

Soft Measures, Behavioral Theories and Applications for Pro-environmental Travel Behavior Change

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Abstract

To reduce and control the demand for private car use, various mobility management schemes have been developed. Mobility management can be categorized into two types: hard measures and soft measures. Hard measures as conventional methods have confronted financial issues or public opposition. In contrast, soft measures have been gradually increasingly discussed for changing the psychology of travelers for pro-environmental travel behavior change without appeal to reward and punishment in travel cost, but the mechanism of the effectiveness of soft measures in travel behavior has not been fully revealed. Hence, this research first compares the two types of measures to clarify the scope of needed knowledge for soft measures, that is, behavioral theories located in diverse sub-disciplines of psychology; in turn reviews behavioral theories and their applications in transportation to reveal the psychological processes underpinning the effectiveness of soft measures capable of changing the factors in the processes; and finally suggests that soft measures are necessary complements to hard measures in mobility management and that volitional factors and strategies in soft measures are in need of more attention and discussion.

Keywords: Soft measures; Pro-environmental travel behavior; Behavioral theories; Psychological Processes; Motivational phase; Volitional phase.

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1. Introduction

The greenhouse gas emissions will pose a world-wide threat to natural and built environment in the near future if the pursuit of current human economic activities and life-style does not change. Particularly, the transportation sector has contributed nearly thirty percent of greenhouse gas emissions in economic activities and its share has gradually increased; and road transportation itself has accounted for ten percent of total emissions (IPCC, 2014). Among the emission sources, excessive private car use has become a major cause. Therefore, carbon emissions can be massively reduced by car use reduction. For example, yearly carbon dioxide could be reduced by 588 kg through the reduction of personal car use for 10 minutes each day, which is approximately equal to 20 times the reduction through adjusting a thermostat by 1 degree over a year (Ohta & Fujii, 2007). Thus, decreasing the demand for car use is an effective approach for carbon emission reduction.

To control travel demand, particularly for private car use which has tremendously increased over the last decades, mobility management has extended to diverse aspects including infrastructure promotion, economic and land use policies, technology, etc. In addition, psychological aspects have also been increasingly paid attention in research and tentative practice. Understanding the types and characteristics of mobility management is beneficial for identifying what is needed to clarify in the foundation underpinning the effectiveness of mobility management measures. Therefore, this research first discusses mobility management and compares hard measures with soft measures in Section 2. Furthermore, behavioral theories could underlie the development and design of soft measures in mobility management. Therefore, Section 3 identifies and reviews influential behavior theories located in diverse sub-disciplines of psychology, and discusses the association between behavioral theories and travel behavior research as well as how empirical studies apply those theories. Finally, Section 4 draws the guidance for soft measure development, including distinct functions between motivational and volitional factors in a psychological process and the possibility of inventing volitional strategies, to move travel behavior research forward and to provide insight into future research on and practice of soft measures.

2. Mobility Management: Hard and Soft Measures

Derived from the pursuit of desired lifestyle in modern industrialized societies, excessive and freewheeling motor car use has become a threat to ecosystems and human environment. In response to this issue, diverse mobility management schemes for controlling and reducing the demand of car use, or mitigating the carbon emissions of motor car have been developed.

Mobility management traditionally aims to reduce car use by road pricing, traffic restriction, and reduced public transport fares. Nevertheless, only appealing to these “hard measures” (or called structural strategies), which change regulations or facilities, may not be effective in reducing car use. It has been indicated that hard measures are often impeded by financial infeasibility, public opposition, or political consideration (Cools et al., 2011; Gärling & Schuitema, 2007; Jones, 2003). In addition, some of hard measures may probably have several side effects, for example, caused by undermined intrinsic motivation (Fujii, 2017). Therefore, in recent years, interest from transportation field has much increased in “soft measures” (or called psychological and behavioral strategies), which include information provision and persuasive communication belonging to intrinsic, non-coercive methods to make people voluntarily change their behavior (Fujii & Taniguchi, 2006). In the past decade, soft transport measures in general have been proved effective in voluntary travel behavior change in Japan, Australia, Germany, the UK, and several other European countries (Cairns et al., 2008; Friman, Larhult, & Gärling, 2013; Fujii & Taniguchi, 2006; Meloni, Sanjust di Teulada, & Spissu, 2016; Moser & Bamberg, 2008).

In practice and research, the frequently implemented and discussed mobility management measures in urban areas are organized in Table 1 (Fujii, 2017; Gärling & Fujii, 2009).

