Evaluation of Soft Transport Policy Measures Based on Behavioural Theory

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WORD COUNT: 5,261 (not including abstract, acknowledgement, references, tables and figures)

Abstract

This paper aims at disentangling possible causal mechanisms mediating the impacts of soft transport policies. A general conceptual framework is first presented to clarify how hard and soft transport policy measures influence travel behaviour. After that several models are presented which identify psychological determinants of people´s current travel behaviour as well as their motivation to change this behaviour. Finally, the psychological determinants are related to specific intervention types that can be used to systematically trigger behaviour change. In a last section future research directions are outlined.

Keywords: Soft transport policy measures, travel behaviour, psychological determinants, intervention types

Acknowledgments

The work on this paper was financially supported by a grant received from the European Union (Successful Travel Awareness Campaigns and Mobility Management Strategies, contract #518368) to Sebastian Bamberg, by grant # 17360244 from the Japanese Ministry of Education under the Grant-in-Aid for Scientific Research (B) to Satoshi Fujii, and by grant #2004-02974 from the Swedish Governmental Agency for Innovation Systems (VINNOVA) to Margareta Friman.

1. Introduction

Motorised transport is in several respects a future threat to the human environment (Gärling and Steg, 2007). Whereas the problem diagnosis is clear, finding effective means for reducing motorised transport, especially private car use, seems difficult. There is growing evidence that hard policy measures (e.g., physical changes to transport infrastructure or operations, traffic engineering, control of road space and changes in price) alone fail to deliver the needed car use reduction (e.g. Kitamura et al. , 1997; Stopher, 2004). Perhaps these sobering experiences are reasons for the demonstrated interest by transport planners in a range of initiatives which are widely described as *soft* transport policy measures (Jones and Sloman, 2006; Rose and Ampt, 2001; Taniguchi et al., 2007). Although a consistent definition of such policies has not yet been developed, a typical feature is that they try to influence individual choice by means of information and persuasion. Frequently implemented examples of soft transport policy measures include workplace travel plans, personalised travel planning, public transport marketing, and travel awareness campaigns (e.g., Gärling and Fujii, 2006).

Still, many transport planners remain sceptical whether soft transport policies should be viewed as key elements of an effective and efficient car-use reduction strategy. To overcome this scepticism strong empirical evidence is needed that soft policies can cause a substantive car-use reduction effect as well as detailed insights into the mechanisms mediating this effect.

The present paper starts with a brief summary of the available empirical evidence for the effectiveness of soft transport policies. The main focus of the paper is on the causal mechanisms that may mediate the impact of soft transport policies. For this purpose a general conceptual framework is first presented to clarify the role

of hard and soft policy measures in changing travel behaviour. After that several models are presented which identify psychological determinants of people´s current travel behaviour as well as their motivation to change this behaviour. Finally, the psychological determinants identified by the models are related to specific intervention types that can be used to systematically trigger behaviour change. In a last section future research directions are briefly discussed.

2. Evidence for the car use reduction effect of soft transport policy measures

In the last few years the British Department for Transport has commissioned a series of scientific reports (Atkins, 1999; Cairns et al., 2004; Dodgson et al., 2000; Dodgson et al., 1997; Halcrow Group, 2002; James, 2002; Sloman, 2003; Steer Davies Gleave, 2003) summarising the available evidence for the effects soft transport policies have have on car use reduction. The majority of evaluation studies compiled in the reviews seem to support the effectiveness of these measures. However, a weakness of all these reviews is that they use traditional narrative techniques for synthesising the quantitative evaluation results. There is growing evidence that this is not a scientifically defensible method. Two recent papers apply more adequate meta-analytical procedures (e.g., Lipsey and Wilson, 2001). In one paper Möser and Bamberg (2007) synthesised the results of 141 studies evaluating the car-use reduction effect of three types of soft transport policy measures: workplace travel plans (44 studies), school travel plans (25 studies), and travel planning/travel awareness campaign/public transport marketing interventions (72 studies). Across all 141 studies a significant standardised mean effect size of 0.15 (Cohen's h) was found, corresponding to a 7% decrease of the proportion of trips conducted by car (from 61% to 54%). However, all studies used a weak quasi-

experimental treatment group pre-post test design. The inability of this design to control for the influence of history, maturation, testing, mortality and regression effects decreases the internal validity of causal inferences (Fujii et al., in press). Furthermore, the external validity, that is the generalisability to the targeted population, is threatened by the fact that most of the synthesised evaluation results are based on non-representative samples.

In the second paper Fujii et al. (in press) we used meta-analytical techniques for calculating the mean car reduction effect found across a set of 15 Japanese ”travel feedback programs” (travel awareness/planning campaigns). The methodological quality of these studies is higher because they use a pre-post-test comparison group design which has a higher internal validity than the treatment group pre-post test design. A standardised mean effect size of 0.17 (Cohen’s *d*) was calculated across all 15 studies. This corresponds to a decrease in the average number of weekly car trips from 6.9 to 5.7. However, the external validity of this finding is limited. The total number of studies is small and most of them are based on small non-representative samples. Furthermore, at least some of the studies seem to have used non-equivalent control and treatment groups, thus making it difficult to rule out alternative explanations for the reported post-test differences.

To summarise, the currently available evaluation results provide empirical evidence for that soft transport policies are effective in motivating people to reduce car use. However, because of the noted methodological problems the question still remains somewhat open of how much of the observed car-use reduction could be causally attributed to the impact of soft policy measures.

3. What do we know about why soft transport policy measures work?

In the research literature on soft transport policy measures, currently one finds very little explicit statements about the theoretically rationales for the proposed measures. Frequently, the only theoretical statement is a reference to the social marketing approach. It appears as if the assumption is made that social marketing is a well-founded theory of behavioural change. This assumption is misleading because social marketing is only a tool for assisting the systematic development and implementation of an intervention. Thus, proponents of soft transport policy measures cannot currently claim that the measures frequently used for changing people's travel behaviour are based on sound, empirically supported, theoretical rationales. This is a very unfortunate state of affairs. In the last decades the necessity for theory-driven intervention planning and evaluation research has been realized (Chapel, 1996, Chen, 1990, Fitz-Gibbon & Morris, 1996; Weiss, 1995). When there is no explicit theoretical link between intervention activities and their intended effects on the problem(s) targeted by the intervention, the information generated by the evaluation is of marginal value in improving the program. Likewise, when success or failures cannot be attributed to individual program components, it is nearly impossible to project the results of the evaluation to other intervention efforts or to know which parts made a difference and which parts did not. As a consequence it is not possible to enhance aspect of the program that work and/or improve or eliminate components that do not work. In short, without the benefit of a clearly articulated theory about how a intervention is supposed to work, one cannot acertain whether it did work, and why it did or did not produce the intended benefits (Weiss, 1996).

In the present paper we will show that theories developed in psychological research has a great potential in providing the theory needed for soft policy measures. We will start with applying these theories to travel behaviour.

3.1 A general conceptual framework

In the next sections we present a summary of the psychological research aiming to identify psychological determinants of people´s current travel behaviour as well as their motivation to change this behaviour. For this purpose we start with the presentation of a general conceptual framework relating the psychological mechanisms, discussed later in more detail, to objective spatial and socio-economic factors frequently used by transport planners for understanding individual travel behaviour.

