stress by 30%.** A study conducted among 10,000 car drivers in Europe has shown that 20 minutes driving in traffic is enough to increase psycho-physical stress. One in three Italians ranks traffic as the major source of stress.	
	  **It reduces CO2 emissions by 45%.** If all commuters travelling into the centre of Cagliari (150.000 trips per day) would switch to P&R for just one daily trip, this would reduce CO_2 emissions by 36,920 tonnes, an amount offset in one year by 4,013 hectares of forest, roughly 140 times the area covered by the Monte Urpinu Park (a well known park in Cagliari)!	

Figure 1: Example of SP scenario

All the LOS attributes, except headway, were considered generic between alternatives. The car attributes were pivoted around the value of the P&R attributes (*i.e.* the reference value was in all cases the P&R) because these are less flexible: *e.g.* travel time by light rail (that represents the major component of P&R travel time) is fixed and it would not have been realistic to change it. Parking time at the railway station could have been varied, but the car park is currently so little used that a scenario that assumed such a high P&R demand as to increase the time looking for parking space at the railway station would not have been perceived as realistic. We verified, through an iterative simulation of the data, that all the values generated for the car alternative were realistic with respect to the values experimented by car users and the level of congestion typical of the corridor. The reference values were only slightly varied across the scenarios so that respondents would not find them boring. The levels for the SP attributes are given in Table 2.

Walking time was also considered as a possible attribute, but not included in the final design as it takes on average only 3 minutes to walk from the car park to the light rail stops, with very minor variations from this mean. We thus decided to keep walking time in the car-only alternative equal to the time indicated in the RP survey and report these values in the introduction to the SP survey when describing the implicit scenario and reminding the respondent of the trip described in the RP.

Table 2: Levels for the SP attributes

Attributes		Levels of variation (CAR-P&R)		
Travel time	between 4 and 25 minutes	equal	-30%	+30%
	longer than 25 minutes	equal	-20%	+20%
Parking time		+6 min.	+10 min	+14 min.
Parking cost	activities shorter than or equal to 2 hours	equal	+1€	+2€
	activities shorter than or equal to 4 hours	+1.5€	+2.5€	+3.5€
	activities longer than 4 hours	+2.5€	+3.5€	+6.5€
Headway		equal	-50%	--------
Information about stress		present	absent	
Information about CO2		present	absent	

In the sample selected, none of the users had to make additional transfers other than from car to light rail (*i.e.* the one implicit in the P&R), therefore a transfer attribute was not included in the SP survey. Respondents were informed in the introduction that the alternative P&R implies a transfer.

The implicit scenario defined for the car alternative implied that (*i*) no free parking was available at the destinations declared by the respondents and the cost increased with respect to the current situation and (*ii*) congestion on the roads also increased resulting in longer in-vehicle travel and parking time. For those trips where the final destination was too far from a light rail stop, the hypothetical scenario also included an extension of the current light railway line. This information was provided in the introduction to the SP survey, along with a brief explanation of the P&R and a reminder of the travel characteristics described in the RP survey.

As mentioned, the RP information was used to customise the SP survey design. Although the trips selected are in the same corridor, they can have quite different origins and destinations and they are made at different times of the day. The variation in travel time is thus substantial. So we analysed the sample and classified respondents into groups with homogeneous LOS characteristics and identified 20 categories. Table 3 shows the categories and the

percentage of sample in each category.
It is important to mention that 84.2 % of those interviewed did not pay for parking, but, as mentioned before, the SP design assumes an implicit scenario whereby no free parking is available at destination. Since the total cost of parking depends on the duration of the activity and hence on the time the car stays parked, we defined the cost categories as a function of the total duration of the activity at the final destination. The cost was then computed as the product of the average duration per category times the average hourly rate. The cost per hour was based on current rates.

Table 3: Travel time-parking cost categories

Parking cost per hour	Total Duration of the activity	Travel time [min]					
		(0 ÷ 10)	(11 ÷ 15)	(16 ÷ 25)	(26 ÷ 35)	(> 36)	Tot
0.5 €	d ≤ 1h	3.05%	5.08%	6.60%	1.52%	0.51%	16.75%
1.5 €	1h <d≤ 2h	2.03%	5.58%	10.66%	6.60%	1.02%	25.89%
2.5 ÷ 3 €	2h <d≤ 4h	3.55%	2.54%	13.71%	6.09%	2.03%	27.92%
≥ 4 €	d > 4h	3.05%	5.08%	14.21%	4.06%	3.05%	29.44%
Tot		11.68%	18.27%	45.18%	18.27%	6.60%	100.00%

27 choice tasks were generated using an orthogonal design that allowed us to estimate the main effect and two-term interactions between stress, parking time and travel time and thus also to account for non-additive effects of the variables in the analysis. The 27 tasks were randomly divided into 3 blocks such that 9 choice tasks were presented to each respondent. We checked that the design did not include dominant cases.
The SP design was tested using simulated data in order to verify that the coefficients assumed to generate the experimental design were recovered and that the values of time implicit in the design would cover the range of values of time (VOT) expected for the area of interest.