Table 1. Mobility management measures

Mobility management measures		Examples
Hard measure (Structural strategy)	Physical change measures	Land use planning to encourage shorter travel time Technical change to make cars more energy-efficient Improving public transport Improving infrastructure for walking and cycling Park and ride schemes
	Legal policies	Prohibiting car traffic in city centers Parking control Decreasing speed limits
	Economic policies	Taxation of cars and fuel Road or congestion pricing Kilometer charging Decreasing costs for public transport
Soft measure (Psychological and behavioral strategy)	Objective information method	Public transport information provision Travel time cognition correction
	Experience facilitation method	Temporary transport system change in fare or frequency
	Communication method	Request for pro-environmental travel behavior (PTB) Advice on PTB Feedback on positive consequences of PTB Feedback on negative consequences of car use behavior Travel goal setting feedback Personalized travel plans

Source: Adapted and supplemented based on Fujii (2017) and Gärling & Fujii (2009)

However, it is worth noting that soft measures may not be useful if commuters are objectively captive to car use resulting from the lack of public transport systems, for example, in a low-density urban structure (Acharya & Morichi, 2007). Meanwhile, hard measures may not operate if the information of public transport systems cannot be accessed and correctly recognized, or the pro-environmental awareness behind a policy cannot be realized by commuters; these tasks could be achieved by, e.g., information provision or verbal communication in soft measures (Fujii, 2017). Therefore, it is a fundamental basis, for mobility management that facilitates people's cooperation for solving a social dilemma like excessive car use, to understand that hard measures changing environmental factors and soft measures influencing psychological factors complement each other (Figure 1) (Fujii, 2017).

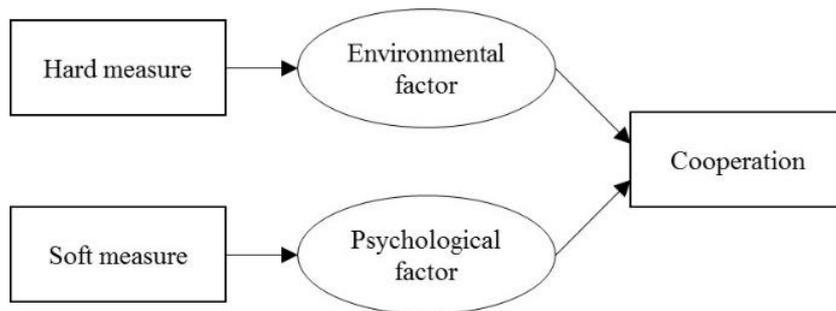


Figure 1. Structural and psychological strategies jointly triggering cooperative behavior

Source: Adapted from Fujii (2017)

(Note: the two terms of hard measure and structural strategy; and the two terms of soft measure and psychological strategy, are at times interchangeably used)

As displayed in Figure 1, hard measures operate through changing external environmental factors. Thus, after perceiving the changed factors, the utility of alternatives in decision-making frame of travelers based on travel time or/and cost then changes. Travel behavior may in turn change. In this process, hard measures could manipulate travel time or cost to predict modified behavior or to achieve desirable outcome. In contrast, for evaluating and implementing soft measures, it is necessary to identify what psychological factors should be targeted, and to clarify the psychological process of behavior change to understand the effect of changing targeted psychological factors on behavior. Therefore, the important behavioral theories that may relate to travel behavior change and may shed light on travel behavior research, and relevant applications are discussed in the following sections.

3. Behavioral Theory and Applications

3.1 Theory of Planned Behavior

The theory of planned behavior (TPB) (Ajzen, 1991) aims to explain how intention to act (or named behavioral intention), regarded as the immediate antecedent of behavior, is formed. This theory is an extension of the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975), based on attitudinal and normative constructs, incorporating perceived behavioral control as an additional determinant of intention (Figure 2). Under the circumstances in which people realized that they are capable of performing target behavior, the construct of perceived behavioral control is irrelevant and thus the TPB can reduce to the TRA. In contrast, when people have no sufficient control over a behavior, high perceived behavioral control is conducive to intention.

