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Incorporation of coping planning into the behavior change model that accounts for implementation intention

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ABSTRACT

Voluntary travel behavior change has been increasingly paid attention for promoting sustainable transportation. However, in the psychological process underlying the foundation of travel behavior change programs, the roles of volitional phase and its constructs have not been fully clarified. This research therefore incorporated coping planning, in addition to implementation intention, as two volitional constructs, to model the volitional phase of travel behavior change, and to investigate how the volitional constructs mediate between behavioral intention and behavior change. The data were collected from citizens in Taipei City, Taiwan, by two questionnaires across a one-month period. The main results suggested that implementation intention mediated the effect of behavioral intention on car use change only through the mediation of coping planning; that coping planning mediated between behavioral intention and car use change; and that the effectiveness of personalized travel plans in behavior change could be attributed to the volitional constructs. Based on the findings, the behavior change model incorporating coping planning could account for the effectiveness of implementation intention in travel behavior. Further implications of implementation intention and coping planning, and potential extension of behavior change process were discussed.

1. Introduction

To promote sustainable transportation by reducing private car use and encouraging public transport use, voluntary travel behavior change (VTBC) has been increasingly paid attention in recent years (e.g., Meloni, Sanjust di Teulada, & Spissu, 2016; Stopher, Clifford, Swann, & Zhang, 2009). Therefore, VTBC programs appealing to soft measures through communication in knowledge and information, as opposed to hard measures through infrastructure and regulations, have been considerably developed surrounding, among others, the question — How to transform commuters from a daily habit of car use into more sustainable modes without resorting to reward and punishment? To respond this question, it is inevitable for any VTBC programs to clarify the psychological process underlying travel behavior change. The psychological process can shed light on the development of soft measures and on the knowledge of how soft measures influence certain psychological factors that in turn facilitate target behavior change.

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In this vein, previous travel behavior studies based on the theory of planned behavior (TPB) (Ajzen, 1991) or/and the norm-activation model (NAM) (Schwartz, 1977) with motivational mechanisms and beliefs to date have been abundantly accumulated; however, volitional mechanisms after motivation formation but before behavior implementation are less known. This lack has prevented not only travel phenomena from being fully understood but also soft transport measures from developing and expanding. Therefore, the volitional factors that have not been included in the mainstream behavioral theories applied in travel behavior research should be further identified.

To promote behavioral change by appeal to volitional factors in addition to motivational ones, diverse domains of psychology have extended and applied behavioral enaction models (Armitage & Conner, 2000) for addressing intention-behavior relations, particularly for inclined abstainers who fail to act on their positive intention (Orbell & Sheeran, 1998; Sheeran, 2002); for example, in health psychology (Evans, Kawabata, & Thomas, 2015; Gaston & Prapavessis, 2014; Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2012, 2013; Koring et al., 2012; Kreausukon, Gellert, Lippke, & Schwarzer, 2012; Lhakhang, Godinho, Knoll, & Schwarzer, 2014; Wiedemann, Lippke, Reuter, Ziegelmann, & Schwarzer, 2011; Zhang & Cooke, 2012), behavioral medicine (Ghisi, Grace, Thomas, & Oh, 2015; Lourenco, Rodrigues, Spana, Gallani, & Cornelio, 2012), hygiene behavior (Bearth, Cousin, & Siegrist, 2014; Mosler, 2012; Zhou, Jiang, Knoll, & Schwarzer, 2015), and educational psychology (Sanetti, Collier-Meek, Long, Kim, & Kratochwill, 2014). Among those studies, the mental simulations of "action planning" and "coping planning" that have been incorporated into the health action process approach (HAPA) (Schwarzer, 2008), referring to situational parameters during action toward target behavior, have been emphasized as fundamental volitional components that helps people translate intention into action. In addition, implementation intention (Gollwitzer, 1999) as another important volitional construct involves a mental link between specified situations and goal-directed responses, partly overlapped with the concept of action planning. These volitional factors provide VTBC programs and studies with insight into identifying possible volitional determinants.

Hence, it is needed first to review key psychological factors and mechanisms from diverse sub-disciplines of psychology, to reveal the current inadequacies of volitional aspects in investigating VTBC or its programs, including the following items which were discussed below. *1.1. The intention-behavior gap*. The discrepancy between intention to change travel behavior and actual behavior, and the necessity of addressing the potential discrepancy were reviewed. *1.2. Volitional phase of behavior change*. Extending from the intention-behavior gap treatment, the spotlight was directed to volitional mechanisms of behavior change. *1.3. Comparison between implementation intention and action planning*. After finding the possible involved factors from previous theories and studies, the two similar constructs were compared for further application. *1.4. Implementation intention in travel behavior*. Focusing on the transportation field, the function of implementation intention as a volitional construct in travel behavior change was explained. *1.5. Coping planning for deliberate behavior change*. As another volitional construct, coping planning which has been paid little attention in transportation was elucidated and its potential role in travel behavior change was proposed. Through the above review and discussion, *1.6. The present research*, with the aid of previous studies, then built the hypotheses concerning the mechanisms of volitional phase of travel behavior change.

1.1. The intention-behavior gap

In travel behavior research, there have been two widely applied behavioral theories. One is the theory of planned behavior (Ajzen, 1991) about how behavioral intentions to act are formed. The other is the norm-activation model (Schwartz, 1977) and its successors explaining how personal norms are activated and determine pro-social behavior, including voluntary travel behavior change. Therefore, there have been numerous empirical studies based on the norm-activation model, for example, Zhang, Schmocker, Fujii, and Yang (2016) predicting public transport usage, Cools et al. (2011) exploring multiple travel adaptations, and Haustein, Klockner, and Blobaum (2009) additionally incorporating socialization constructs to predict car use. In addition, Bamberg, Hunecke, and Blobaum (2007) and Bamberg and Möser (2007) combined the two above theories which were jointly used to predict public transport use. The common feature among these and other relevant studies (e.g., Kim, Fujii, & Lee, 2013) is that behavioral intention is treated as the most proximal predictor or one of the most proximal predictors of behavior. Namely, no mediator was introduced between behavioral intention and behavior. Thus, the intention-behavior gap (Sheeran, 2002), which involves that people fail to act on their intentions, could not be addressed based on such behavior change processes. This gap has prevented soft transport policy measures from intervening in the post-intentional phase, or called the "volitional phase" of behavior change.

1.2. Volitional phase of behavior change

Aiming at the deficiency present in the volitional phase of behavior change, 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). Another construct is planning, of which the formation could reduce the uncertainty of implementation intention, and thereby planning could be regarded as an essential component of implementation intention; namely, planning might explain how behavioral intentions are put into practice (Gärling & Fujii, 2002).

In a similar vein but more extended, in the health psychology field, the health action process approach (HAPA) (Schwarzer, 2008) has provided a theory framework accommodating a motivational phase and a volitional phase of behavior

change, the latter of which incorporates planning as the mediator between intention to act and action initiative. According to HAPA, the planning construct could be subdivided into two separate factors of mental simulation — action planning and coping planning. This distinction between both planning cognitions could be psychometrically identified (Sniehotta, Schwarzer, Scholz, & Schuz, 2005). Action planning refers to the situational parameters of when, where, and how to perform actions towards target behavior. Coping planning involves both anticipation of potential barriers emerging during performing the actions, and corresponding ideas for overcoming the barriers. Thus, 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 et al., 2012), behavioral medicine (Ghisi et al., 2015), and education (Sanetti et al., 2014), have provided evidence that the intervention targeting action and coping planning could facilitate behavior change.