Figure 1

In the conceptual framework (see Figure 1) the perception of the built environment (e.g. available transport infrastructure, distribution and quality of shopping/leisure facilities) forms the central interface between external spatial, socio-economic factors and internal psychological mechanisms. Perception provides the knowledge base from which people derive their personal set of possible travel options. Because we assume that trip chains rather than trips constitute choice options (see Axhausen and Gärling, 1992; Gärling et al., 2002), we define a travel option as a bundle of attributes describing a trip chain (purposes, departure and arrival times, travel times, monetary costs, uncertainty and convenience). Besides the built environment, stable individual factors (e.g., family structure, income, working situation or value orientations) influence the perception of possible travel options. Situational factors (e.g., weather, time pressure, unexpected events) are a third determinant. These factors are frequently“ disturbances” forcing changes in travel

habits. When planning a trip chain the person has to select a travel option from the perceived set of possible options.

Hard transport policy measures (road pricing, parking fees, new public transport services, or improvement of bike and walk paths) aim at modifying the objective environment. However, these modifications influence individual choices only indirectly. People must perceive them, deliberately reflect on the consequences they may have for the possible set of travel options, and judge whether these consequences provide enough reasons to change their current behaviour. In contrast, the aim of soft transport policy measures is to directly influence the decision making process by changing or correcting people's perceptions of the objective environment, by altering their judgement of the consequences associated with the use of different travel options, and by directly motivating them to test new alternative travel options. The framework stresses the interdependence of hard and soft transport policies: with the implementation of hard measures the frame conditions for using the desired transport alternatives are improved which provides the argument that soft measures can be used to motivate current car users to test these alternatives personally.

3.2 Models of psychological correlates of current car use and car use reduction

In this section research results are presented with the aiming of providing a more detailed picture of the processes summarised in the general conceptual model (Figure 1) under the heading 'decision making'[1]. In the last decade most psychological research addressing a person's decision to use the car has been guided by two theoretical models: The Norm-Activation Model (NAM) developed by Schwartz (1977) and the Theory of Planned Behaviour (TPB) developed by Ajzen (1991). Both are briefly described in the following.

The Norm-Activation Model. Originally the NAM was developed to explain pro-social behaviours. Consequently, researchers using this model conceptualise car use reduction as a behaviour primarily driven by pro-social motives. This view is reflected in the assumption that a personal norm is the most important determinant of travel mode choice. A personal norm is defined as the felt obligation to bring own behaviour in line with personally important internalised self-standards. The NAM assumes that the formation as well as activation of personal norms is the result of an interplay of cognitive, emotional, and social factors. Problem awareness and perceived responsibility are important cognitive preconditions for the development of a personal norm. The perception that one is responsible for an action that causes harm to other people frequently triggers negative emotional reactions such as feelings of guilt (e.g., Weiner, 1995), defined as a "painful feeling of regret that is aroused when the actor actually causes, anticipates causing, or is associated with an aversive event" (Ferguson and Stegge, 1998, p. 20). Guilt is an important pro-social emotion because it results in a felt obligation to compensate for the caused damage (Baumeister, 1998). Besides feelings of guilt, social norms also contribute to the development of personal norms. They inform people about what behavioural standards their social reference group views as appropriate in a particular context. When people internalise these social expectations, social norms become the content of their personal norms.

The Theory of Planned Behaviour. The TPB (Ajzen, 1991) is a hedonic model of human motivation assuming that people avoid punishments and seek rewards. According to this model, travel mode choice is guided by a rational evaluation of behavioural consequences. The sum of perceived positive and negative consequences determines the global attitude toward a transport option. Attitude does not directly determine travel behaviour but indirectly via behavioural intention. The

TPB also stresses the importance of situational constraints. For example, when forming the intention whether they should use the bus or car for a specific trip, people do not only take into account their attitudes toward these two transport options but also judge the difficulty to use these options. This is referred to as perceived behavioural control (PBC). Social norms are viewed as a third factor influencing behavioural intention. In the TPB social norms are primarily conceptualised as perceived social pressure, that is the expectations of significant reference persons to use or not use a specific transport option. The TPB further assumes that when PBC corresponds to objective behavioural control, it predicts behaviour directly. For a review of studies using the NAM and TPB for explaining car use, see Anable et al. (2006) or Wall (2005).

A joint model. The existence of two empirically supported but contrasting models for explaining and predicting travel behaviour is unsatisfactory. Based on the assumption that the motivation to perform a behaviour is frequently a mixture of different motives, Bamberg and colleagues (Bamberg et al. , 2008; Bamberg and Möser, 2007) proposed to combine both theoretical frameworks by introducing *personal norm* into the TPB as an additional independent predictor of intention. Figure 2 presents the proposed joint model. Compared with the TPB this model ascribes social norms a different role. In line with pioneering studies of the informational influence of social norms (see Moscovici, 1985), it is assumed that people follow social norms less because they fear social sanctions, as assumed by the TPB, but because social norms inform them of what behaviour is appropriate. Thus, social norms do not only provide information whether a specific behavioural option is morally right or wrong but also whether it is beneficial or easy to perform.

Figure 2

Bamberg et al. (2007) conducted two studies in which they successfully applied the joint model to explain people's choices of public transport for daily travel. Furthermore, Bamberg and Möser (2007) tested the model with meta-analytically synthesised information found in 46 studies published since 1995 in peer-reviewed journals. These studies reported correlations of the joint model constructs with different kinds of pro-environmental behaviour obtained from 57 independent samples. These 57 correlation matrices were used as input for a meta-analytical structural equation model (MASEM, see Becker, 2000; Viswesvaran and Ones, 1995). MASEM provides a powerful statistical tool for synthesising the results of theory-driven quantitative research. Whereas meta-analysis (MA) numerically synthesise quantitative research findings (in our case correlation coefficients) across different studies and contexts, structural equation modelling (SEM) allows to check how well a á priori formulated theoretical model (in our case the joint model) fits the empirical pattern of these pooled correlations. Technically, MASEM is conducted by means of the following two-stage procedure (Viswesvaran and Ones, 1995). In the first stage, the correlation coefficients of two constructs obtained from the primary studies are meta-analytically pooled. Bamberg and Möser (2007) use the Hedges and Olkin (1985) r-to-Z method for this purpose. Because a Bonferroni-adjusted Q-statistic (Cheung, 2000) indicates heterogeneity of correlation matrices, random-effects pooled correlations were calculated (e.g., Hedges and Vevea, 1998). The left part of Table 1 presents the obtained matrix of random effects pooled correlations.

In the second stage, the pooled correlation matrix was used as input for a SEM path analysis. Because not all 57 single correlation matrices assessed all nine model variables simultaneously, the pooled correlations are based on different sample sizes. However, for fitting a SEM model information about the total sample size is needed. Bamberg and Möser use the harmonic mean for solving this problem.

The aim of the SEM analysis is to check how well the a-priori formulated model depicted in Figure 2 fits the empirical pattern represented by the pooled correlations. Figure 2 depictures the results (standardised path coefficients and explained variances) of this confirmatory model test. The overall model fit is acceptable (χ^2 = 148.54; *df* = 14, $p < .001$; *RMSEA* = .089; *CFI* = .98; *SRMR* = .039). As can be seen, the results confirm that behavioural intention mediates all the associations between the psychological variables and behaviour. After controlling for intention, the association between PBC and behaviour is no longer statistically significant. Across all included studies intention explains on average 27% of the variance in behaviour. The hypothesis that PBC, attitude, and personal norm have independent effects on intention is also confirmed. Together PBC, attitude, and personal norm explain on average 52% of the variance in intention. As hypothesised, feelings of guilt, social norm, responsibility, and problem awareness all have significant effects on personal norm. Together these four variables explain on average 58% of the variance in personal norm. The assumption is also confirmed that besides its direct as well as indirect (via guilt) effects on personal norm, social norm has a direct effect on PBC and attitude. There is furthermore a direct path from feelings of guilt to attitude. The MASEM results also support the assumed indirect, although important, role of problem awareness. This variable has a direct effect on responsibility, guilt, social norm, and personal norm.