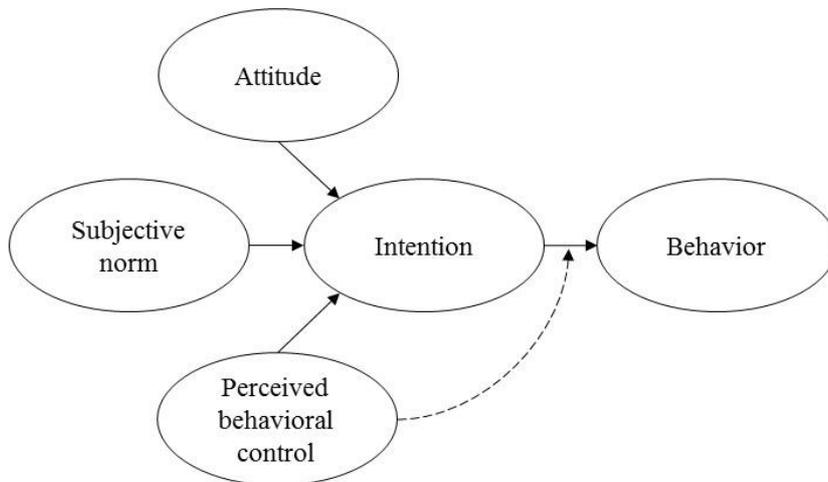


Figure 2. Theory of planned behavior

Source: Ajzen (1991)

In the TPB, intention is hypothesized to fully mediate the effects of attitude and subjective norm, and fully or partially mediate the effect of perceived behavioral control on behavior. Moreover, all background influences, such as individual, social, and information factors, are assumed to be included in the three beliefs respectively forming attitude toward the behavior, subjective norm, and perceived behavioral control. Consequently, intention is the only proximal determinant of behavior in some cases (when perceived behavioral control does not moderate between intention and behavior). As a general theory with these assertions for all behaviors, including travel behavior, in recent years the TPB has given rise to dispute and disagreement over its predictive validity and practical utility for behavior change (see Head & Noar, 2014; Ogden, 2015; Rhodes, 2015; Sniehotta,

Presseau, & Araujo-Soares, 2014; Sniehotta, Presseau, & Araújo-Soares, 2015; Trafimow, 2015). The TPB has also been open to extension (Fishbein & Ajzen, 2010), on the basis of it, for a specific target behavior, e.g., in need of volitional rather than motivational facilitation, or for behavior under specific circumstances such as a split-second decision based on a reactive process rather than a reflective one (Armitage, 2015; Conner, 2015; Gollwitzer & Oettingen, 2015).

In earlier travel behavior research, the TRA/TPB has impacted the formation of travel behavior theories. For example, Koppelman and Lyon (1981) introduced attitude and divided it into perceptions of and feelings toward travel modes as the factors influencing mode choice. However, it has also been suggested that the TPB is not sufficient for travel behavior and the mechanisms and processes beyond the measured constructs in the TPB ought to be additionally considered (e.g., Gärling, Gillholm, & Gärling, 1998).

3.2 Norm Activation Model

When it comes to pro-social or pro-environmental behavior, such as voluntary car use reduction, the TPB cannot fully elucidate, for example, the process in which people still is likely to perform pro-social behavior without strong social pressure represented by subjective norm in the TPB.

In contrast, the norm activation model (NAM) (Schwartz, 1977; Schwartz & Howard, 1981) can be applied to explain how moral obligation is activated and determines intention to perform pro-social behavior and its performance. This model contains the three constructs of consequence (problem) awareness, perceived responsibility, and personal norm which is moral obligation to perform or refrain from specific actions. Among these constructs, perceived responsibility for a behavior causing harm to society or other people may trigger the formation of personal norm, in turn triggering pro-social intention and behavior. In addition, the fact that the harm will be caused is informed by awareness of consequences. Thus, the formation of problem awareness has been viewed as a prerequisite to triggering operative behaviors (Fujii, 2017). The above interpretation of these constructs is to use the NAM as a mediator model (Figure 3). Another interpretation, called a moderator model, is to regard problem awareness and perceived responsibility as two moderators between the relationship between personal norm and the formation of pro-social intention and behavior (Figure 3). The mediator model has been found to be more fit for explaining morality and pro-social behavior (De Groot & Steg, 2009).