3.1. Information attributes

The use of information attributes in the SP survey deserves further consideration. As mentioned in the introduction, information is not commonly used in SPs. The major challenges in including information about CO_2 and stress as attributes in the SP survey concern how they should be presented to respondents in order to be clearly understood.
Regarding stress, the problem consists in properly explaining to the respondents that the transport system is a major cause of stress and that even if they are unaware of it, this can form a non-negligible part of the overall stress that individuals accumulate due to common daily hassles, such as time pressure, job concerns, and financial considerations (Kanner *et al*., 1981). The same type of problem occurs for CO_2 emissions, because often people see the effects of climate change as an external rather than a personal cost. Therefore sustainable mobility choices are seen as a social dilemma, where the individual is not aware of the external costs or not motivated enough to reduce them.
We paid careful attention to how to best present the soft measures in the SP survey. In particular we tested the following aspects:

(i) Whether to use only images, only text or both.

Psychological studies (Boulding, 1956; Martineau, 1958) have shown that human behaviour is dependent upon image rather than objective reality. The "image theory" suggests in fact that using images instead of words allows to better capture the psychological or distorted representation of objective reality residing and existing in the mind of the individual (Myers, 1968). The use of pictures to represent attributes as opposed to entire alternatives is common in environmental and health economics (see *e.g.* Arnberger and Eder, 2015; Blasch and Turner, 2015; Brouwer *et al.* 2015; Scarpa *et al*., 2007;) but not in transport. Several transportation studies have used images in different forms (cartoon/realistic, real context/general context; with/without text) to provide information as persuasive technology (Wardman *et al*., 1997; Jariyasunant *et al*., 2011; Froehlich *et al*., 2009). However none of these have used images to specifically describe attributes in an SP survey and thus no discussion is reported on the specific effect of each type of image. Some literature suggests that using images helps to understand the information conveyed. However, there is also the risk that the images provide a lot of information, and can distract respondents' attention away from what is required for the SP survey. Moreover, using images probably also causes or accentuates the problem of framing. Framing is the semantic manipulation of rationally identical problems and refers to the influence that the way information is presented has on individual preferences (Avineri and Waygood, 2013).

(ii) The type of information that should be included in the text. The major difficulty is explaining to people what the information provided means.

As shown by many studies, people are unaware of how much CO_2 they emit on their trips and even less so of how much stress driving actually causes. So an absolute value would have been difficult to understand because people do not have not a familiar point of reference. An improvement in terms of percentage would work better, though not all people deal easily with percentages, so it is important to test whether this is clearly understood. Another issue discussed was whether to consider the CO_2 emitted based only on the distance travelled or to also include the pollution produced when looking for a parking space and by congestion. We thought the latter case was more realistic and calculated that all these effects would sum up to a reduction of 45% in CO_2 emissions.

Regarding stress, we decided to test a percentage reduction in order to be consistent with the information about CO_2. However, it was of course difficult to determine the value of this reduction as we did not find studies that indicated how to calculate the value of the stress. Gee and Takeuchi (2004) found that traffic stress may result from the hassles of driving and parking, the potential for unintentional injuries, and pecuniary hardships and inconveniences of vehicle maintenance and purchase. We thus assumed a 30% reduction based on the average proportion of the trips by car to be substituted with the trip by light rail.

The text used to describe the soft measures was: "*45% reduction in CO_2 emissions*" and "*30% reduction in stress*".

(iii) The type of context that should be included in the images.

Two cases were discussed: (1) whether to use a general context or (2) some images specific to the study area. Representing the actual context is more realistic as respondents are likely to recognise parts of the city where they live. On the other hand, evaluating an image that refers to existing places can be affected by personal experience, which is unknown to the modeller.

The images tested for case (1) are shown in pictures B and D in Figure 2. The idea of associating a tree in blossom with the P&R and a leafless tree with the car alternative is drawn from UBIGreen (Mankoff, and Landay, 2009). The images tested for case (2) are shown in pictures C and F in Figure 2. The light rail depicted in the P&R option in F is actually the one operating in the corridor of interest, while the car option in C depicts the congestion in a well-known road in Cagliari.