Table 1

For an adequate evaluation of the presented MASEM results, the methodological problems with which this new method are still struggling should also be mentioned. One major problem concerns the determination of the appropriate sample size for fitting the SEM. The use of the harmonic mean for solving this problem is an ad hoc solutions, not based on statistical theory (but see Cheung and

Chan, 2005, for a more sophisticated statistical approach). A second problem is that the traditional methods used for pooling correlations ignore the sampling variation across studies as well as the potential covariation among the elements of the pooled correlation matrix, which may bias the standard errors of the parameter estimation . A third problem is that MASEM uses a correlation matrix instead of a covariance matrix as input, which may also lead to biased standard errors of parameter estimation.

Recently, Gardner and Abraham (2008) reported the results of a meta-analysis synthesising the results of 23 independent studies analysing the psychological correlates of intention of car use and actual car use, which support the results reported by Bamberg and Möser (2007) The right part of Table 1 presents the pooled mean correlation between car use and the constructs included in the integrative model reported by this meta-analysis. As can be seen, the pooled mean correlations reported for car use are very similar to those reported by Bamberg and Möser (2007) across different kinds of pro-environmental behaviours.

A self-regulation model of behavioural change. NAM and TPB focus on the explanation and prediction of current travel behaviour. However, for the development of effective soft transport policy measures, an understanding of the processes underlying people's motivation to *voluntarily change* their travel behaviour is more relevant. Bamberg (2008) proposed a self-regulation model that aims at explaining the processes motivating a person to voluntarily change his or her travel behaviour. The term self-regulation refers to the central assumption of this model that for understanding voluntary behavioural changes, one has to analyse the motivational processes leading to the setting of behavioural change goals, the development and enactment of strategies to achieve those goals, and the appraisal and revision of the goals and strategies accordingly (Carver and Scheier, 1998; Vohs

and Baumeister, 2004). From this perspective voluntary car use reduction is best viewed as a transition process through different motivational stages. Figure 3 depicts graphically the proposed process. A brief description follows.

Figure 3

The end of a first motivational stage is marked by the setting of a car-use reduction goal (also other goals may be set, such as cutting expenses, increase public transport use, and others), that is an intention to pursuit this goal. On one hand, the setting of such a goal reflects the felt obligation (personal norm) to bring one's current travel behaviour more in line with important self-relevant standards (values). As discussed above, the felt obligation to reduce one's car use is activated by moral emotions like feelings of guilt and fear elicited by the insight that current travel behaviour has negative collective consequences as well as the perceived own responsibility for this harm. Behavioural change supporting social norms are viewed as a second determinant of the felt obligation to reduce car use. On the other hand, the intention to achieve the desired car-use reduction goal also depends on the perceived goal feasibility, that is the perception of possible alternative travel options. Because the general car-use reduction goal is too abstract to guide behavioural change directly, in a second motivational stage a detailed behavioural strategy (e.g., using the bus or the bike instead of the car) is selected to reach the goal. The formation of an intention to use a specific behavioural option as the means of achieving the general car-use reduction goal is viewed as marking the end of this second selection stage. The TPB (Ajzen, 1991) provides a way of modelling the selection process. The successful initiation and enactment of the selected behavioural strategy marks the end of a third motivational stage. Gollwitzer (1999) assumes that

this stage is characterized by behavioral planning which is a very effective strategy for promoting the actual enactment of intended new behaviour. Forming a new habit (Fujii and Gärling, 2007) is a fourth stage of a successful behavioural change process.

Bamberg (2008) performed a correlational test of the self-regulation model of voluntary behavioural change. For this purpose a sample of 1,358 adults were confronted with the question which statement best expressed their personal car-use goal for the next month. The statement 'My goal is to decrease my car use' was chosen by 20% of the total sample, 18% chose 'I would like to decrease my car use, but I am unable to do so at the present time', 22% 'My goal is to stay at the same level of car use', 2% 'My goal is to increase my car use', and 39% chose the statement 'I have no goal to change my car use'. Figure 3 shows the results of a SEM model of the structural relations postulated by the self-regulation model. As theoretically expected, the results indicate a strong association between awareness of the negative collective consequences of current car use and the perceived personal responsibility to contribute to the reduction of this harm (ß = 0.79; R^2 = 0.63). Feelings of guilt and fear seem to mediate the relationship between perceived responsibility and the felt obligation to bring current travel behaviour more in line with important self-standards. Personal responsibility strongly affected feelings of guilt and fear (ß = 0.70; R^2 = 0.49) but did not directly affect personal norm, whereas feelings of guilt and fear directly affected personal norm (ß = .21). The results also provided correlational evidence for an association between the perceived expectations of important reference persons (social norms) and the perceived personal responsibility (ß = 0.23; R^2 = 0.05). Furthermore, there was a strong association between perceived social norms and the felt obligation to reduce car use

(ß = 0.57). Together with feelings of guilt and fear (ß = 0.21), social norm explained 41 % of the variance in personal norm.

As assumed, personal norm was directly (ß = .18) as well as indirectly associated with the intention to achieve the car use reduction goal via its significant association with goal feasibility (ß = .26), emotions anticipated with goal progress (ß = .34) and failure (ß = .15). Besides, personal norm, goal intention was significantly associated with goal feasibility (ß = .59) and emotions anticipated with goal progress (ß = .37). Together, personal norm, goal feasibility and emotions anticipated from goal progress explained 65 % of the variance in goal intention.

Confronted with the question which behavioural strategy they want to use for achieving their car use reduction goal, participants choose most frequently the two options ”Using public transport more frequently for everyday trips ” (29 %) and ”Walk more frequently for everyday trips shorter than 3 km” (26 %). The selection of the specific behavioural strategy (behavioural intention) for reaching the intended car-use reduction goal was strongly affected by goal intention (ß = .51) and behavioural control (ß = .63), and to a smaller extent by personal norm (ß = .12) and attitude (ß = .10). Together, personal norm, attitude, goal intention, and behavioural control explained 68 % of the variance in behavioural intention. The results also showed that planning may be a strategy people use for overcoming the volitional problem associated with the initiation of the intended new behaviour. Behavioural planning was significantly associated with behavioural intention (ß = .52) and behavioural control (ß = .18). Together both variables explained 44 % of the variance in planning.