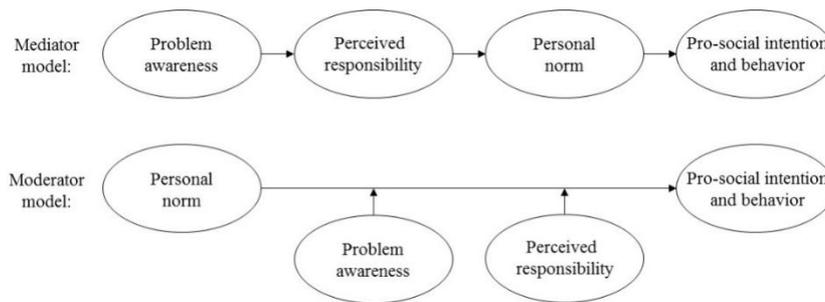


Figure 3. Norm activation model and two interpretations

Source: Schwartz (1977); Schwartz & Howard (1981)

Applying the NAM was considered to be better than the TPB in explaining car use reduction in some literature (e.g., Bamberg, Fujii, Friman, & Gärling, 2011). Such a perspective may consider that while car use behavior largely relies on pros and cons of car usage, it is also probably strongly determined by pro-social motives (Nordlund & Garvill, 2003). Therefore, there have been numerous empirical travel studies based on the norm-activation model, for example, Zhang et al. (2016) predicting public transport usage, Cools et al. (2011) exploring multiple travel adaptations, Haustein et al. (2009) additionally incorporating socialization constructs to predict car use, and Kim et al. (2013) positioning problem awareness to precede the attitude-intention-behavior relation to predict car use reduction. Nevertheless, these and other relevant research treated behavioral intention as the most proximal predictor or one of the most proximal predictors of behavior. That is, no mediator was introduced between behavioral intention and behavior. Thus, the intention-behavior gap, which involves that people fail to act on their intentions, was not addressed. In Section 3.4, there is further discussion on the issue of the intention-behavior gap.

3.3 A Joint Theory of TPB and NAM

Following the perspective that the NAM better explains the pro-environmental behavior, the NAM constructs have been integrated into the TPB to form a joint theory (Bamberg & Möser, 2007). It could be applied to the behavior also influenced by moral obligation, such as public transport use (Bamberg, Hunecke, & Blobaum, 2007). In this theory, the formation of personal norm, in addition to being influenced by the other NAM constructs, is in part influenced by social norm, which informs people of whether a behavior is normal (namely, performed by a majority of others) to help them make decision in uncertainty. Thus, social norm here as an informational social influence is not equal to the TPB's subjective norm as a normative social influence caused by perceived expectations of significant others. Then, personal norm in turn determines behavioral intention together with attitude and perceived behavioral control (Figure 4).

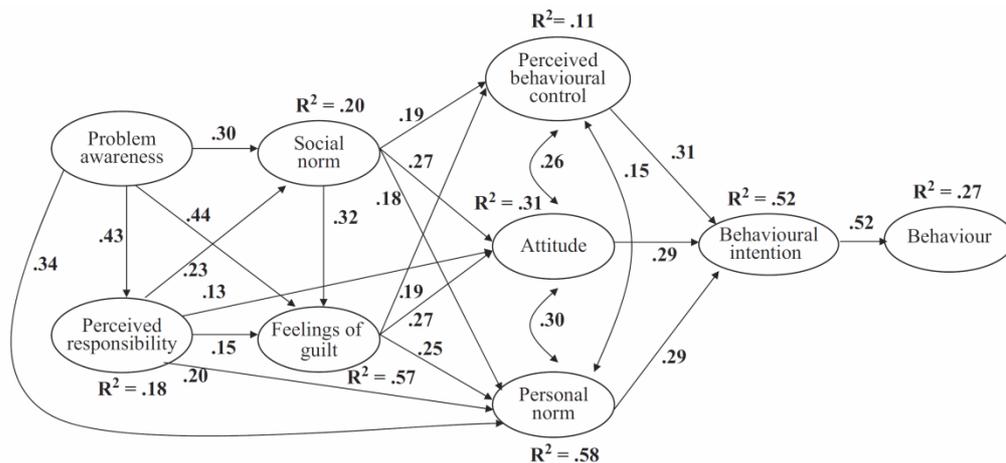


Figure 4. A joint theory combing TPB and NAM constructs with meta-analytical pooled correlations

Source: Bamberg et al. (2011); Bamberg & Möser (2007)

3.4 Intention-Behavior Gap

With the TPB or/and the NAM, the volitional phase of behavior change, in contrast to the motivational phase to which such theories have paid much attention, cannot be addressed. However, it has often been found in many cases that high proportion of people with a particular intention failed to act on their intention (ranging between 26% and 57%: Gallois et al., 1992; Orbell & Sheeran, 1998; Sheeran & Orbell, 2000a; Sheeran & Orbell, 2000b; Stanton et al., 1996; Sutton, Bickler, Sanchoaldrige, & Saidi, 1994), and that intention explained a low variance in behavior (Bamberg & Möser, 2007; Sheeran, 2002) or no variance (Cools et al., 2011).