(iv) Whether to use abstract or real images *i.e.* cartoons or real people.
Works that have included images in SP designs usually recommend using realistic but controlled images; *i.e.* real images modified on the computer so as to leave only the elements of relevance for the SP eliminating all those that can distract from the main focus (see for example, Galilea and Ortúzar, 2005; Sillano and Ortúzar, 2005; Strazzera *et al*., 2010). However in our case it was not the specific elements included in the picture that were of relevance, in this sense we did not need to "clean" a real picture, but we did need to provide an image that properly conveyed the overall impression we wanted to create in the interviewee. Kamargianni and Polydoropoulou (2013) used an SP design defining three attributes by means of pictures. They used realistic images for two attributes and a cartoon image for the third, but did not explain the reason for this choice. We decided to test *smiles* as abstract images. Emoticons are a modern form of communication, very popular nowadays among both young and old. They convey messages quickly, clearly and concisely and are often used to represent common expressions in the place of words.
Pictures A, E and F in Figure 1 show the cartoon images tested, while G and H show the images tested using real people. In the latter case we tried to use faces that were representative of the average Italian. The gesture with the right hand made by the man in picture H is very characteristic of Italian body language.

Since we did not have a large sample available, we decided to collect another sample simply for testing the images to decide the best way of presenting the soft measures. 36 employees from the University of Cagliari were selected for this purpose. Each respondent in the pilot sample was presented with 8 cases, randomly selected from the combination of the images shown in Figure 1, with and without explanatory text. The aim of this test was to understand whether the image was clear, relevant, effective and original. Hence we decided to elicit individual preferences based on a 5-point Likert scale to measure the degree of agreement or disagreement with each adjective (clear, relevant, effective and original) for each example presented. Lastly we asked the respondents to choose the best of the 8 cases presented.
The test showed that the use of words alone to convey information was not effective as respondents paid little attention to them. Conversely, the combination of text and image proved very powerful and the best way to quickly capture people's attention. The mix of text and image also avoids heterogeneity in the interpretation of the image. Moreover the test showed that individuals have a marked preference for realistic images.
In particular, cases C and H accompanied by an objective definition scored highest for all four adjectives and were thus chosen and tested in the SP pilot survey.
The model estimated on this data showed that: (*i*) the CO_2 reduction had the expected sign but was not highly significant; (*ii*) the stress variable instead was not perceived as we intended, *i.e.* as a benefit. We decided therefore to change the explanation of these variables and define them more precisely. The following explanation was used in the final design (see Figure 1):

a. A study conducted among 10,000 car drivers in Europe has shown that 20 minutes driving in traffic is enough to increase psycho-physical stress. One in three Italians ranks traffic as the major source of stress.
b. If all commuters travelling into the centre of Cagliari (150,000 trips per day) were to switch to P&R for just one daily trip, this would reduce CO_2 emissions by 36,920 tonnes, an amount offset in one year by 4,013 hectares of forest, roughly 140 times the area covered by the "Monte Urpinu" Park (a well-known park in Cagliari).