1.3. Comparison between implementation intention and action planning

It can be identified that implementation intention and action planning share the characteristics of the environmental parameters of when, where, and occasionally how to act. In contrast, the difference between the two constructs can also be found. Implementation intention, by the original definition, is formed in the "if (environmental cue) — then (action/response)" structure embedded in a relatively immediate and automatic process to trigger a simple response. Not necessarily limited to a "if — then" form, action planning is used to focus on the parameters surrounding the action portion with an active manner, instead of on environmental cues and responses to cues with a conditioned manner, in a more deliberate and conscious process to facilitate target behavior (Hagger & Luszczynska, 2014; Pakpour et al., 2011). However, the difference between them is still compatible with the aforementioned view that planning, which aims at action/response portion, is an essential component of implementation intention. Meanwhile, concerning the function, action planning and implementation intention are consistent in reducing the uncertainty of implementing an intention, even if through overlapping but different mechanisms. Thus, the two constructs have been used interchangeably in behavior research depending on the target behavior of interest, and used as the same factor to meta-analyze its effect across diverse behaviors (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011; Belanger-Gravel, Godin, & Amireault, 2013).

1.4. Implementation intention in travel behavior

In travel behavior research, implementation intention is used to represent the concept of action planning, probably because they share the similar function, namely, reducing the uncertainty of implementing an intention. The travel behavior studies considering this function have addressed the intention-behavior relation, despite being fewer in number, by introducing implementation intention. The implementation intentions specifically were measured by the strength of effort to perform a change or the extent of informing oneself of information for a change (Bamberg, 2013; Fujii, 2005; Taniguchi & Fujii, 2007). The empirical evidence has shown that implementation intention appears to mediate between behavioral intention and travel behavior. Following the vein of travel behavior studies, therefore, this research adopts the term "implementation intention" in the succeeding sections to represent the mental simulation of action planning that reduces the uncertainty of implementing a behavioral intention to change travel behavior by specifying the parameters of action (referring to time, places, and means of travel behavior) towards the change.

1.5. Coping planning for deliberate behavior change

Although implementation intention has been considered a volitional construct addressing the intention-behavior gap in travel behavior, there is still room for explaining the efficacy of implementation intention, and for the possibility of other proximal determinants of travel behavior. As a relatively deliberate decision-making process, travel behavior change (e.g., not using a car in a current car trip) relates to other behavior in daily life (e.g., rearrangement of activity time and locations), and involves potential barriers to breaking a travel habit (e.g., activity schedules suddenly altered, or the need for doing errands on the way of travel) or the anticipation of known barriers but without coping ideas. Therefore, subjects who have formed behavioral intention and implementation intention, for example, to reduce car use, may still not act on their intention (Bamberg, 2013). Based on this perspective, a strong construct of coping planning as a cognitive link between anticipated barriers and coping strategy seems to be indispensable for deliberate behavior change, such as dietary habit modification (Godinho, Alvarez, Lima, & Schwarzer, 2014) and teaching behavior change (Sanetti et al., 2014). Hence, facilitating travel behavior change should also consider and examine the role of coping planning in behavior change process and in its association with implementation intention.

1.6. The present research

The present research assumed that travel behavior change comprises a volitional phase. On this view, implementation intention (or action planning) and coping planning as volitional constructs may enable increasing the intention-behavior consistency in travel behavior. Therefore, in addition to "implementation intention" which has been previously introduced

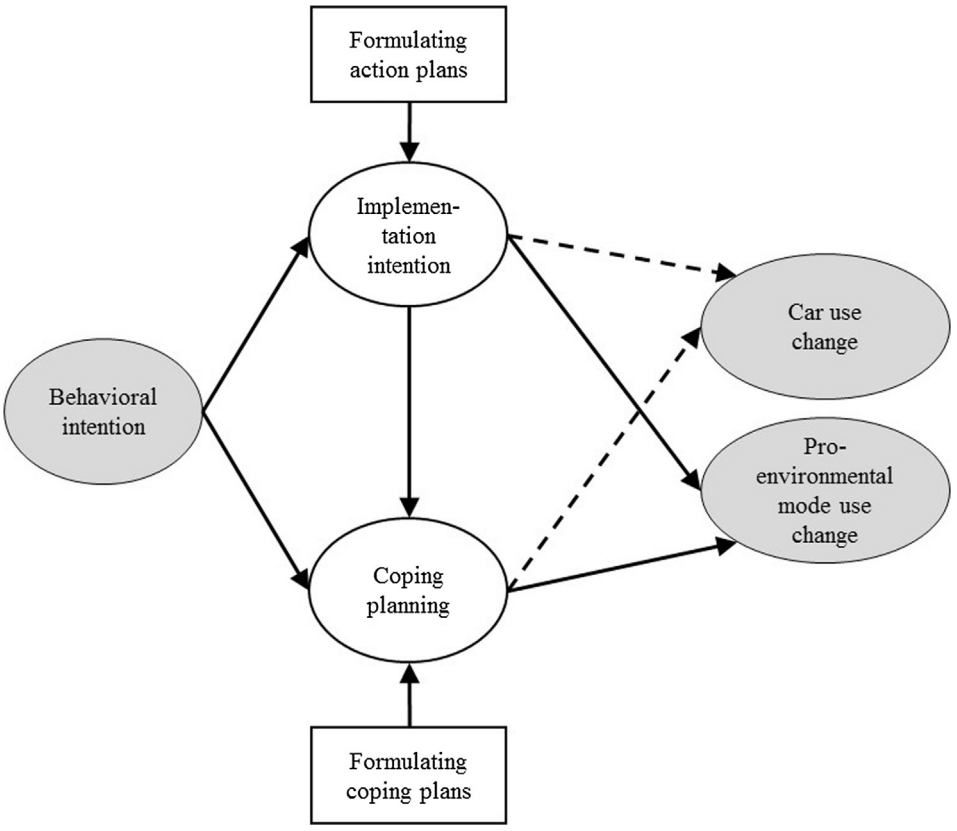

Fig. 1. Proposed hypothesized model. (Solid line denotes an expected positive effect; dotted line denotes an expected negative one.)

in travel behavior studies, the present research aimed to additionally incorporate "coping planning" into the volitional phase of travel behavior change model; and then to investigate the respective roles of the two constructs in behavior change, particularly for how they mediate the effect of behavioral intention on behavior change.

Specifically, this research asserted that behavioral intention is a determinant of implementation intention and of coping planning. The reason for asserting this hypothesis is because behavioral intention has been regarded as the indicator of the transition from a motivational phase to a volitional phase (Schuz, Sniehotta, Mallach, Wiedemann, & Schwarzer, 2009; Schwarzer, 2008); in addition, it is also because behavioral intention has been supported to be a determinant of planning, despite the planning as a single construct without subdivision (Gärling & Fujii, 2002).

Furthermore, the relationship between action planning (or implementation intention) and coping planning in HAPA remains open to debate without stipulating their relationship (Schwarzer, 2008; Schwarzer, Lippke, & Luszczynska, 2011). Correspondingly, empirical studies have demonstrated the discrepancy in this relationship (e.g., Ghisi et al., 2015; Presseau et al., 2014; Scholz, Schuz, Ziegelmann, Lippke, & Schwarzer, 2008; Ziegelmann & Lippke, 2007).[1] Hence, the unclarified relationship may obscure the mechanism of how behavioral intentions are implemented in travel behavior. This research followed the perspective that potential barrier anticipation and coping ideas clearly emerge only when people contemplate the parameters of actions towards goal attainment (Schwarzer, 2008; Sniehotta et al., 2005; Wiedemann, Lippke, Reuter, Ziegelmann, & Schuz, 2011), and thus hypothesized that subjects act on their intention to change travel behavior (namely, to reduce car use and increase pro-environmental mode use) not only through implementation intention or coping planning alone, but also through implementation intention and coping planning in sequence. Specifically, it was hypothesized that coping planning partially mediates the effect of implementation intention on travel behavior change.