4. Conclusions and practical implications

The research summarised in the last sections demonstrates a considerable progress in the understanding of the psychological factors influencing current travel behaviour as well as the voluntary change of this behaviour. Especially relevant for the development of new, and hopefully more effective, soft transport policy measures is the growing insight that voluntary behavioural change should be conceptualised as a transition through different motivational stages. In a first stage people develop a goal to reduce their current car use. The available evidence indicates that the setting of such a goal is mainly motivated by moral reasoning, that is people's awareness of the negative collective consequences of their current travel behaviour, their perceived own responsibility to prevent this harm, as well as the perception of change supporting social norms. This finding stands in sharp contrast to the view, currently widespread among transport planners, that soft transport policy measures are most successful if they are oriented toward hedonistic motives. If the presented findings hold true, such a strategy may not only be ineffective but even counterproductive because it would undermine people's intrinsic pro-social motivation (see Deci and Ryan, 1985). This should not be taken to mean that changes in the external environment, the central target of hard policy measures, can be neglected. On the contrary, the presented findings underline their central role for promoting voluntary change of travel behaviour. The perceived feasibility of setting car-use reduction goal is in fact a strong predictor of a person's goal intention and the degree of perceived behavioural control a strong predictor of the intention to use an alternative travel option as a mean to reach this goal. Because goal feasibility and perceived behavioural control reflect the existing objective infrastructural conditions, this confirms the central role of hard policy measures with the aim of improving these objective conditions. Recently, Eriksson et al. (2008) showed that work commuters by car stated that public transport services must be improved in order for them to be

able to reduce car use. It is furthermore essential that individuals perceive the service to be satisfying after starting to use it in order to change travel habits (Friman et al., 2001; Friman and Gärling, 2001; Fujii, et al., 2001). However, as discussed in the context of the general conceptual framework, such hard measures do not trigger behavioural change directly but only indirectly. By decreasing the costs associated with using the 'right' travel option they facilitate the formation of a car-use reduction goal (Loukopoulos et al., 2008).

The setting of a car-use reduction goal is only a first step on the long road to actual car-use reduction. In a second stage people weigh the pros and cons of possible alternative travel options and decide which of the possible alternatives they will use as a means to achieve their set car-use reduction goal. The successful initiation of the selected behavioural strategy is the main task people solve in a third stage.

Viewing voluntary behavioural change as a transition through different motivational stages has important implications for the development of future soft policies. Currently, most soft policies measures use one single intervention concept for all car users. If behavioural change is a transition through different stages, more flexible intervention concepts would be needed, which would allow matching the delivered measures to the specific motivational stage in which a car user currently is (Gärling and Fujii, 2006). For example, interventions targeting car users in earlier stages would likely to be more successful if they focus on interventions able to increase problem awareness and the perceived personal responsibility. Interventions making supporting social norms salient would also important in this early stage. For car users who already have formed a car-use reduction goal, interventions providing information about the availability as well as pros and cons of different alternative travel options should be more effective. Persons who already have formed an

intention to use a specific alternative travel option would benefit most from interventions supporting the implementation of this intention.

The self-regulation model of voluntary behavioural change presented above provides a ”blueprint” for the theory-based development of stage-based soft-policy interventions. Figure 4 demonstrates how the change mechanisms postulated by this model could be connected with specific intervention techniques able to activate these mechanisms. For example, in the literature one can find a variety of techniques aiming to make social norms more salient (intervention type I) like mass media role-modelling, entertainment-education, or behavioural journalism (e.g., McAlister, 1995, see also Goldstein and Cialdini, 2007, and Schulz, 1998). Scenario-based risk information (e.g., Hendrickx, Vlek, & Oppewal, 1989), dramatic relief, reevaluation, and consciousness raising (e.g., Prochaska et al., 2002) are examples of intervention techniques aiming to increase a person’s problem awareness and self-focus (intervention type II). Locke and Latham (2002) have demonstrated that stimulating the setting of a feasible but challenging goal (intervention type III) leads to a better performance than does setting an easy goal. However, the positive effect of difficult goals occurs only if a person accepts the challenge and has sufficient experience, self-efficacy, and feedback (e.g., McCalley and Midden, 2002). Intervention type IV comprises all techniques aiming to increase the perceived behavioural control as well as a positive attitude towards alternative behavioural options (e.g., Ajzen and Manstead, 2007). Linking members to new networks by mentor programs, buddy systems, and self-help groups (e.g., Heaney and Israel, 2002) are examples of techniques to improve social support (intervention type V). Intervention type VI consists of all measures aiming at changing objective environmental conditions in a way that barriers to desired travel behaviour are reduced. Techniques like planning exactly when, where, and how the intended new behaviour should be initiated

(Gärling and Fujii, 2002; Gollwitzer, 1999) or the training of coping skills like identifying risk situations, practicing solutions, and coping with lapses (e.g., Marlatt & Gordon, 1985) are good examples of the type VII interventions.

5. Future research directions

Two types of future research activities are particularly needed for making progress in the development of effective and efficient soft transport policy measures: One research type should concentrate on the theory-based development and experimental tests of new intervention ideas. The focus of this research would be on applying the insights of behavioural science research to improve the understanding of the causal mechanisms underlying travel behaviour as well as its voluntary change. If supported by enough empirical evidence, in a second step the identified causal mechanisms should be systematically connected with intervention ideas/techniques potentially able to activate these mechanisms (see Figure 4). In a third step a series of small-scale experimental studies should be conducted to test whether the newly developed intervention ideas are indeed able to activate the mediating causal mechanisms and whether the activation of these mechanisms results in behavioural change (for an examples of such a research program, see Taniguchi et al., 2008). A critical feature of such experiments is the random assignment of participants to experimental and control groups (Fujii et al., in press) – with the intervention applied only to the experimental group. Because the focus of this research is on causality, high internal validity is essential whereas external validity - the generalisability of a result to the general population - is less important. For this reason studies aiming to test the causal effects of new theory-based intervention techniques may use convenience samples. Ideally, this type of research would result in a collection of

empirically supported change mechanisms as well as intervention techniques able to activate these mechanisms.

A second type of research should concentrate on the development of large-scale evaluation of prototypes of soft transport policy measures under realistic field conditions. In practice most policy measures consist of a package of different empirically-supported intervention techniques. However, the development of such intervention packages should also be based on theory-driven assumptions about the causal role of each element included in the package. Besides the evaluation of the procedures used for producing and delivering the intervention to the target group (so-called process evaluation), the aim of such large-scale intervention studies is the valid estimation of the behavioural effect one can expect from these measure under real field conditions (so-called outcome evaluation). For this purpose not only high internal but also high external validity is essential. Thus, to guarantee a high internal validity of the evaluation results true experimental research designs should be used. Fuji et al. (in press) provide an overview of how to apply such research designs within the context of soft transport policies evaluation. To guarantee high external validity of the results, a large scale intervention study is required based on data from a representative sample of the population. This is likely to require the use of personal interviews rather than self-completion questionnaires, and of incentives to encourage participation in the surveys. As soon as a body of adequate high-quality evaluation studies is available, meta-analytic techniques should be used to calculate more reliable and precise estimates of the intervention effects. Furthermore, if the synthesis of the available evaluation results indicate a strong variability of the reported intervention effects, meta-analyses provide statistical tools for analysing the potential sources of this variability, that is the possible impact on the reported evaluation results of sample characteristics, differences in the intervention

techniques, or infra-structural conditions. A precondition for this is that the evaluation reports contain enough detailed information of these factors.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179-211.

Ajzen, I., and Manstead, A. S. R. (2007). Changing health-related behaviors: An approach based on the theory of planned behavior. In K. van den Bos, M. Hewstone, J. de Wit, H. Schut and M. Stroebe (Eds.), *The scope of social psychology: Theory and applications* (pp. 43-63). New York: Psychology Press.

Anable, J., Lane, B.and Kelay, T. (2006*). A review of public attitudes to climate change and transport: summary report.* Research report for the Department for Transport, London. Retrieved May 20, 2008, from http://www.dft.gov.uk/pdf/pgr/sustainable/climatechange/areviewofpublicattitudestocl5731 .