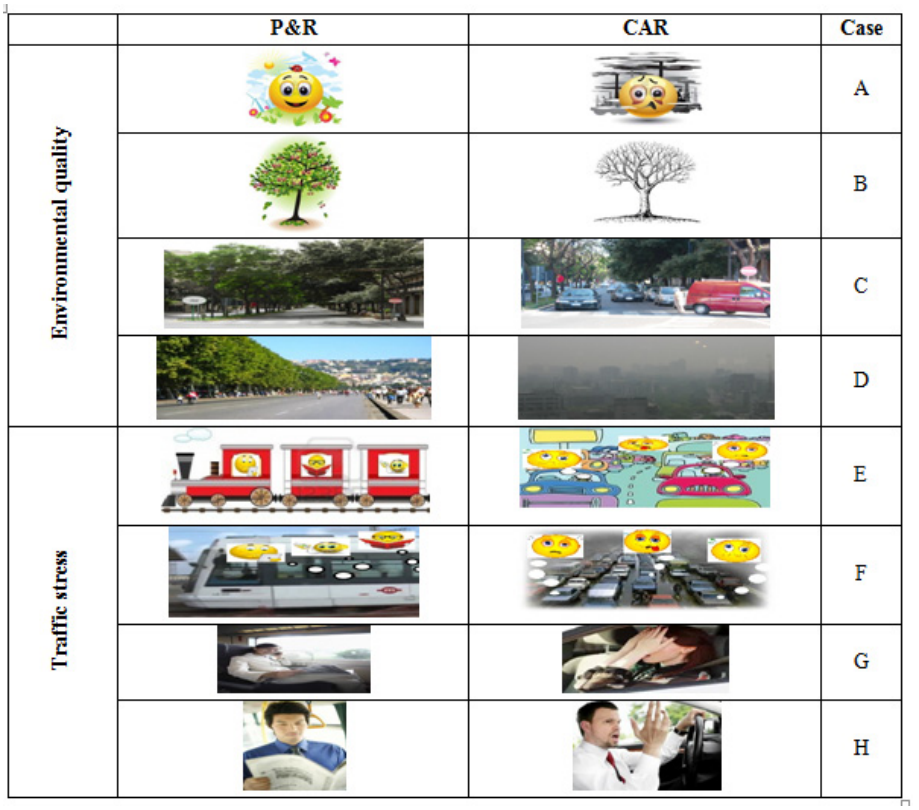

Figure 2: Images tested

4. Personal norm toward the environment and perception of stress and information

Personal norm toward the environment and perception of stress and information were collected as part of a broader questionnaire aimed at measuring all the items included in the Theory of Planned Behaviour (TPB). In collaboration with a team of environmental psychologists, we defined 57 items that cover the following statements: behaviour (5 items), motivations (10 items), general awareness of consequences (3 items), universal values (12 items), intention (4 items), measure of concern (1 items), personal norm (3 items), social norm (6 items), perceived behavioural control (4 items), attitudes (6 items), environmental self-identity (3 items). A 5-point Likert scale was used to measure the level of agreement or disagreement with each statement.

Two types of factor analysis were conducted to identify the latent dimensions underpinning our set of items: Principal Component Analysis (PCA) and Factor Analysis (FA). The PCA examines all the variances in the observed variables while FA only considers the shared variance, trying not to consider the error variance in the specific non-observed variable (Tabachnick & Fiddel 2007). To determine the factorability of the data and the number of factors to be extracted we used the Kaiser-Meyer-Olkin (KMO) test, the Scree test or Cattell test (Cattell 1966) and Parallel Analysis. For ease of reading, the axes are rotated using oblique rotation. Cronbach's alpha test was then used to obtain a measure of the reliability of each latent factor's means. The test produces a value between 0 and 1; the closer the value to 1 the more the item examined behaves consistently with respect to each item of every factor. The full list of items and a more detailed description of these analyses can be found in Sottile *et al*. (2015).

This analysis allowed us to identify 16 latent constructs. In this study we concentrate on the 3 factors that are related to the information attributes tested in the SP experiment: (1) perceived stress; (2) perception of information about stress; (3) personal norm with respect to the environment.
Tables 4 shows the statements used to describe the three latent variables that are relevant for this study; Table 5 gives a summary of the test results. All analyses on the latent constructs were conducted for both the samples of 303 observations that only completed the psychological survey and the sample of 62 observations that also completed the RP and SP surveys. As mentioned before, similar results were found for both samples.

Table 4: Latent variables Items

Latent Variables	Items (Indicators of Latent Variables)
Perception of Traffic Stress	Which of the following aspects stresses you more
	Traffic
	Car maintenance
	Accidents
	Difficulties in finding a parking place
	Traffic noise
Perception of information about Stress	Do you think that receiving information about the level of stress associated with driving can:
	Be important but not as much as travel costs and times
	Increase people's awareness as to the negative effects associated with car use
	Provide an incentive to reduce car use
	Make car users reflect about the possibility of switching to public transport
	Has absolutely no influence on the choice of travel mode
	Be considered useless
	Make car users switch to public transport
Personal Norm	Do you agree or disagree with the following statements:
	Regardless of what other people do, I feel a moral duty to travel in an environmentally more sustainable way
	Regardless of what other people do, I feel bad if I am unable to travel in an environmentally more sustainable way
	Regardless of what other people do, I feel good if I do not use the car a lot

Table 5: FA results

Latent Variables	KMO	No. Factors	Variance explained	Alpha factor 1
Traffic stress	0.747	1	46%	0.703
Info stress	0.736	2	67%	0.820
Personal Norm	0.548	1	57%	0.588

Regarding the latent variable Info Stress, in this study we only took into account one factor defined by the indicators 1, 2, 3, 4, 7.

More in-depth analyses were conducted on the three latent constructs identified. Regarding the perception of traffic stress, we found that the scores of each item (as reported in Table 4) were on average greater than 3 except for car maintenance. Therefore it seems that our sample is on average mildly stressed by difficulties in finding a parking place, by traffic, traffic noise and the risk of accidents. As expected those who drive are more stressed (scored higher on all these statements) than those who do not and only experience traffic as passengers or simply as citizens.
Regarding the perception of the information about stress we found that respondents agreed that receiving this kind of information increases people's awareness about the negative effects associated with car use, though they also agreed that this is not as important as travel costs and times.
Regarding the analysis of the personal norm scores we found that respondents clearly exhibited pro-environmental behaviour. In particular the scores for the first and third statements were on average around 4, though with a standard deviation of more than 1. Interestingly drivers more than non-drivers feel a moral duty to travel in a more environmentally sustainable way, which probably reveals a sense of guilt.