Moreover, in VTBC programs, personalized travel plans (PTP) have been shown to be effective (Fujii & Taniguchi, 2005; Meloni et al., 2016). However, the psychological process underlying the effectiveness of the intervention has not been clearly elucidated. Considering this issue in conjunction with the potential roles of planning constructs, this research hypothesized

[1] Action planning and coping planning were regarded as independently mediating between behavioral intention and behavior in Ghisi et al. (2015) and Presseau et al. (2014). The correlation between the two types of planning was assumed and supported in Scholz et al. (2008). Action planning completely mediated the effect of behavioral intention on coping planning, and coping planning partially mediated the effect of action planning on behavior in Ziegelmann and Lippke (2007).

that implementation intention and coping planning can mediate the effect of requesting the PTP containing action plans and coping plans on travel behavior change.

This research aimed at the changes in car use and pro-environmental mode use considered representative of travel behavior, and used empirical data collected from ordinary citizens, to examine the above hypotheses surrounding the functions of implementation intention and coping planning, and to compare the hypothesized model with its possible competing models. The proposed hypotheses could be organized as follows and shown as a structural model in Fig. 1.

Hypothesis 1: Implementation intention mediates the effect of behavioral intention on travel behavior change.
Hypothesis 2: Coping planning mediates the effect of behavioral intention on travel behavior change.
Hypothesis 3: Coping planning partially mediates the effect of implementation intention on travel behavior change.
Hypothesis 4: Implementation intention mediates the effect of formulating action plans on travel behavior change.
Hypothesis 5: Coping planning mediates the effect of formulating coping plans on travel behavior change.

2. Method

2.1. Participants

A total of 163 citizens in Taipei City, Taiwan, were screened and enrolled from 888 citizens by the qualifications for participation (e.g., having access to a car; not being a professional driver) in a web interview, following email invitations sent to 8459 citizens who were randomly chosen from a list composed of partial Taipei citizens provided by a market research company. These enrolled participants answered the first questionnaire on travel behavior self-report and received intervention or no intervention on the internet. Since 42 participants dropped out, the 121 remaining participants as the final sample completed the second questionnaire on travel behavior self-report and on the assessment of psychological factors one month after the first survey (the procedure is further described in detail in Section 2.2). Regarding the characteristics of the participants as the final sample, males accounted for 58%. The participants aged 20–29 accounted for 15%, aged 30–39 for 42%, aged 40–49 for 32%, and aged above 50 for 11%. There were 84% of participants employed or self-employed at workplace, 13% employed or self-employed at home, and 3% accounted for by students. The average one-way travel time of the main trip of the participants was 38 min (*SD* = 25 min). The conditions of survey participation and the distributions of participant characteristics are displayed in Table 1.

2.2. Procedure

The data collection of this research was conducted in two phases. There were the first questionnaire survey and intervention performance in Phase 1. One month later, the second questionnaire survey proceeded in Phase 2. The overall flow of survey is illustrated in Fig. 2. Furthermore, the detailed procedure, the contents of the questionnaires (also see Section 2.3 for questionnaire items), and the intervention are described as below.

Table 1
Conditions of participation and distributions of participant characteristics.

Conditions of participation			Percent of Participants (*N* = 121)
Owning a car or having access to a car owned by others			100%
Not being a professional driver			100%
Having a car driving license			100%
Living in Taipei City from the previous week to the following month			100%
Characteristics	Percent of Participants (*N* = 121)	Characteristics	Percent of Participants (*N* = 121)
Age		Employment status	
20–29	14.9%	Employed at workplace	77.7%
30–39	42.1%	Employed at home	5.8%
40–49	32.2%	Self-employed at workplace	6.6%
50–59	9.1%	Self-employed at home	1.7%
Above 60	1.7%	Student	4.1%
Gender		Homemaker	2.5%
Male	57.9%	Non-working & none of above	1.7%
Female	42.1%	Most frequently used mode	
Monthly income (USD)		Car	34.7%
Less than $300	3.3%	Scooter	32.2%
$300–$749	7.4%	Train	1.7%
$750–$1,499	44.6%	Metro	20.7%
$1500–$2299	29.8%	Bus	4.1%
$2300–$2999	9.1%	Bicycle	1.7%
Above $3000	5.8%	Walking	5.0%
		Main trip travel time on average (one-way)	38 min (SD = 25)

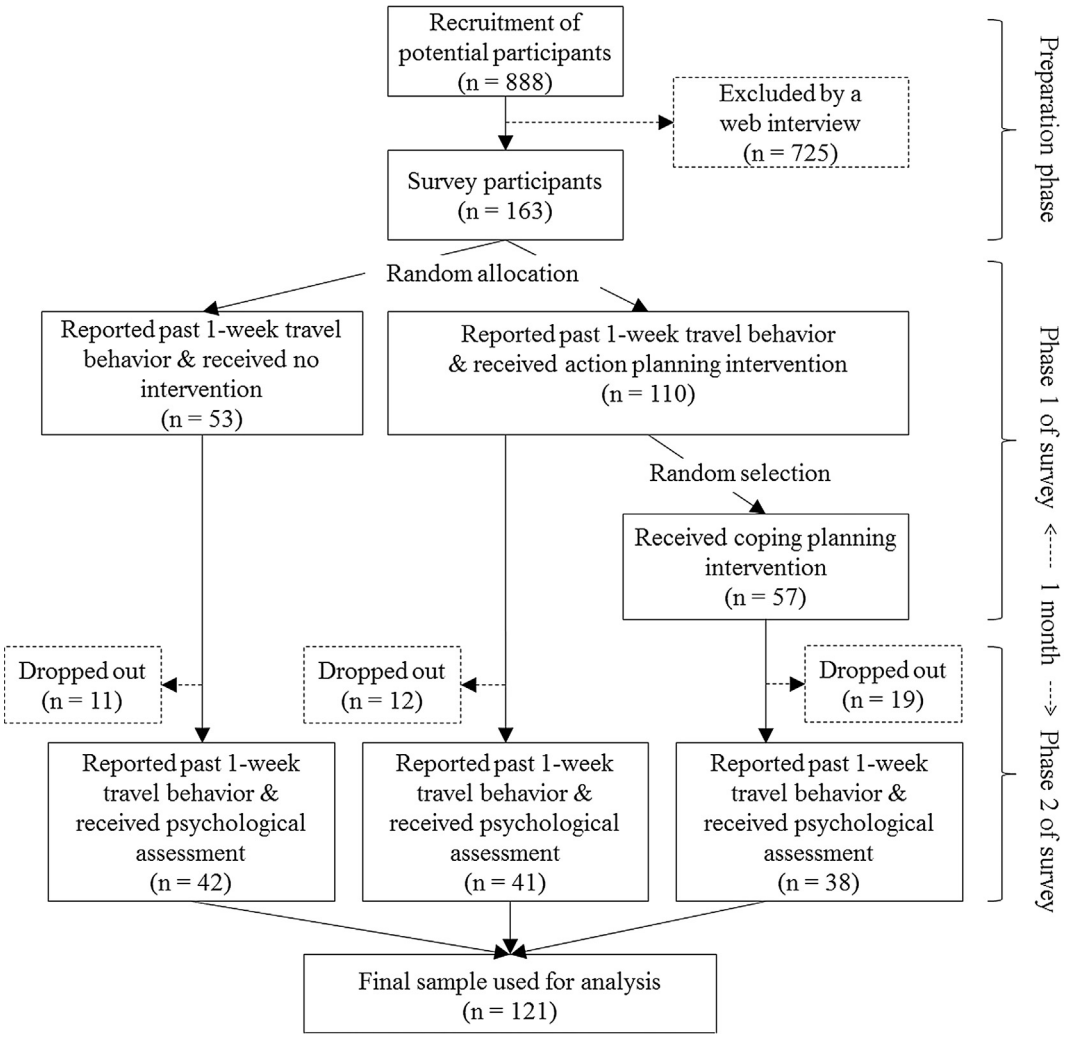

Fig. 2. Flow of preparation phase and two phases of survey.