Atkins, W. S.(1999). *Assessing the effect of transport white paper policies on national traffic.* (Final Report and Appendices, Department for Environment, Food and Rural Affairs (UK) (DETR)). London.

Axhausen, K., and Gärling, T. (1992). Activity-based approaches to travel analysis: Conceptual frameworks, models, and research problems. *Transport Reviews*, *12*, 323-341.

Bamberg, S. (2008). *Why and how do people voluntarily change environmentally harmful behaviors? A self-regulation approach*. Manuscript submitted for publication.

Bamberg, S., and Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology, 27,* 14-25.

Bamberg, S., Hunecke, M., and Blöhbaum. (2007). Social context, morality and the use of public transportation - Results from two field studies. *Journal of Environmental Psychology, 27*, 190-203.

Baumeister, R. F. (1998). The self. In D. T. Gilbert, S. T. Fiske, and G. Lindzey (Eds.), *The handbook of social psychology* (pp. 680-740). Boston: MacGraw-Hill.

Becker, B. J. (2000). Multivariate meta-analysis. In H. E. A. Tinsley and D. Brown (Eds.), *Handbook of applied multivariate statistics and mathematical modelling* (pp. 499-525). San Diego: Academic Press.

Cairns, S., Sloman, L., Newson, C., Anable, J., Kirkbride, A., and Goodwin, P (2004). *Smarter choices - Changing the way we travel.* (Final report of the research project: The influence of soft factor interventions on travel demand. Research report for the Department for Transport). London. Retrieved December 1, 2005, from http://www.dft.gov.uk/stellent/groups/dft_susttravel/documents/page/dft_susttravel_029722.pdf.

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

Chapel, T., & Cotton, D. (1996). *Introduction to program evaluation: A guide for planning and policy practitioners.* Atlanta, GA: Office of Program Planning and Evaluation. Center for Disease Control and Prevention.

Chen, H. T. (1990). *Theory-driven evaluations*. Newbury Park, CA: Sage Publications.

Cheung, M. W.-L., & Chan, W. (2005). Meta-Analytic structural equation modeling: A two-stage approach. *Psychological Methods, 10,* 40-64.

Cheung, S. F. (2000). *Examining solutions to two practical issues in meta-analysis: Dependent correlations and missing data in correlation matrices.* Unpublished doctoral dissertation, Chinese University of Hong Kong, Hong Kong.

Deci, E. L., and Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Dodgson, J., Pacey, J., and Begg, M. (2000). *Motors and modems revisited* (National Economic Research Associates (NERA)). London.

Dodgson, J., Sandbach, J., McKinnon, A., Shurmer, M., van Dijk, T., and Lane, B. (1997). *Motors or modems* (National Economic Research Associates (NERA)). London.

Eriksson, L., Friman, M., and Gärling, T. (2008). Car users' stated reasons for reduction of commuting. *Transportation Research F, 11,* 427-433.

Ferguson, T. J., and Stegge, H. (1998). Measuring guilt in children. A rose by any other name has still thorns. In J. Bybee (Ed.), *Guilt and children* (pp. 19-74). San Diego, CA: Academic Press.

Fitz-Gibbon, C., & Morris, L. L. (1996). Theory-based evaluation. *Evaluation Practice, 17*, 177-184.

Friman, M., and Gärling, T. (2001). Frequency of negative critical incidents and satisfaction with public transport services. II. *Journal of Retailing and Consumer Services, 8,* 105-114.

Friman, M., Edvardsson, B., and Gärling, T. (2001). Frequency of negative critical incidents and satisfaction with public transport services. I. *Journal of Retailing and Consumer Services. 8,* 95-104.

Fujii, S., and Gärling, T. (2003). Application of attitude theory for improved predictive accuracy of stated preference methods in travel demand analysis. *Transportation Research A, 37,* 389-402.

Fujii, S., and Gärling. T. (2007). Role and acquisition of car-use habit, In Tommy Garling and Linda Steg (Eds.), *Threats from car traffic to the quality of urban life: Problems, causes, and solutions* (pp. 235- 250). Amsterdam: Elsevier.

Fujii, S., Bamberg, S., Friman, M., and Gärling, T. (in press) Are effects of travel feedback programs correctly assessed? *Transportmetrika*.

Gardner, B., and Abraham, C. (2008). Psychological correlates of car use: A meta-analysis. *Transportation Research Part F, 11*, 300-311 .

Gärling, T., and Fujii, S. (2002). Structural equation modeling of determinants of implementation intentions. *Scandinavian Journal of Psychology, 43,* 1-8.

Gärling, T., and Fujii, S. (2006, August). *Travel behavior modification: Theories, mehods, and programs*. Resource paper presented at the IATBR conference, Kyoto University, Japan.

Gärling, T., and Steg, L. (Eds.) (2007). *Threats from car traffic to the quality of urban life: Problems, causes, and solutions*. Amsterdam: Elsevier.

Gärling, T., Eek, D., Loukopoulos, P., Fujii, S., Johansson-Stenman, O., Kitamura, R., Pendyala, R., and Vilhelmson, B. (2002). A conceptual analysis of the impact of travel demand management on private car use. *Transport Policy*, *9*, 59-70.

Goldstein, N. J., and Cialdini, R. B. (2007). Using social norms as a lever of social influence. In A. R. Pratkanis (Ed.). *The science of social influence* (pp. 167-192). New York: Psychology Press.

Gollwitzer, P.M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54*, 493–503.

Halcrow Group (2002). *Multi-modal studies: soft factors likely to affect travel demand* (update final report, Department for transport). London.

Heaney, C. A., and Israel, B. A. (2002). Social networks and social support. In K. Glanz, F. M. Lewis and B. K. Rimer (Eds.), *Health behavior and health education: Theory, research and practice* (pp.185-209). San Francisco: Jossey-Bass.

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis.* Orlando, FL: Academic Press.

Hedges, L. V., & Vevea, J. L. (1998). Fixed- and random-effects models in meta-analysis. *Psychological Methods, 3,* 486-504.

Hendrickx, L., Vlek, C., Oppewal, H. (1989). Relative importance of scenario information and frequency information in the judgement of risk. *Acta Psychologica, 72,* 463.

James, A. (2002). *Review of Halcrow soft factors report* (Unpublished report for South West Transport Activists Roundtable).

Jones, P., and Sloman, L. (2006). Encouraging behavioral change through marketing and management: What can be achieved? In K. W. Axhausen (Eds.), *Moving through nets: The physical and social dimensions of travel* (pp. XXX-XXX). Oxford: Elsevier.

Kitamura, R., Fujii, S., Pas, E. I. (1997) Time use data for travel demand analysis: Toward the next generation of transportation planning methodologies. *Transport Policy,* 4, 225-235.

Lipsey, M. W., and Wilson, D. (2001). *Practical meta-analysis.* Thousand Oaks, CA: Sage.

Locke, E. A., and Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist, 57*, 705 – 717.

Loukopoulos, P., Gärling, T., Jakobsson, C., and Fujii, S. (2007). A cost-minimization principle of adaptation of private car use in response to road pricing schemes. In C. Jensen-Butler, M. Larsen, B. Madsen, O. A. Nielsen and B. Sloth, B. (Eds.), *Road pricing, the economy, and the environment* (pp. 331-349). Oxford: Elsevier.

Marlatt, G. A., & Gordon, J. R. (1985). *Relapse prevention: Maintenance strategies in the treatment of addictive behaviors*. New York: Guilford Press.