5. Hybrid Choice Models

The models used in this paper are hybrid choice models (HCM) that allow us to account for the fact that the utility associated with each alternative (car and P&R in our case) depends on the effect of awareness, which is accounted for in the systematic utility of the discrete choice model of the HCM, and on the psychological effects that are accounted for explicitly in the latent variable model of the HCM. The HCM thus allows us to disentangle the effect of awareness as measured with the information provided in the SP survey from the psychological effect as measured with the statements about stress and environment.
Let U_{qt} be the utility that individual q associates with alternative j. In the hybrid choice model this is defined as:

$$U_{qj} = ASC_j + \boldsymbol{\theta}_j \boldsymbol{LOS}_{qj} + \boldsymbol{\beta}_j \boldsymbol{SE}_q + \boldsymbol{\tau}_j \boldsymbol{I}_{qj} + \lambda_j \left(\boldsymbol{\alpha} \boldsymbol{SE}_q^{'} + \omega_q \right) + \varepsilon_{qj} \tag{1}$$

Where ***LOS*** is the vector of level of service characteristics as included in the SP scenarios, ***SE*** is a vector of socioeconomic characteristics while ***I*** is the vector of information attributes as presented in the SP cases: stress reduction and CO_2 emissions reduction. These two information attributes represent the benefit achievable from switching from car-only to park and ride. These are dummy variables, equal to one if the information is provided, zero otherwise. *ASC* is the constant specific to the P&R alternative and $\left(\boldsymbol{\alpha} \boldsymbol{SE}_q^{'} + \omega_q \right)$ is the latent variable (LV) that depends in turn on a vector of socioeconomic characteristics (***SE***'), which can differ from that included in the discrete choice. $\boldsymbol{\theta}$, $\boldsymbol{\beta}$, $\boldsymbol{\tau}$ and $\boldsymbol{\alpha}$ are vectors of coefficients associated respectively with ***LOS***; ***SE***, ***I*** and ***SE***'. ω_q is a normal distributed error term with zero mean and standard deviation σ_w. λ is the coefficient associated with *LV*. Finally, ε_{qt} is the error term identically and independently distributed following a type 1 extreme value distribution.
The statements reported in Table 4 are used as indicators of the latent variables and are linked to them by means of the following measurement equations:

$$I_{qk} = \gamma_k + \zeta_k LV_q + \upsilon_{qk} \quad k = 1, \ldots, K \tag{2}$$

where I_{qk} is the k-th indicator for the latent variable, γ_k is the intersect, ζ_k is the coefficient associated with the latent variable (γ and ζ are normalised to zero and one for the first indicator for identification purposes), and υ_{qk} is the normal distributed error term with zero mean and standard deviation $\sigma_{\upsilon k}$.
The discrete choice is modelled as a mixed logit model, while distributions of the latent variable and the indicators

are respectively:

$$f_{LV}(LV_q \mid SE_q;\alpha,\sigma_\omega) = \frac{1}{\sigma_\omega}\phi\left(\frac{LV_q - \alpha SE_q}{\sigma_\omega}\right)$$
$$f_I(I_q \mid LV_q;\gamma,\zeta,\sigma_\upsilon) = \frac{1}{\sigma_{\upsilon_k}}\phi\left(\frac{I_{qk} - \gamma_k - \zeta\, LV_q}{\sigma_{\upsilon_k}}\right) \quad (3)$$

The choice probabilities are given by:

$$P_{qj} = \int_\omega P_{qj}(LV_q(\omega_q)) f_{LV}(\omega_q) f_I(LV_q(\omega_q)) f(\omega)\, d\omega \quad (4)$$

Models are estimated using PythonBiogeme. Table 6 gives the results of 3 models estimated including one latent effect at a time. The model was estimated using 513 observations (57 individuals answering 9 choice tasks each) because we eliminated 5 individuals lexicographic in the alternative. Given the small sample, it was not possible to estimate a model with all the LVs together. At the same time we also tested many other systematic effects, but only left the most significant. Although the sample is very small, and these results cannot be considered conclusive, they are interesting and very promising. Firstly we note that the signs of all the parameters of the LOS attributes are in agreement with the microeconomic theory and are all significantly different from zero, with a significance level of 95% except for the time spent looking for parking, likely because it has a very low value for the P&R alternative.
The two information attributes, which describe the effect of the soft measure tested in the SP, were included as specific to the P&R alternative. The parameters associated with them are positive, demonstrating that the utility of P&R increases with the level of awareness attained through the provision of information about the light rail alternative. In all models the coefficient of stress is significant at 95%, the coefficient of CO_2 at 80% (in a one-tail test). All three latent variables significantly affect the choice of P&R. Further, as can be seen, the results are in line with those obtained for the two information variables. This suggests the absence of cognitive dissonance as the psychological aspects of the benefits associated with reducing car use have a positive effect on the P&R utility. Cognitive dissonance is defined as inconsistency between attitudes or between attitudes and behaviour. If someone believes that environmental conservation is desirable but continues to drive a car, that person engages in attitude-discrepant behaviour. Cognitive dissonance is experienced especially if, for example, the inconsistency is stressed by mass-media campaigns and creates unpleasant psychological tension. Dissonance, being psychologically uncomfortable, motivates people to attempt to correct it either by reducing car use (behavioural change) or by having a less negative attitude toward the undesirable effects of car use (attitude change). Particularly, the more individuals consider receiving information about stress useful, the more they tend to behave sustainably choosing P&R (positive sign of the latent variables). Lastly, those aspects associated with stress would appear to have a greater influence on travel choice than environmental aspects (the information received about the reduction of CO_2 emissions is not as significant in mode choice as the information on stress and the same can be said for personal norms compared to the other two variables). Indeed individuals are reasonably expected to be more sensitive to effects that have immediate repercussions such as stress, rather than to long term effects such as environmental pollution.