(1) Phase 1 of survey: behavior report and intervention treatment

In phase 1, the first questionnaire requested the 163 participants to self-report their mode use frequency and duration of intra-city trips for each mode day-by-day over the previous week. The intra-city trip denotes a trip of which both the initial origin and the final destination were within Taipei City.

After the self-report, 110 participants from the 163 participants were randomly assigned to receive the intervention of formulating personalized action plans. These participants followed the procedures below to complete the action plans on switching the travel behavior of one daily round-trip from car to public transport through an internet platform. (1) Reflect on current daily car trips and select one that is most likely to be replaced by public transport. (2) Choose a date within the following month for attempting not to use car in the selected car trip. (3) See the instructions of how to use Google Maps to search public transport modes and arrange schedules for commuting. (4) Search and choose public transport modes for the selected trip by Google Maps or other public transport applications for Taipei City. (5) In the form of action plans, which has included the purpose of the selected trip and the chosen date, note the planned departure time from home for the selected trip. (6) Note the departure time, arrival time, and stations or locations of the chosen public transport modes. (7) Note the expected arrival time to destination. (8) Similarly for the return travel, note the items in the procedures (5)–(7) from destination to home. (9) Download the webpage including the completed form of action plans to a computer or mobile device.

Of the 110 participants who received the action plan intervention, 57 participants were additionally randomly assigned to receive the intervention of formulating personalized coping plans also through the internet platform, immediately after the formation of action plans. To trigger these participants both to contemplate potential barriers to switching from car use to public transport, and to develop ideas for overcoming the barriers, they were requested to follow the steps below. (1) Read a

statement of a potential barrier; there were six potential barriers (Thomas, 2014; Zhang, Stopher, & Halling, 2013) which contained "inflexibility of departure time," "longer commuting time," "difficulty of reaching the places not near a station," "weather interference," "un-freedom of doing other errands on the way," and "inconvenience of carrying things" (regarding the barrier statements, e.g., "... public transport may not allow you freedom to do other errands, such as shopping, on the way to the main destination..."). (2) Read corresponding suggestions on the potential barrier (e.g., choosing shopping places by public transport accessibility). (3) In the form of coping plans, develop one's own ideas or the ideas based on the provided suggestions for overcoming the potential barrier. (4) Repeat the procedures (2)–(3) for each of remaining potential barriers. (5) Note one's own current barriers in the form apart from the potential barriers listed by this research. (6) Repeat the procedure (3) for each of one's own current barriers. (7) Download the webpage including the completed form of coping plans to a computer or mobile device.

(2) Phase 2 of survey: behavior report and psychological assessment

The participants in Phase 1 were invited to attend the survey in Phase 2 one month later. Except for 42 participants who dropped out (including those who did not completely formulate action or coping plans), the remaining 121 participants answered the second questionnaire. The dropout rate of the participants receiving both interventions (33%) was markedly higher than of the participants receiving merely one intervention (22%) or no intervention (21%); therefore, it was worth noting that much burden of travel plan intervention might cause cessation of attempt at travel behavior change. This questionnaire consisted of a travel behavior self-report over the previous week as in Phase 1, and the assessment on behavioral intention, implementation intention, and coping planning. Finally, the participants were asked to provide optional comments on the survey.

2.3. Measures

The constructs used in the behavior change model for volitional phase were assessed by multiple indicator items other than intervention conditions as dummy variables. The measures of the constructs and the specification of the dummy variables are described below and in Table 2.

The assessment of *behavioral intention* involved the intentions to reduce frequency and time of car use, to make an effort to reduce car use, and to think over how to reduce car use. *Implementation intention* was assessed, as a second-order factor, on the extent of informing oneself about the information for specifying time, places, and means to adopt alternatives to car use. Moreover, its four first-order factors: action planning on three public transport modes and walking with divergent measured items were used according to the features of the public transport system in the research area; however, public bicycle was excluded from the first-order factors because not all participants can ride it. *Coping planning* was assessed following the measurement proposed in Hsieh, Kanda, and Fujii (2017), which substituted the domain-specific barrier situations for the previous generalized measures widely used (Schwarzer et al., 2011; Sniehotta et al., 2005), and substituted the form of a ratio, which is the ratio of the extent of coping plans to the perceived degree of barriers, for previously only assessing the extent of coping plans. Regarding *car use*, car use frequency and duration, and the use frequency and duration of each other mode were self-reported for each day over the preceding seven days. Thus, car use frequency share and car use duration share can be calculated as the two measures of car use. Moreover, car use was assessed twice: in Time 1 over seven days before the survey including intervention of Phase 1, and in Time 2 over seven days before the survey of Phase 2. *Pro-environmental mode use* was measured by the aggregates of the use frequency share and the use duration share from train, metro, bus, public bicycle, private bicycle, and walking; and was also assessed twice. *Formulating action plans* and *formulating coping plans* were dummy variables determined by whether a participant received the action plan intervention and the coping plan one, respectively. Table 2 lists in detail the measured items of the above constructs, the number of items, and the psychological scales of the measures.

3. Results

3.1. Preliminary analysis

The means, standard deviations, Cronbach's alphas, and factor analyses for each construct are presented in Table 3. For reliability by alpha, each construct met the criteria for a satisfactory internal consistency among measures. Concerning travel behavior change in means (which are available given alphas) before and after intervention, the mean of car use decreased after intervention, and the mean of pro-environmental mode use increased. The two preliminary tendencies agreed with the expectation of performing interventions. To further examine the heterogeneous scales of constructs, confirmatory factor analysis (CFA) was employed for each psychological construct. The result showed that all the factor loadings were significant for the constructs with multiple indicators. In addition, composite reliability and average variance extracted of the constructs were higher than the criteria (>0.6 and >0.5, respectively). Thus, the indicators within a construct could reflect a common concept, and the variances in the indicators were explained by their own construct more than measurement errors. Thus, these indicators were used for their respective constructs in the following correlation analysis and path analysis.

Table 2
Constructs/variables, measures, and scale.

Construct/variable	Measured items	Psychological scale
Behavioral intention (4 items)	1. "I intend to reduce car use frequency" 2. "I intend to reduce car use time" 3. "I think over how to reduce car use as far as possible" 4. "I intend to make an effort to reduce car use"	1 (strongly disagree) to 7 (strongly agree)
Implementation intention (second-order factor) (12 items)	Action planning on train use (first-order factor): "Assuming that you are planning to use train in some trips instead of your car, do you know . . ." 1. ". . . how to search train schedules?" 2. ". . . how to check required travel time by train?" 3. ". . . how to check train station locations?" Action planning on metro use (first-order factor): "Assuming that you are planning to use metro in some trips instead of your car, do you know . . ." 4. ". . . how to search metro schedules?" 5. ". . . how to check required travel time by metro?" 6. ". . . how to check metro station locations?" 7. ". . . how to check whether to transfer to other metro lines?" Action planning on bus use (first-order factor): "Assuming that you are planning to use bus in some trips instead of your car, do you know . . ." 8. ". . . how to search bus schedules?" 9. ". . . how to check required travel time by bus?" 10. ". . . how to check bus stop or station locations?" 11. ". . . how to check whether to transfer to other bus lines?" Action planning on walking (first-order factor): "Assuming that you are planning to use walking in some trips instead of your car, do you know . . ." 12. ". . . how to check required travel time by walking?"	1 (no, not at all) to 7 (yes, exactly)