McAlister, A. (1995). Behavioral journalism: Beyond the marketing model for health communication. *Journal of Health Promotion, 9*, 417-420.

McCalley, L. T., and Midden, C. J. H. (2002). Energy conservation through product-integrated feedback: The roles of goal-setting and social orientation. *Journal of Economic Psychology, 23,* 589–603.

Moscovici, S. (1985). Social influence and conformity. In G. Lindsey and E. Aronson (Eds.). *Handbook of social psychology* (Vol. 2, 3rd ed., pp. 347-412). New York: Random House.

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

Prochaska, J. O., Redding, C. A., and Evers, K. E. (2002). The transtheoretical model and stages of change. In K. Glanz, C. E. Lewis and B. K. Rimer (Eds.), *Health behavior and health education: Theory, research, and practice* (pp. 99-120). San Francisco: Jossey-Bass.

Rose, G., and Ampt, E. (2001) Travel blending: An Australian travel awareness initiative, *Transportation Research D*, *6*, 9–110.

Scheier, M. F., and Carver, C. S. (2003). Goals and confidence as self-regulatory elements underlying health and illness behaviour. In L. D. Cameron and H. Leventhal (Eds.), *The self-regulation of health and illness behaviour* (pp. 17–41). London: Routledge.

Schulz, P. W. (1998). Changing behavior with normative feedback interventions: A field Experiment on curbside recycling. *Basic and Applied Social Psychology, 21,* 25-36.

Schwartz, S. H. (1977). Normative influence on altruism. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 10, pp. 221-279). New York: Academic Press.

Sloman, L. (2003). *Less traffic where people live: how local transport schemes can help cut traffic* (Transport for Quality of Life). Machynlleth.

Steer Davies Gleave (2003b). *Evaluation of first Yellow Bus.* (Report for the Department for Transport). UK: London.

Stopher, P. R. (2004). Reducing road congestion: A reality check. *Transport Policy*, *11,* 117-131.

Taniguchi, A., Suzuki, H., and Fujii, S. (2007). Mobility management in Japan: Its development and meta-analysis of travel feedback programs, *Transportation Research Record*, *2021*, 100-117.

Viswesvaran, C., & Ones, D. C. (1995). Theory testing: Combining psychometric meta-analysis and structural equation modelling. *Personnel Psychology, 48,* 865-885.

Vohs, K. D., and Baumeister, R. F. (2004). Understanding self-regulation: An introduction. In R. F. Baumeister and K. D. Vohs (Eds), *Handbook of Self-*

regulation: Research, Theory, and Applications (pp. 1–9). New York: Guilford.

Wall, R. (2005). *Psychological and contextual influences on travel mode choice for commuting.* Unpublished PhD thesis, Institute of Energy and Sustainable Development, De Montfort University.

Weiner, B. (1995). *Judgments of responsibility: A foundation for a theory of social conduct*. New York: Guilford Press.

Weiss, C. H. (1995). Nothing as practical as good theory: Exploring theory-based evaluation for comprehensive community initiatives for children and families. In J. P. Connell, A. C. Kubisch, L. B. Schorr, & C. H. Weiss (Eds.), *New approaches to evaluating community initiatives.*

Weiss, C. H. (1996). Excerpts from evaluation research: Methods of assessing program effectiveness. *Evaluation Practice, 17,* 173-175.

Footnote

1. In this paper the space limit excludes a discussion of the extensive research literature on the relationship between psychological variables such as attitude and actual behaviour. In general this relationship is likely to be strong in the travel behaviour area (for a review and analysis, see Fujii & Gärling, 2003).

Table 1

Meta-analytical pooled mean correlations of psychological correlates associated with general pro-environmental behaviour, respectively car driving.

	Pro-Environmental Behaviour Bamberg and Möser, 2007				Car-Driving Gardner and Abraham, 2007			
Construct	N	k	r_+	95% CI	N	k	r_+	95% CI
1. Problem awareness	8,276	18	.22*	[.11, .27]	799	3	-.24*	[-.33, -.15]
2. Responsibility	1,866	6	.25*	[.13, .34]	---	---	---	---
3. Social norm	7,325	18	.31*	[.21, .41]	993	2	.36	[.36, .36]
4. Guilt feelings	3,203	5	.31*	[.21, .38]	---	---	---	---
5. PBC	8,029	18	.30*	[.18, .40]	324	2	.31*	[-.05, .65]
6. Attitude	6,751	17	.54*	[.26, .56]	569	4	.27*	[-.15, .70]
7. Personal norm	6,840	11	.58*	[.12, .61]	563	2	-.41*[b]	[-.70, -.11]
9. Behavioural intention	5,654	15	.52*	[.42, .61]	2,517	4	.53*	[.35, .72]

Note. N = pooled sample size; k = number of pooled studies; r_+ = pooled mean correlation; CI = confidence interval,
* = Q-statistic indicates heterogeneity of the pooled correlations; b = personal norm for non-car-use

Captions to Illustrations

Fig. 1. A general conceptual framework

Fig. 2. Results based on the meta-analytically pooled mean correlations found in 57 samples, PBC = perceived behavioural control, single-headed arrows = standardised path-coefficients; double-headed arrows = correlations, R^2 = explained variance. (Adapted from Bamberg and Mösel, 2007.)

Fig. 3. SEM test of the self-regulation model of voluntary behavioural change (standardised path coefficients and explained variances; * $p > .05$)

Fig. 4. Possible linkages of stages of a self-regulation model and intervention techniques.