These situations could be labeled as the “intention-behavior gap,” consisting of two types: “inclined abstainer” and “disinclined actor,” in contrast to “inclined actor” and “disinclined abstainer” with intention-behavior consistency (Orbell & Sheeran, 1998; Sheeran, 2002). The intention-behavior relationship could be briefly illustrated as in Figure 5. The disinclined actor, in spite of being a desirable outcome, cannot be captured by the models based on behavioral intention as the proximal predictor of behavior, such as the TPB or the integration of the TPB and the NAM. Moreover, the other type with the intention-behavior gap, inclined abstainer, not only cannot be explained by the models, but also lead to an undesirable consequence. Thus, if the volitional phase of behavior change is not clarified to underlie volitional intervention facilitating intention-behavior consistency, the gap may prevent motivational intervention alone from changing behavior. In particular, it is a pressing issue for behavior change theory and practice to explain and address the problem of inclined abstainer.

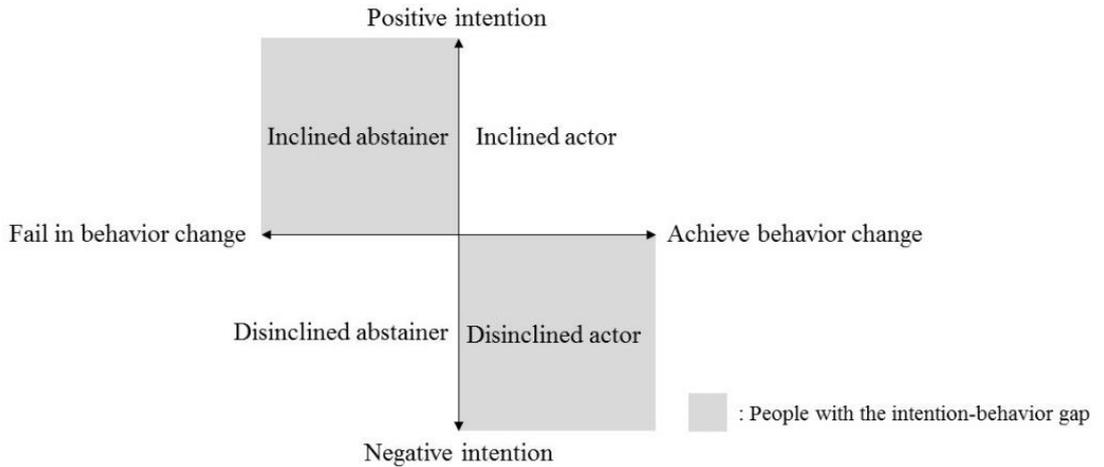


Figure 5. Decomposition of intention-behavior relationship

Source: Organized by this research

3.5 Volitional Mechanism: Implementation Intention

Aiming at the deficiency of volitional mechanisms in dominant behavioral theories, self-regulation theories (Karoly, 1993) have been applied to increase intention-behavior consistency. One important self-regulatory construct is implementation intention, which translates a goal into action by a mental link between specified situational cues and goal-directed responses in the form of “if—then.” Namely, if a situation specified in advance arises, then a subject will make a response linked to the situation (Gollwitzer, 1999).

The transportation field has introduced the construct of implementation intention, and supported it as a more proximal determinant of behavior than behavioral intention in the psychological processes of travel behavior, for example, the processes of the formation of public transport use (Bamberg, 2013b), car use reduction (Taniguchi & Fujii, 2007), and bicycle parking behavior modification (Fujii, 2005). Among these studies, in particular, Bamberg (2013b) integrated implementation intention with goal intention and other goal-related cognitions to form a goal-directed behavior process, and meanwhile incorporated them into the joint theory based on the TPB and the NAM (Bamberg & Möser, 2007); an applied case of travel mode use (Bamberg, 2013b) is shown in Figure 6. This integrated model attempts to elucidate a self-regulated behavioral change through four sequential stages: pre-decision terminated by forming goal intention, pre-action by forming behavioral intention, action by forming implementation intention, and post-action by initiating behavior (Bamberg, 2013b). This model may represent that the understanding of motivational mechanisms in behavior change processes has advanced from the knowledge gained from the TRA/TPB.

However, even though such a refined model based on previous theories has been applied to travel behavior, how volitional phase and its factors influence travel behavior has not been sufficiently revealed. The inadequacy of applying the self-regulated model is that implementation intention as the sole volitional construct was considered responsible for the whole volitional mechanism.