Construct/variable	Measured items	Psychological scale
Coping planning (12 items)	(a) "When you use public transport, (*the detailed statement of the potential barrier*). Could (*the potential barrier*) be a barrier if you switch from car use to public transport?" (b) "Is it easy for you to overcome (*the potential barrier*)?" 1. (b) divided by (a), for the potential barrier "inflexibility of departure time" 2. (b) divided by (a), for the potential barrier "longer commuting time" 3. (b) divided by (a), for the potential barrier "difficulty of reaching the places not near a station" 4. (b) divided by (a), for the potential barrier "weather interference" 5. (b) divided by (a), for the potential barrier "un-freedom of doing other errands on the way" 6. (b) divided by (a), for the potential barrier "inconvenience of carrying things"	(a): 1 (no, not at all) to 7 (yes, largely) (b): 1 (very difficult) to 7 (very easy)
Past car use (in Time 1) (2 items)	1. Car use frequency share over the previous seven days reported before intervention 2. Car use duration share over the previous seven days reported before intervention	—
Current car use (in Time 2) (2 items)	1. Car use frequency share over the previous seven days reported one month after intervention 2. Car use duration share over the previous seven days reported one month after intervention	—
Past pro-environmental mode use (in Time 1) (2 items)	1. Pro-environmental mode use frequency share over the previous seven days reported before intervention 2. Pro-environmental mode use duration share over the previous seven days reported before intervention	—
Current pro-environmental mode use (in Time 2) (2 items)	1. Pro-environmental mode use frequency share over the previous seven days reported one month after intervention 2. Pro-environmental mode use duration share over the previous seven days reported one month after intervention	—
Formulating action plans	Dummy variable (1 = formulating action plans; 0 = not)	—
Formulating coping plans	Dummy variable (1 = formulating coping plans; 0 = not)	—

Note: Behavioral intention, implementation intention, and coping planning were assessed at the time point one month after intervention.

The correlation analysis of constructs and variables is displayed in Table 4. Behavioral intention, implementation intention, and coping planning as the three potential psychological determinants of travel behavior showed significant correlations with current car use and pro-environmental mode use. While this result implied that these determinants may impact on current travel behavior, their roles in behavior change needed to be further confirmed with simultaneously

Table 3
Descriptive statistics and confirmatory factor analysis.

Variable	M	SD	Alpha	Factor loadings of CFA						Composite reliability	Average variance extracted
				Indi. 1[a]	Indi. 2	Indi. 3	Indi. 4	Indi. 5	Indi. 6		
Psychological construct											
BI	4.86	1.54	0.98	0.96	0.97[†]	0.95[†]	0.95[†]			0.98	0.92
II	5.11	1.21	0.94	0.77	0.84[†]	0.79[†]	0.75[†]			0.87	0.62
AP_train	5.24	1.44	0.88	0.88	0.87[†]	0.80[†]				0.89	0.72
AP_metro	5.45	1.40	0.94	0.91	0.97[†]	0.82[†]	0.86[†]			0.94	0.80
AP_bus	4.78	1.36	0.93	0.92	0.95[†]	0.77[†]	0.85[†]			0.93	0.77
AP_walk	4.62	1.68	—	1.00						—	—
CP	1.13	0.75	0.88	0.81	0.72[†]	0.92[†]	0.60[†]	0.82[†]	0.68[†]	0.89	0.59
Behavioral construct[b]											
P_Car use	0.44	0.44	0.98	—	—						
C_Car use	0.31	0.33	0.97	—	—						
P_PEM use	0.38	0.40	0.97	—	—						
C_PEM use	0.42	0.35	0.96	—	—						

Note: BI = behavioral intention; II = implementation intention; AP_train = action planning on train use; AP_metro = action planning on metro use; AP_bus = action planning on bus use; AP_walk = action planning on walking; CP = coping planning; P_Car use = past car use; C_Car use = current past car use; P_PEM use = past pro-environmental mode use; C_PEM use = current pro-environmental mode use.

[a] The unstandardized factor loading of the first indicator was constrained to 1 as a reference item, and thereby, other factor loadings of remaining indicators within a construct can then be estimated given the constraint.

[b] The behavioral constructs cannot be individually analyzed by CFA owing to under-identification given only two indicators.

[†] $p < 0.01$.

Table 4
Correlations of constructs and intervention dummies.

	BI	II	CP	P_Car use	C_Car use	P_PEM use	C_PEM use	F_APs	F_CPs
BI	1.00								
II	0.45***	1.00							
CP	0.59***	0.42***	1.00						
P_Car use	−0.14	−0.18*	−0.10	1.00					
C_Car use	−0.32***	−0.28***	−0.26**	0.31***	1.00				
P_PEM use	0.16*	0.15	0.18*	−0.46***	−0.16*	1.00			
C_PEM use	0.23**	0.33***	0.31***	−0.11	−0.50***	0.19**	1.00		
F_APs	0.11	0.24**	0.20**	−0.28***	−0.19**	−0.18**	0.02	1.00	
F_CPs	0.23**	0.15	0.44***	−0.07	−0.25***	0.06	0.16*	0.49***	1.00

Note: BI = behavioral intention; II = implementation intention; CP = coping planning; P_Car use = past car use; C_Car use = current car use; P_PEM use = past pro-environmental mode use; C_PEM use = current pro-environmental mode use; F_APs = formulating action plans (dummy); F_CPs = formulating coping plans (dummy).

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

considering their relations with one another, as discussed in the path analysis below. In addition, current car use and pro-environmental mode use were, respectively, significantly correlated with their past one. The two correlations might reflect the stability of travel behavior over one month even though the interventions had been performed. Moreover, there were two significant correlations between intervention conditions and corresponding target planning constructs, namely, between formulating action plans and implementation intention, and between coping plans and coping planning. In addition, in the relations of the intervention conditions with the remaining determinants of behavior, there was a significant correlation between formulating action plans and coping planning. This effect might result from the relationship that implementation intention, which enhanced by formulating action plans, influences coping planning; this relationship was contained in Hypothesis 3 proposed above. Notably, there was a significant correlation between formulating coping plans and behavioral intention. Thus, in the further path analysis, the effect of formulating coping plans on behavioral intention was additionally explored based on the proposed hypotheses.

3.2. Path analysis

Structural equation modeling was used to simultaneously estimate the path coefficients among the constructs and the intervention conditions. The paths were specified as in Fig. 3 according to the proposed hypotheses. In addition to the hypothesized model, three competing models based on the associations between behavioral intention and behavior in past research were also estimated to perform model comparisons. Specifically, competing model 1 (Fig. 4) considered that