Table 6: Model results

	Variables	HCM 1 (Info Stress)		HCM 2 (Personal Norm)		HCM 3 (Stress)	
		Estimate	Robust t-test	Estimate	Robust t-test	Estimate	Robust t-test
	Constant_P&R	-18.900	-4.97	-3.330	-2.81	-6.750	-5.04
LOS	Travel time	-0.109	-4.50	-0.068	-3.53	-0.080	-4.04
	Parking Time	-0.087	-1.58	-0.046	-1.06	-0.040	-0.93
	Parking cost	-0.711	-5.90	-0.498	-5.15	-0.510	-4.81
	Travel time * Parking Time	0.018	1.14	0.024	1.62	0.047	3.11
	Waiting time	-0.162	-2.88	-0.1	-2.16	-0.13	-2.48
SE	Age 18-30 (P&R)	-2.010	-5.62				
	Age 31-40 (P&R)			1.210	4.88	1.240	4.26
	Female (P&R)	0.719	2.63	0.836	3.75	0.778	3.31
	Self-employed (P&R)			1.650	4.36		
	Presence of children (P&R)			0.770	3.35	1.130	3.79
I	CO2 Reduction (P&R)	0.535	1.83	0.345	1.46	0.371	1.48
	Stress Reduction (P&R)	0.699	2.49	0.489	2.14	0.546	2.20
LV	LV_Info Stress (P&R)	5.550	5.38				
	LV_Personal Norm (P&R)			0.299	1.66		
	LV_Stress (P&R)					1.110	5.18
	# of observations	513		513		513	
	L(max)	-3,459.54		-2,455.20		-4,334.79	

Table 6 (continue): Model results

LV model (Variables)	HCM 1 (Info Stress)		HCM 2 (Personal Norm)		HCM 3 (Stress)	
	Estimate	Robust t-test	Estimate	Robust t-test	Estimate	Robust t-test
LV_Constant	3.510	47.44	3.140	63.05	3.930	18.82
Age 31-40	-0.069	-1.79			-0.380	-2.16
Age > 41	-0.333	-4.21	0.052	6.95	-0.680	-5.29
Female	0.093	3.25			0.205	2.09
Self-employed	0.144	3.83			0.623	4.90
No. of household members					-0.160	-3.57
Presence of children	0.145	3.00				
No.of cars per household	-0.063	-2.91	0.211	15.96		
Random term	-1.230	-7.64	-0.515	-8.28	-0.220	-5.03
Ind2: Constant	-3.270	-3.87	-4.930	-10.43	-0.210	-0.73
Coeff_LV	1.980	8.05	2.070	16.14	0.820	9.01
Sigma	-0.143	-3.12	-2.670	-67.67	0.141	3.17
Ind3: Constant	-8.470	-4.33	0.646	2.43	-0.070	-0.21
Coeff_LV	3.450	6.13	0.776	10.80	0.610	6.03
Sigma	-0.496	-9.06	-0.033	-1.21	0.094	2.30
Ind4: Constant	-7.890	-4.13			0.526	1.80
Coeff_LV	3.360	6.06			0.861	10.22
Sigma	-0.795	-10.25			0.132	2.74
Ind5: Constant					-0.570	-2.27
Coeff_LV					0.864	10.70
Sigma					0.010	0.22
Ind7: Constant	-5.870	-4.06				
Coeff_LV	2.580	6.20				
Sigma	-0.511	-15.67				

Conclusions

This study describes the methodology used to assess the effect of soft measures using an SP survey experiment. This has made it possible to disentangle the effect of the soft measure and, more precisely, the effect of the awareness of the soft measure in the choice of environmentally friendly travel modes. To the best of our knowledge, this is the first time SP techniques have been used in transportation studies to assess the effectiveness of VTBC programmes.
We focused on the effect of raising people's awareness about the benefits of park and ride (P&R) as an alternative to the car as driver in terms of environmental quality improvement (reduction in CO_2), and stress reduction. CO_2 reduction is a common measure in TPT programmes and our study contributes to the literature by disentangling the

effect of this soft measure from the others usually included in TPT studies. Unlike previous studies here we tested a new effect, i.e. stress, an important and insidious component of modern life that can have serious health effects.