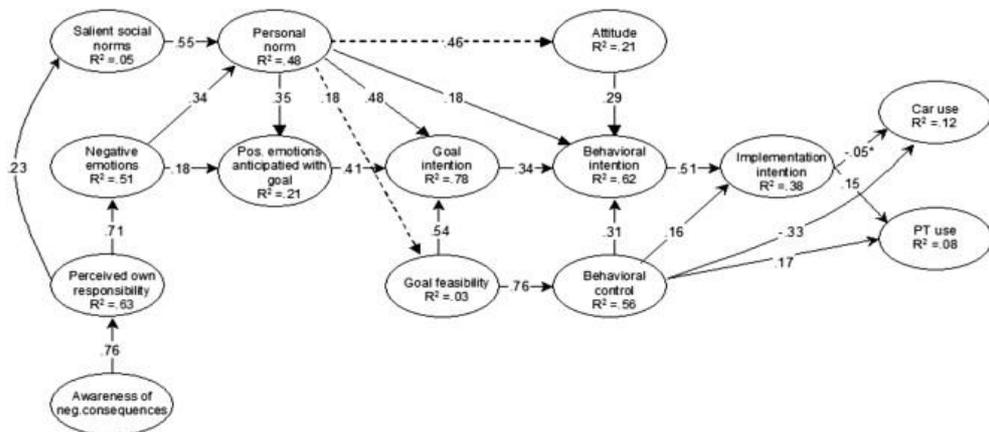


Figure 6. Self-regulated behavior change model with estimated coefficients for travel mode use

Source: Bamberg (2013b)

3.6 Volitional Mechanism: Action Planning and Coping Planning

Aside from implementation intention, another possible volitional factor influencing behavior is planning. The formation of planning, as a mental simulation of behavioral enactment, could reduce the uncertainty of implementing an intention. Thus, planning might explain how behavioral intentions are put into practice (Gärling & Fujii, 2002). The construct of planning has also been used to address the intention-behavior relation, for example, by treating it as the mediator in the relation and thereby increasing the explained variance in behavior (Sniehotta, Scholz, & Schwarzer, 2005).

In a similar vein but more extended, the health action process approach (HAPA) (Schwarzer, 2008) has provided a theoretical framework (Figure 7) that accommodates motivational and volitional phases of behavior change, in which the volitional phase incorporates not only self-efficacies (Bandura, 1997) as explanatory variables, but planning as the mediator between intention to act and action initiative, maintenance, and recovery. The planning factor could be subdivided into two separate constructs involving mental simulation: action planning and coping planning. This distinction between both planning cognitions has been psychometrically identified (Sniehotta, Schwarzer, Scholz, & Schuz, 2005). The definitions and functions of, and further possible relation between action planning and coping planning are discussed below.

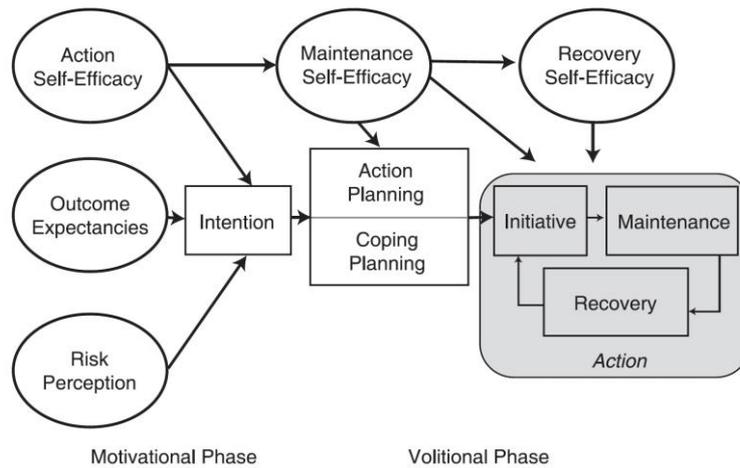


Figure 7. Theoretical framework of the HAPA

Source: Schwarzer (2008)

(1) Action planning

Action planning as one mental simulation is similar to implementation intention, but has been applied in facilitating a more deliberate behavior, distinguished from implementation intention in a more automatic one (Hagger & Luszczynska, 2014). Specifically, action planning refers to situational parameters (“when” and “where”) and a sequence of actions toward target behavior (“how”). When these elements are explicitly specified by a person who has not yet formed a behavioral habit, the intention of actions is not easily ignored or dismissed, and thereby the likelihood and speed of behavioral enactment may be increased (Gollwitzer & Sheeran, 2006; Schwarzer, 2008).