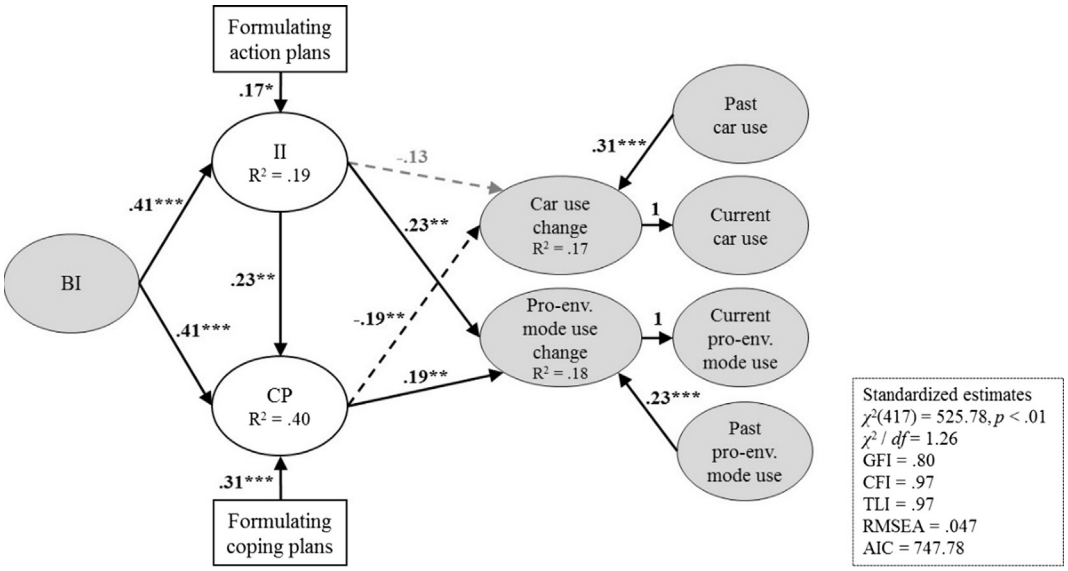

Fig. 3. Hypothesized model: implementation intention and coping planning as complete mediators between behavioral intention and behavior change. (BI = behavioral intention; II = implementation intention; CP = coping planning. Solid line denotes a positive effect; dotted line denotes a negative one; gray line shows an insignificant influence. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$. These notes are also for Figs. 4–7).

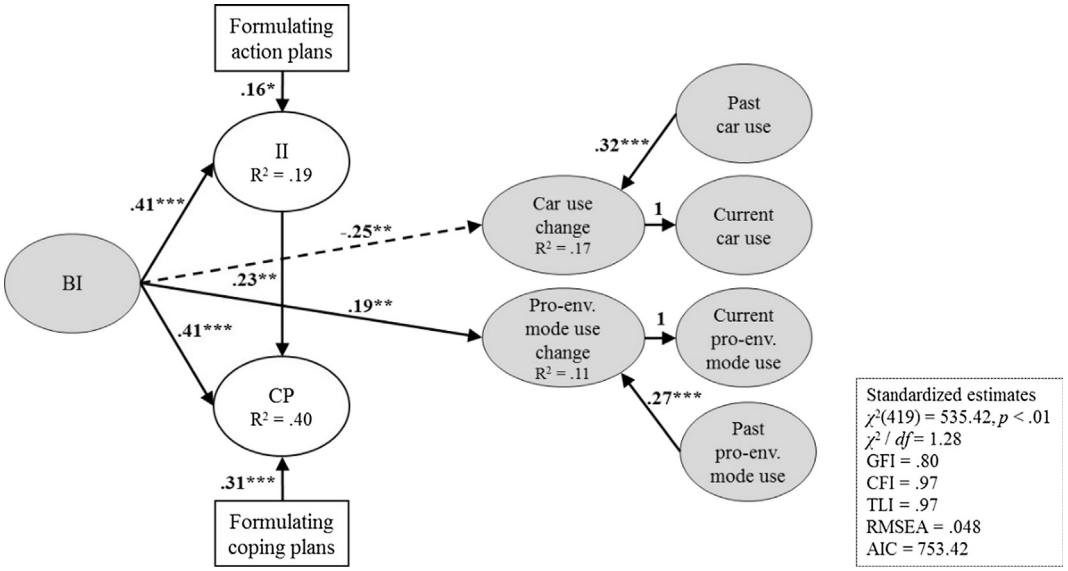

Fig. 4. Competing model 1: behavioral intention as the only proximal determinant of behavior change.

behavioral intention proximally predicts behavior change without the mediations of implementation intention and coping planning (Bamberg et al., 2007; Cools et al., 2011; Haustein et al., 2009; Kim et al., 2013; Zhang et al., 2016). Competing model 2 (Fig. 5) additionally considered that implementation intention mediates the effect of behavioral intention on behavior change (Bamberg, 2013); this mediation was set to be partial to observe the change in the association between behavioral intention and behavior change. Moreover, competing model 3 (Fig. 6) additionally allowed for coping planning to be another partial mediator between behavioral intention and behavior change, but remained behavioral intention proximally predicting behavior change. Namely, from competing model 1 to competing model 3, there ranged from a more constrained model to a less constrained one by freeing the paths that were constrained to 0 in the preceding competing model. Furthermore, a modified model (Fig. 7) was also estimated to incorporate the potential influence of formulating coping plans on behavioral intention into the hypothesized model.

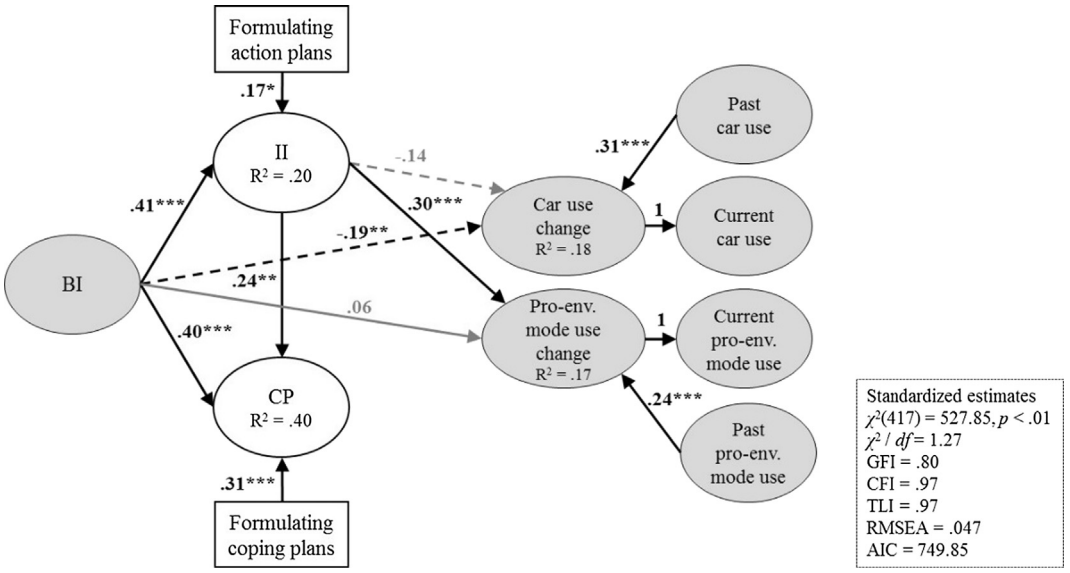

Fig. 5. Competing model 2: implementation intention as a partial mediator between behavioral intention and behavior change.