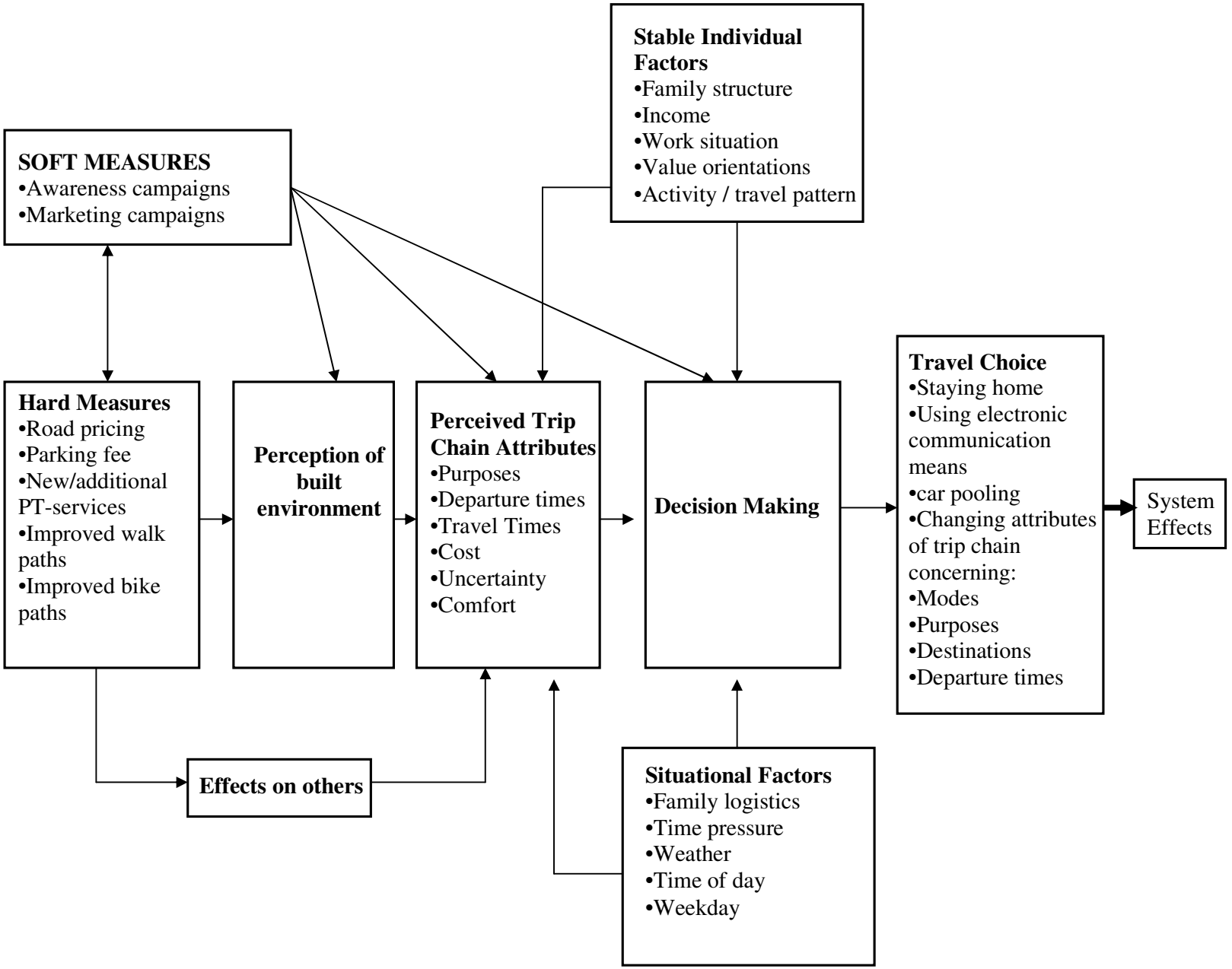
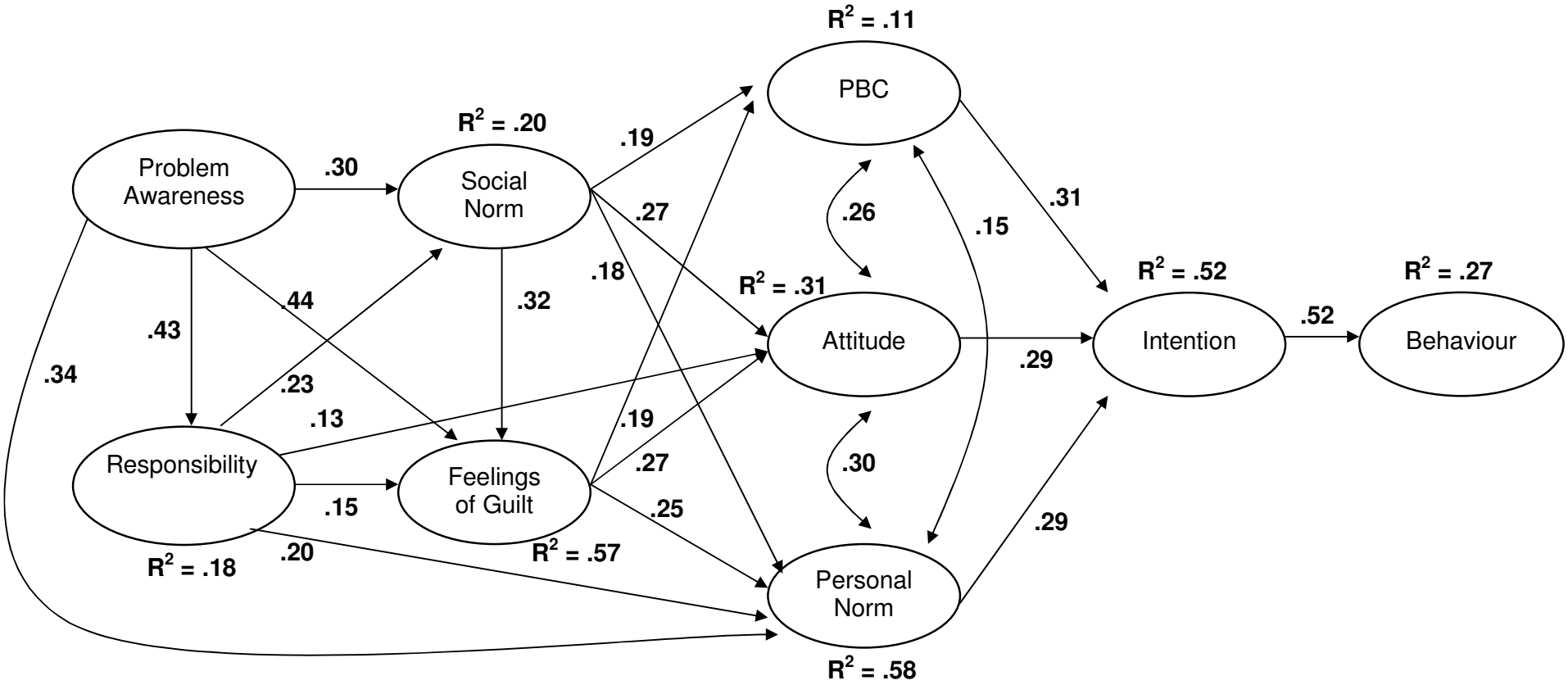

Stable Individual Factors
•Family structure
•Income
•Work situation
•Value orientations
•Activity / travel pattern
SOFT MEASURES
•Awareness campaigns
•Marketing campaigns
Hard Measures
•Road pricing
•Parking fee
•New/additional PT-services
•Improved walk paths
•Improved bike paths
Perception of built environment
Perceived Trip Chain Attributes
•Purposes
•Departure times
•Travel Times
•Cost
•Uncertainty
•Comfort
Decision Making
Travel Choice
•Staying home
•Using electronic communication means
•car pooling
•Changing attributes of trip chain concerning:
•Modes
•Purposes
•Destinations
•Departure times
System Effects
Effects on others
Situational Factors
•Family logistics
•Time pressure
•Weather
•Time of day
•Weekday