(2) Coping planning

Even if action planning could help people in implementing their intentions, the execution of the mental simulation of action planning is still probably impeded by diverse barriers resulting from habitual responses, competing intentions, and actual demands (Sniehotta, Schwarzer, et al., 2005). Thus, in addition to action planning as a task-facilitating mechanism, behavioral enactment may also rely on other volitional mechanisms, such as coping planning which is a barrier-focused mental simulation. Coping planning involves a cognitive link between “anticipation of barriers” and “strategy for overcoming barriers.” The former anticipation is to foresee the scenarios that obstacle actions toward target behavior. The latter strategy is in turn to develop ideas for overcoming the scenarios (Schwarzer, 2008; Schwarzer, Lippke, & Luszczynska, 2011). People who have strong coping planning may foresee potential barriers to behavior change, and thereby have the opportunity

to prevent the barriers from emerging or to develop the ideas for overcoming the barriers in advance of their emergence (Schwarzer, 2008). Thus, coping planning could protect intention from potential barriers to initiating action or breaking an undesirable habit (Sniehotta, Schwarzer, et al., 2005).

(3) Conjunction of action planning and coping planning

Imagining potential barriers and then generating coping ideas may proceed only after contemplating situational parameters of actions and how to act (Schwarzer, 2008). This sequence suggests that coping planning may make action planning adjustable and flexible, or otherwise increase its feasibility, and thereby more probably lead to behavior change. In addition, the two planning cognitions may function differently in behavior change: action planning plays an important role in action initiative, whereas in the maintenance of behavior requiring a sequence of actions, coping planning may be more influential (Sniehotta, Scholz, & Schwarzer, 2006; Ziegelmann, Lippke, & Schwarzer, 2006). Empirical studies in diverse fields, such as health promotion (Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2012), behavioral medicine (Ghisi, Grace, Thomas, & Oh, 2015), and education (Sanetti, Collier-Meek, Long, Kim, & Kratochwill, 2014), have provided evidence that the intervention targeting action and coping planning could facilitate behavior change.

Even though action and coping planning have been paid much attention in behavior change research in diverse sub-disciplines of psychology, to date there is little systematic discussion and application of action and coping planning for travel behavior change. Particularly, the role of coping planning and its associations with other psychological factors in travel behavior have not been disclosed. This deficiency may prevent soft measures aimed at enhancing volitional factors from further development and extension.

(4) Association of planning with motivation

Although the HAPA exhibits the feature of a stage model, the potential looped relationship between motivational and volitional phases have also been implied by empirical studies. For example, the extent to which people think about a desired future and contrast it with the present reality (which could be regarded as the components of and the prerequisites for planning) influences whether perceived behavioral control is effective in strengthening their behavioral intentions (Gollwitzer & Oettingen, 2015). In addition, either action planning or coping planning had an interaction effect with perceived behavioral control on health behavior (Pakpour & Sniehotta, 2012). Therefore, planning might play, aside from the mediator between behavioral intention and behavior for a volitional phase, the moderator between perceived behavioral control and behavioral intention (which in turn influences behavior) for a motivational phase.

Since in the transportation field planning constructs, particularly for coping planning, are less discussed, the present research focused on the volitional phase of travel behavior change. However, it is still worth noting the association of planning with motivation when a study attempts to build a behavior change model with a complete psychological process.

4. Guidance from Review for Travel Behavior Research

4.1 Soft Transport Measures on Car Use Reduction

Mobility management schemes have been widely used to reduce car use by road pricing, traffic restriction, and reduced public transport fares. Nevertheless, only appealing to these “hard measures,” which change regulations or facilities, may not be effective in reducing car use. Hard measures are often impeded by public opposition, political consideration, or financial infeasibility. Therefore, in recent years, interest from transportation field has much increased in “soft measures,” which include information provision and persuasive communication belonging to intrinsic, non-coercive methods to make people voluntarily change their behavior.

4.2 Motivational Strategy versus Volitional Strategy in Soft Measures

In soft measures for behavior change, there are two types of strategies with different natures based on distinct psychological processes: initial motivational stage and subsequent volitional stage. Thus, soft measures could be divided into “motivational strategy” and “volitional strategy” (Kuhl & Fuhrmann, 1998; Schmitz & Wiese, 2006). In the transportation field, while motivational strategies (e.g., travel awareness campaign) are applied earlier and wider than volitional strategies (e.g., workplace travel plan formulation), the volitional ones have been gradually increasing in recent years (Cairns et al., 2008; Fujii & Taniguchi, 2006).