The paper provides an in-depth discussion of how these soft measures have been included in the SP survey, the difficulties encountered and the solutions found. The results show that awareness of the benefits in terms of reduced stress and pollution is effective in getting individuals to shift from car to park and ride. However a larger sample is needed to confirm these results. We also found that the use of images is very effective, though clearly images need to be accompanied by text that conveys the exact message. Defining images for the soft measures is powerful but also very complicated and it is crucial to test them carefully with dedicated tests.

The last but not the least aspect to be mentioned is that the study also includes information on the theory of planned behaviour. This makes it possible to discriminate between the effect of raising awareness through the information provided in the SP and the psychological effects that influence individuals' choices and awareness of environment and stress.

References

Abdel-Aty, M., Kitamura, R. and Jovanis, P., 1997. Using stated preference data for studying the effect of advanced traffic information on drivers' route choice. Transportation Research Part C, 5(1), pp. 39-50.

Abrahamse, W. and Matthies, E., 2012. Informational strategies to promote pro-environmental behaviours: Changing knowledge, awareness, and attitudes. Environmental psychology: An introduction, pp. 223-232.

Ajzen, I., 1991. The theory of planned behaviour. Organizational Behaviour and Human Decision Processes, 50(2), pp. 179-211.

Arnberger, A., and Eder, R., 2015. Are urban visitors' general preferences for green-spaces similar to their preferences when seeking stress relief?. Urban Forestry & Urban Greening. In Press, Accepted Manuscript, Available online 12 August 2015.

Ampt, E., 2003. Voluntary Household Travel Behaviour Change - Theory and Practice. 10th International Association of Travel Behaviour Research Conference, 10-15 August, 2003, Lucerne, Switzerland.

Avineri, E. and Waygood, E.O.D., 2013. Applying valence framing to enhance the effect of information on transport related carbon dioxide emissions. Transportation Research Part A, 48, pp. 31-48.

Blasch, J. and Turner, R. W., 2015. Environmental art, prior knowledge about climate change, and carbon offsets. Journal of Environmental Studies and Sciences, 1-15.

Bonsall, P., Shires, J., Maule, J., Matthews, B. and Beale, J., 2007. Responses to complex pricing signals: theory, evidence and implications for road pricing. Transportation Research Part A, 41(7), pp.672-683.

Boulding, K.E., 1956. The Image: Knowledge and Life in Society. Ann Arbor MI: University of Michigan Press.

Brazil, W. and Caulfield, B., 2014. Testing individuals' ability to compare emissions from public transport and driving trips. Journal of Public Transportation, 17(2), pp. 27-43.

Brouwer, R., Martin Ortega, J., Dekker, T., Sardonini, L., Andreu, J., Kontogianni, A. and Windle, J., 2015. Improving value transfer through socio economic adjustments in a multicountry choice experiment of water conservation alternatives. Australian Journal of Agricultural and Resource Economics. 59 (3), pp. 458–478,

Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A. and Goodwin, P., 2004. Smarter choice, changing the way we travel. Final report of the research project: 'The influence of soft factor interventions on travel demand'. Published by the Department for Transport, London on the 'Sustainable Travel' section of www.dft.gov.uk.

Cattell, R. B., 1966. The screen test for the number of factors. Multivariate Behavioral Research, 1, pp. 245-276.

Froehlich, J., Consolvo, S., Dillahunt, T., Harrison, B., Klasnja, P., Mankoff, J. and Landay, J., 2009."UBIGreen: Investigating a Mobile Tool for Tracking and Supporting Green Transportation Habits" Human-Computer Interaction Institute. Paper 119.

Fujii, S. and Taniguchi, A., 2005. Reducing family car-use by providing travel advice or requesting behavioural plans: An experimental analysis of travel feedback programs. Transportation Research Part D, 10, pp. 385-393.

Galilea, P. and Ortúzar, J. De D., 2005. Valuing noise level reductions in a residential location context. Transportation Research, D, 10, pp. 305-322.

Gärling, T. and Fujii, S., 2009. Travel behaviour modification: theories, methods, and programs. In: R. KITAMURA, T. YOSHI AND T. YAMAMOTO (eds.) The expanding sphere of travel behaviour research. IATBR, pp. 97-128.

Gee, G.C. and Takeuchi, D.T., 2004. Traffic stress, vehicular burden and well-being: A multilevel analysis. Social Science & Medicine, 59, pp. 405-414.

Hennessy, D. A. and Wiesenthal, D. L., 1999. Traffic Congestion, Driver Stress and Driver Aggression. Aggressive Behavior, 25, pp. 409-423.

Jariyasunant, J., Carrel, A., Ekambaram, V., Gaker, D. J., Kote, T., Sengupta, R. and Walker, J. L., 2011. The Quantified Traveler: Using personal travel data to promote sustainable transport behavior. University of California Transportation Center.