Fig. 1. A general conceptual framework



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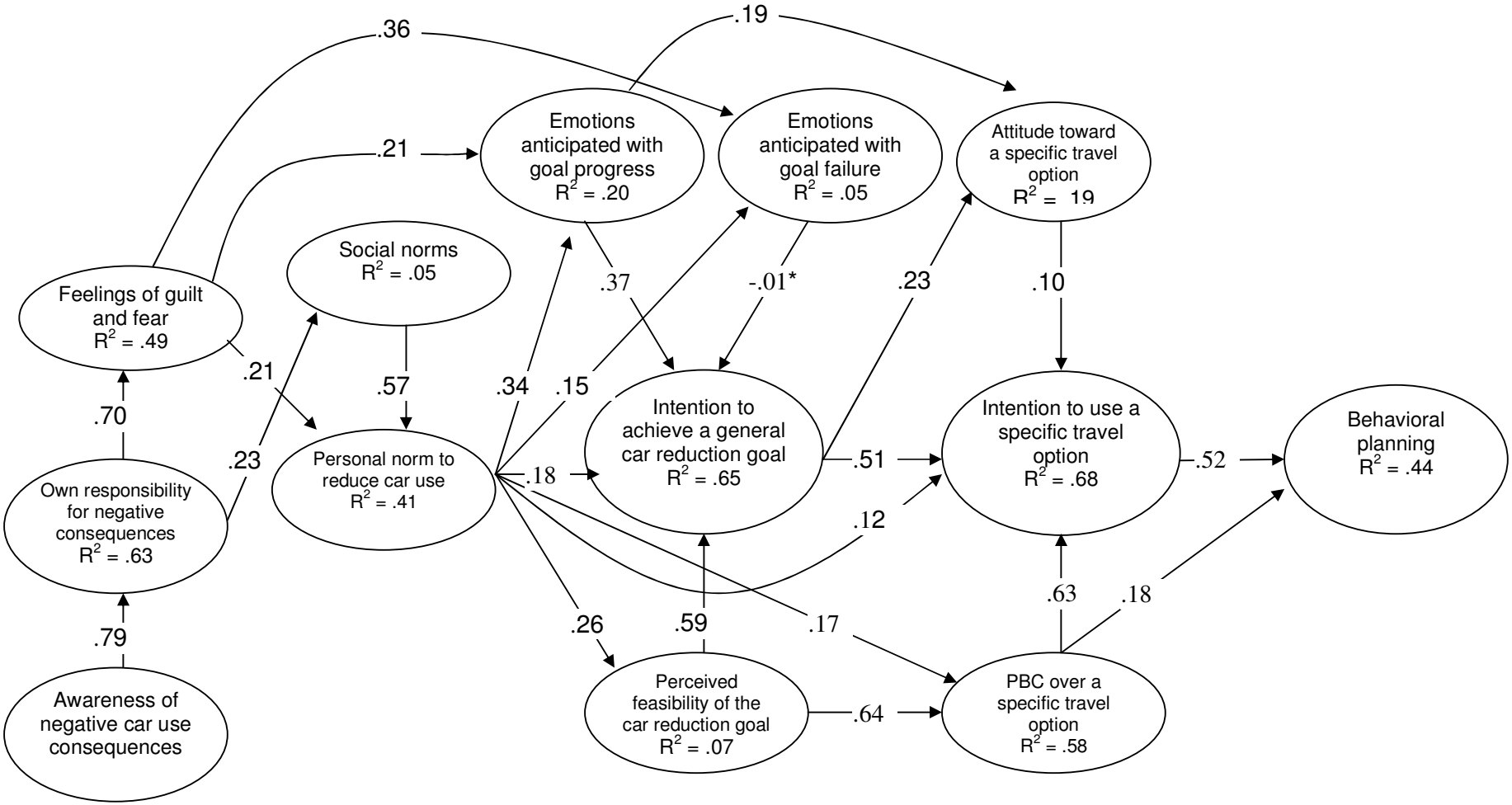

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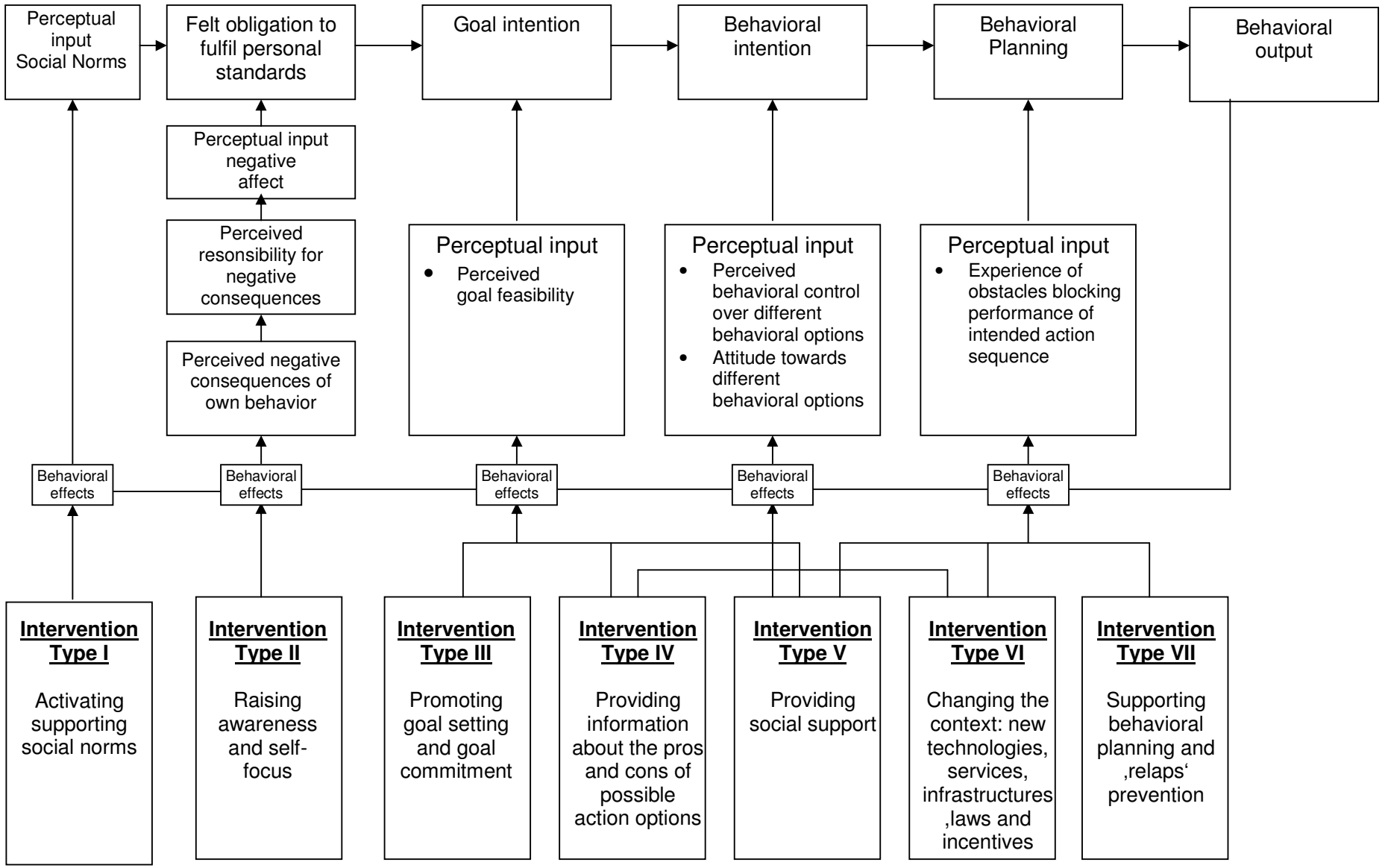
Perceptual input Social Norms
Felt obligation to fulfil personal standards
Goal intention
Behavioral intention
Behavioral Planning
Behavioral output
Perceptual input negative affect
Perceived resonsibility for negative consequences
Perceived negative consequences of own behavior
Perceptual input
Perceived goal feasibility
Perceptual input
Perceived behavioral control over different behavioral options
Attitude towards different behavioral options
Perceptual input
Experience of obstacles blocking performance of intended action sequence
Behavioral effects
Behavioral effects
Behavioral effects
Behavioral effects
Behavioral effects
Intervention Type I
Activating supporting social norms
Intervention Type II
Raising awareness and self-focus
Intervention Type III
Promoting goal setting and goal commitment
Intervention Type IV
Providing information about the pros and cons of possible action options
Intervention Type V
Providing social support
Intervention Type VI
Changing the context: new technologies, services, infrastructures ,laws and incentives
Intervention Type VII
Supporting behavioral planning and ‚relaps' prevention

Fig. 4. Possible linkages of stages of a self-regulation model and intervention techniques.