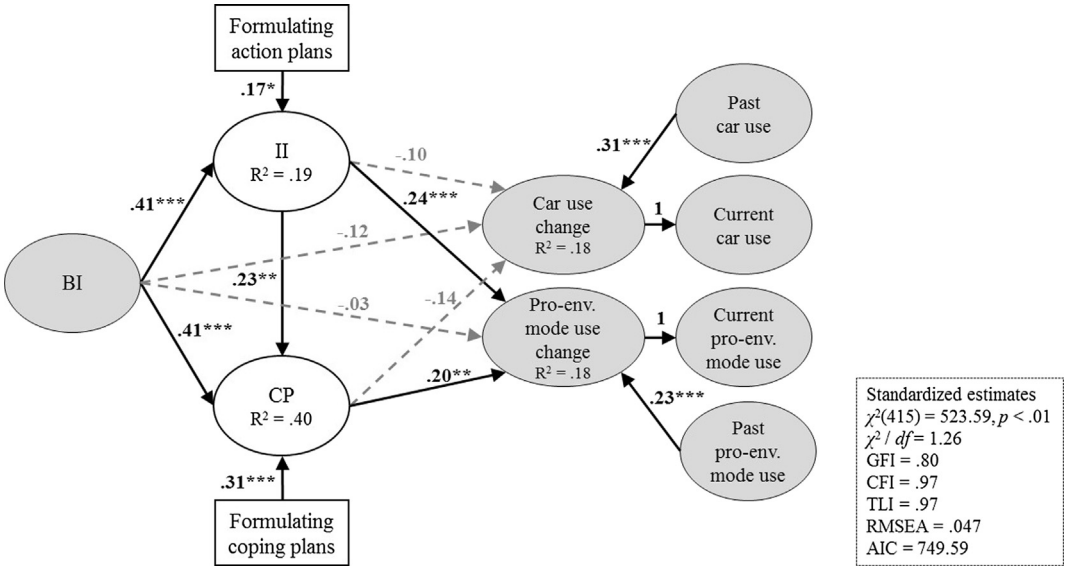

Fig. 6. Competing model 3: implementation intention and coping planning as partial mediators between behavioral intention and behavior change.

To represent the concept of behavior change, the two constructs *car use change* and *pro-environmental mode use change* were created as the dependent constructs in all the models; instead of using the difference in the means of behavior between two time points that may cause errors arising from different numbers of trips among participants. Both the constructs were set to receive the influence of respective past travel behavior, and to completely reflect respective current travel behavior (namely, fixing the parameters at 1).

To evaluate the overall fits of the models, multiple fit indices were adopted aside from χ^2 test which is sensitive to sample size and the degree of freedom (Rigdon, 1995). The adopted indices included χ^2/df (which should fall in the range from 1 to 2); GFI, the goodness-of-fit index; CFI, the comparative fit index; TLI, the Tucker-Lewis index (the criteria of the three indices: ≥ 0.9); and RMSEA, the root mean square error of approximation (which should be lower than 0.8). Moreover, to compare the fits between the models, the Akaike information criterion (AIC) of which the lower value indicates a better and more parsimonious fit was used, and chi-square difference tests were conducted.

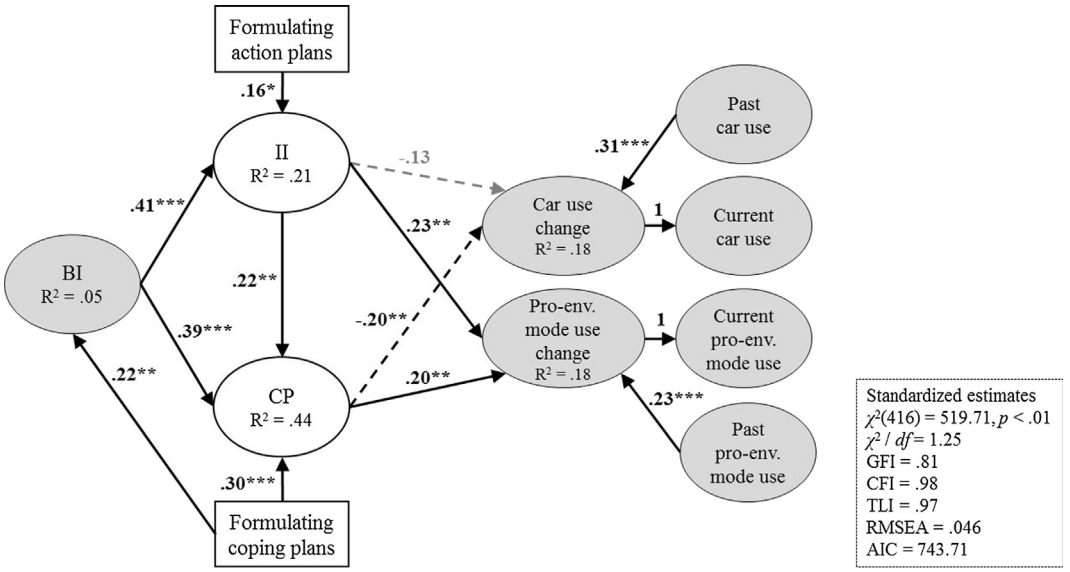

Fig. 7. Modified model: behavioral intention enhanced by formulating coping plans.

3.2.1. Hypothesized model: implementation intention and coping planning as complete mediators between behavioral intention and behavior change

In the hypothesized model, implementation intention and coping planning were treated as the two complete, sequential mediators between behavioral intention and behavior change (Fig. 3). Namely, all the effect of behavioral intention on behavior change was hypothesized to be mediated by implementation intention, coping planning, and the two constructs in sequence. This model exhibited an acceptable fit with $\chi^2/df = 1.26$, CFI = 0.97, TLI = 0.97, and RMSEA = 0.047, except GFI = 0.80 did not meet the criterion (Table 5).

Table 5
Estimation results of path analysis.

Path			Hypothesized model	Competing model 1	Competing model 2	Competing model 3	Modified model
			Standardized coefficients				
BI	⇒	II	0.41***	0.41***	0.41***	0.41***	0.41***
BI	⇒	CP	0.41***	0.41***	0.40***	0.41***	0.39***
BI	⇒	Car use_BC	—	−0.25**	−0.19**	−0.12	—
BI	⇒	PEM use_BC	—	0.19**	0.06	0.03	—
II	⇒	CP	0.23**	0.23**	0.24**	0.23**	0.22**
II	⇒	Car use_BC	−0.13	—	−0.14	−0.10	−0.13
II	⇒	PEM use_BC	0.23**	—	0.30***	0.24***	0.23**
CP	⇒	Car use_BC	−0.19**	—	—	−0.14	−0.20**
CP	⇒	PEM use_BC	0.19**	—	—	0.20**	0.20**
F_APs	⇒	II	0.17*	0.16*	0.17*	0.17*	0.16*
F_CPs	⇒	CP	0.31***	0.31***	0.31***	0.31***	0.30***
F_CPs	⇒	BI	—	—	—	—	0.22**
P_Car use	⇒	Car use_BC	0.31***	0.32***	0.31***	0.31***	0.31***
P_PEM use	⇒	PEM use_BC	0.23***	0.27***	0.24***	0.23***	0.23***
N			121	121	121	121	121
χ^2 (*df*)			525.78 (417)	535.42 (419)	527.85 (417)	523.59 (415)	519.71 (416)
χ^2 test			$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$
χ^2/df			1.26	1.28	1.27	1.26	1.25
GFI			0.80	0.80	0.80	0.80	0.81
CFI			0.97	0.97	0.97	0.97	0.98
TLI (NNFI)			0.97	0.97	0.97	0.97	0.97
RMSEA			0.047	0.048	0.047	0.047	0.046
AIC			747.78	753.42	749.85	749.59	743.71

Note: BI = behavioral intention; II = implementation intention; CP = coping planning; Car use_BC = car use change; PEM use_BC = pro-environmental mode use change; F_APs = formulating action plans; F_CPs = formulating coping plans; P_Car use = past car use; P_PEM use = past pro-environmental mode use.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

According to the estimation results (Table 5), behavioral intention had strong direct influences on both volitional constructs. Implementation intention impacted directly on pro-environmental mode use change, and indirectly on car use change through the mediation of coping planning. In contrast, coping planning directly impacted on both behavior changes. In addition, formulating action plans and formulating coping plans respectively influenced implementation intention and coping planning, which in turn influenced behavior changes. Based on these results, Hypothesis 2, 3, and 5 were supported, whereas Hypothesis 1 was not fully supported because the mediation of implementation intention between behavioral intention and car use change was dependent on coping planning. Similarly for Hypothesis 4, the effect of formulating action plans on car use change relied on the "sequential mediation of implementation intention and coping planning." In general, the hypothesized model could elucidate how behavioral intention to change behavior is implemented by implementation intention and coping planning, and account for implementation intention effects on behavior change.