Motivational strategies are applied to activating individual consequence awareness, responsibility, morality, etc. (the NAM constructs), or in conjunction with changing individual attitude toward behavior, perceived social pressure, etc. (the TPB constructs). The positive facilitation of these motivational factors could strengthen the intention of reducing car use (Bamberg, 2013b; Bamberg & Möser, 2007; Cools et al., 2011; Hausteil et al., 2009).

In contrast, the volitional factors that impact on travel behavior change, and the mechanism how the factors trigger the change, have been paid little attention in soft measure development and effectiveness evaluation. In the process of travel behavior change, only implementation intention is identified as the foundation of volitional strategies. Compared to motivational strategies, the development of volitional ones for travel behavior change relatively lacks a sound theoretical basis.

However, in addition to motivational strategies, volitional strategies appear indispensable for travel behavior change. The importance of volitional strategies and their underlying mechanisms is because the intention-behavior gap has often been found. The gap may be caused by, for example, lacking an action specification, unforeseen barriers emerging during action toward target behavior, or falling into temptation or habitual behavior, despite a formed intention to achieve a desired state (Schwarzer, 2008). Thus, to stride over these hindrances in the post-intentional volitional phase, more proximal determinants of behavior, than intention, should be identified. Based on the identified volitional factors, volitional strategies for improving those factors may help people translate their intentions into behavior, that is, bridge the intention-behavior gap. Therefore, it is time to reconsider

soft transport policy measures to supplement the insufficiency of volitional mechanisms and strategies.

4.3 Absence of Coping Planning in Volitional Strategy

Among the psychological factors in the volitional phase of behavior change, the mental simulations of action planning and coping planning may be two key factors that bridge the intention-behavior gap.

Action planning involves the specific situational parameters (“when” and “where”) and a sequence of actions toward target behavior (“how”). Action planning could increase the performance likelihood and speed of required actions toward target behavior because the actions would be more automatically elicited and a formed intention would not be easily ignored or dismissed if people know or can inform themselves of when, where and how to act. Action planning techniques have applied to reducing car use (Bamberg, 2013a; Fujii & Taniguchi, 2005), and have displayed a greater effectiveness than motivational strategy in some cases (e.g., Fujii & Taniguchi (2005)).

Coping planning is another post-intentional mental simulation which involves both “anticipation of barriers” and “strategy for overcoming barriers.” The former is imagining scenarios that obstacle actions toward target behavior, and the latter is developing plans for overcoming the scenarios in advance. For example: “If the shop I like to go is too far from a metro station, I will find another similar shop near the station instead.” In general, coping planning is formed after contemplating situational parameters and action methods. Thus, the formation of coping planning not merely accompanies action planning, but makes it practicable or modifiable. For this reason, a strategy based on coping planning in conjunction with action planning has been recently increasingly used to promote behavior change in some fields including health psychology (Evans, Kawabata, & Thomas, 2015; Gaston & Prapavessis, 2014; Guillaumie et al., 2012; Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2013; Koring et al., 2012; Kreausukon, Gellert, Lippke, & Schwarzer, 2012; Lhakhang, Godinho, Knoll, & Schwarzer, 2014; Wiedemann, Lippke, Reuter, Ziegelmann, & Schwarzer, 2011; Y. Zhang & Cooke, 2012), behavioral medicine (Ghisi et al., 2015; Lourenco, Rodrigues, Spana, Gallani, & Cornelio, 2012), hygiene (Bearth, Cousin, & Siegrist, 2014; Mosler, 2012; Zhou, Jiang, Knoll, & Schwarzer, 2015), and education (Sanetti et al., 2014).

In the transportation field, however, so far there is little discussion and application of coping planning for travel behavior change. Hence, the role of coping planning in travel behavior change, namely, its relationships with other psychological factors (e.g., action planning) and target behavior, as well as the effectiveness of soft measures based on coping planning, have not been sufficiently explored.

5. Conclusion

This research compared the conventional hard measures with newly emphasized soft measures, and thereby revealed their respective characteristics. Then reviewing the behavioral theories and investigating their applications in the transportation field suggested that understanding behavioral theories and identifying influential factors in psychological processes are needed for the development of soft measures. In addition, based on the contrast with other disciplines, volitional factors and strategies are less paid attention in soft transport measure research. In future research or practice dedicated to soft measure development or implementation, therefore, the volitional mechanisms underlying the effectiveness of volitional strategies in behavior change should be further clarified to more efficiently induce pro-environmental travel behavior.

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