Kamargianni, M. and Polydoropoulou, A., 2013. Hybrid choice model to investigate effects of teenagers' attitudes toward walking and cycling on mode choice behavior. Transportation Research Record: Journal of the Transportation Research Board, 2382(1), pp. 151-161.

Kanner, A. D., Coyne, J. C., Schaefer, C. and Lazarus, R. S., 1981. Comparison of two modes of stress measurement: Daily hassles and uplifts versus major life events. Journal of behavioral medicine, 4(1), pp. 1-39.

Koslowsky, M. and Krausz, M., 1993. On the relationship between commuting, stress symptoms, and attitudinal measures: A LISREL application. Journal of Applied Behavioral Science, 29, pp. 485-492.
Lucas, J. L. and Heady, R. B., 2002. Flextime commuters and their driver stress, feelings of time urgency, and commute satisfaction. Journal of Business and Psychology, 16(4), pp. 565-571.
Martineau, P., 1958. The Personality of the Retail Store. Harvard Business Review 36, pp. 47-55.
Meloni, I., Sanjust, B., Sottile, E. and Cherchi, E., 2013. Propensity for voluntary travel behaviour changes: An experimental analysis. Procedia - Social and Behavioural Sciences, 87, pp. 31-43.
Myers, J. G., 1968. Consumer Image and Attitude. Institute of Business and Economic Research. University of California, Berkeley.
Richter, J., Friman, M. and Gärling, T., 2011. Soft transport policy measures: gaps knowledge. International journal of sustainable transportation, 5(4), pp. 199-215.
Rose, G. and Ampt, E., 2001. Travel blending: an Australian travel awareness initiative. Transportation Research Part D, 6, pp. 95-110.
Sanjust, B., Meloni, I. and Spissu, E., 2014. An impact assessment of a travel behaviour change program: A case study of a light rail service in Cagliari, Italy. Case Studies on Transport Policy.
Scarpa, R., Campbell, D., and Hutchinson, W. G., 2007. Benefit estimates for landscape improvements: sequential Bayesian design and respondents' rationality in a choice experiment. Land Economics, 83(4), pp. 617-634.
Shinar, D., and Compton, R., 2004. Aggressive driving: an observational study of driver, vehicle, and situational variables. Accident Analysis & Prevention, 36(3), 429-437.
Schwanen, T., Banister, D. and Anable, J., 2011. Scientific research about climate change mitigation in transport: A critical review. Transportation Research Part A: Policy and Practice, 45(10), pp. 993-1006.
Schultz, P. W., 2001. The structure of environmental concern: Concern for self, other people, and the biosphere. Journal of environmental psychology, 21(4), pp. 327-339.
Sillano M. and Ortúzar, J. De D., 2005. Willingness-to-pay estimation with mixed logit models: some new evidence. Environment and Planning A, 37, pp. 525-550.
Sottile, E., Meloni, I. and Cherchi, E., 2013. A Hybrid Discrete Choice Model to Assess the Effect of Awareness and attitude toward environmental friendly modes. SIDT, 16-18 October 2013, Trieste, Italy.
Sottile, E., Cherchi, E. and Meloni, I., 2015. Psychological profiles of commuters in Cagliari. Working Paper, accepted for the 14th WCTR, 10-15 July 2016 Shanghai, China.
Stopher, P., 2005. Voluntary travel behaviour change. In K.J. Button and D.A. Hensher (eds.) Handbook of Transport Strategy, Policy and Institutions, Elsevier.
Strazzera, E., Cherchi, E. and Ferrini, S., 2010. Assessment of regeneration projects in urban areas of environmental interest: a stated choice approach to estimate use and quasi-option values. Environmental and Planning A, 42(2), pp. 452-468.
Tabachnick, G. G. and Fidell, L. S., 2007. Experimental Designs Using ANOVA. Belmont, CA: Duxbury.
Taniguchi, A., Hara, F., Takano, S., Kagaya, S. and Fujii, S., 2003. Psychological and behavioural effects of Travel Feedback Program for travel behaviour modification. Transportation Research Record: Journal of the Transportation Research Board, 1839, pp. 182-190.
Wardman, M., Bonsall, P. W. and Shires, J. D., 1997. Driver response to variable message signs: a stated preference investigation. Transportation Research Part C: Emerging Technologies, 5(6), pp. 389-405.
Wener, R. E. and Evans, G. W., 2011. Comparing stress of car and train commuters. Transportation Research Part F: Traffic Psychology and Behaviour, 14(2), pp. 111-116.
Wener, R. E., Evans, G. W., Phillips, D. and Nadler, N., 2003. Running for the 7:45: The effects of public transit improvements on commuter stress. Transportation, 30(2), pp. 203-220.