3.2.2. Competing model 1: behavioral intention as the only proximal determinant of behavior change

The competing model 1 treated behavioral intention as the only proximal determinant of behavior change (Fig. 4). The paths from volitional constructs to behavior change were constrained to 0. The overall model fit was as follows: $\chi^2/df = 1.28$, GFI = 0.80, CFI = 0.97, TLI = 0.97, and RMSEA = 0.048. In this model, behavioral intention had significant effects on car use change and pro-environmental mode use change. However, this model showed a markedly lower explained variance in pro-environmental mode use change (11%) compared to the hypothesized model (18%).

3.2.3. Competing model 2: implementation intention as a partial mediator between behavioral intention and behavior change

In the competing model 2 (Fig. 5), implementation intention as a partial mediator between behavioral intention and behavior change was considered following the competing model 1. The overall model fit was as follows: $\chi^2/df = 1.27$, GFI = 0.80, CFI = 0.97, TLI = 0.97, and RMSEA = 0.047. The direct effect of behavioral intention on pro-environmental mode use change, which was significant in the competing model 1, turn to be insignificant with a marked decrease in the coefficient (from $\beta = 0.19$, $p = 0.03$; to $\beta = 0.06$, $p = 0.50$). Moreover, the direct effect of behavioral intention on car use change decreased compared to the competing model 1 but still remained significant. The results implied that implementation intention may function mainly in mediating between behavioral intention and pro-environmental mode use change, and that implementation intention alone may not sufficiently bridge the intention-behavior gap in travel behavior.

3.2.4. Competing model 3: implementation intention and coping planning as partial mediators between behavioral intention and behavior change

In addition to implementation intention, coping planning was treated as another mediator in competing model 3 (Fig. 6), of which the overall model fit was as follows: $\chi^2/df = 1.26$, GFI = 0.80, CFI = 0.97, TLI = 0.97, and RMSEA = 0.047. With the additional mediation of coping planning, all the path coefficients from behavioral intention and from implementation intention to behavior change, decreased when compared to the competing model 2. Notably, behavioral intention no longer significantly directly predicted behavior change. However, with specifying behavioral intention as a proximal determinant of behavior change, the influence of behavioral intention on car use change could not be mediated in this model. By contrast, the hypothesized model treating behavioral intention as a distal determinant explained that behavioral intention to reduce car use is put into action by planning constructs.

3.2.5. Modified model: behavioral intention enhanced by formulating coping plans

A model modified based on the hypothesized model was estimated to test the effect of formulating coping plans on behavioral intention (Fig. 7). This modified model showed the overall model fit with $\chi^2/df = 1.25$, GFI = 0.81, CFI = 0.98, TLI = 0.97, and RMSEA = 0.046. Moreover, the variance in coping planning was explained for 44% higher than the other models. The estimation result exhibited a significant influence of formulating coping plans on behavioral intention. Thus, coping plan intervention effects were mediated by behavioral intention not only on coping planning, but also on implementation intention. The intervention effect on behavioral intention and its successive impacts may partly explain the reason why coping plan interventions are often more effective than action plan ones in health psychology research (Schwarzer, 2008).

3.3. Model comparison

The above estimated models were compared by goodness of fit and chi-square difference analysis to determine a better model of the volitional phase of travel behavior change. In Table 5, these models exhibited a close fit in both absolute fit measures (GFI, RMSEA) and incremental fit measures (CFI, TLI). In AIC as a parsimonious fit measure, the modified model, followed by the hypothesized one, showed a lower value which denotes that a reduced chi-square value by increasing estimated parameters is acceptable in parsimony. To further contrast these models, the chi-square difference analysis was conducted (Table 6). The hypothesized model was better than the competing model 1 and 2, but did not significantly differ from the competing model 3. In contrast, the modified model was determined a better model than the other models in terms of this analysis.

Table 6
Goodness of fit comparison between models by chi-square difference analysis.

	Hypothesized model χ^2 (*df*) = 525.78 (417)	Competing model 1 χ^2 (*df*) = 535.42 (419)	Competing model 2 χ^2 (*df*) = 527.85 (417)	Competing model 3 χ^2 (*df*) = 523.59 (415)	Modified model χ^2 (*df*) = 519.71 (416)
Hypothesized model χ^2 (*df*) = 525.78 (417)	—				
Competing model 1 χ^2 (*df*) = 535.42 (419)	$\Delta\chi^2$ (2) = 9.64*** HM better than CM1	—			
Competing model 2 χ^2 (*df*) = 527.85 (417)	HM better than CM2	$\Delta\chi^2$ (2) = 7.57** CM2 better than CM1	—		
Competing model 3 χ^2 (*df*) = 523.59 (415)	$\Delta\chi^2$ (2) = 2.19, ns	$\Delta\chi^2$ (4) = 11.83** CM3 better than CM1	$\Delta\chi^2$ (2) = 4.26, ns	—	
Modified model χ^2 (*df*) = 519.71 (416)	$\Delta\chi^2$ (1) = 6.07** MM better than HM	$\Delta\chi^2$ (3) = 15.71*** MM better than CM1	$\Delta\chi^2$ (1) = 8.14*** MM better than CM2	MM better than CM3	—

Note: HM = hypothesized model; CM1 = competing model 1; CM2 = competing model 2; CM3 = competing model 3; MM = modified model.
** $p < 0.05$.
*** $p < 0.01$; ns: not significant.

3.4. Comparison to Bamberg's (2013) work

The main interest of Bamberg (2013), concerned with stage transitions from the initial predecision to the final postaction of travel behavior change process, differs from the present research, whereas the two cases share several features. That work modeling the behavior change process for car and public transport use also incorporated implementation intention, predicted by behavioral intention, as a proximal determinant of behavior. Although that work and the present research differ in the measures of implementation intention, both represent the similar concept of implementation intention that involves informing oneself about necessary details for action. Meanwhile, the two cases share the similar target behavior, for which, despite a slight difference from public transport use, the present research adopted pro-environmental mode use considering the widespread bicycle use in Taipei City. Based on the similarities, the actional and postactional stages in that work could be analogous to the volitional phase in the present research. Thus, the comparison in the volitional phase could be conducted, to reveal, by another approach aside from the preceding analysis, the function of coping planning as an additional proximal determinant of behavior.

Concerning similar results, the present research corresponds with Bamberg's work in the path from implementation intention to car use, indicating the insignificant effect (see Table 7). In addition, both cases reported a significant influence of action planning on pro-environmental mode use (or public transport use). For dissimilar results, there was no significant effect of behavioral intention on car use in Bamberg's work, whereas in the present research the effect of behavioral intention on car use could be found through the mediations of "coping planning" (−0.078) and of "action planning and coping planning in sequence" (−0.018). Furthermore, the present research indicated a larger total effect of behavioral intention on pro-environmental mode use (0.190) with the additional mediation of coping planning, compared to that work with the single

Table 7
Comparison to Bamberg (2013).

	Bamberg (2013)	The present research[#]
Implementation intention ⇒ Car use	Standardized coefficient: −0.05, $p > 0.05$	Standardized coefficient: −0.13, $p > 0.05$
Implementation intention ⇒ Pro-environmental mode use (or public transport use)	Standardized coefficient: 0.15**, $p < 0.05$	Standardized coefficient: 0.23**, $p < 0.05$
Effect of behavioral intention on car use[†]	Total effect: 0	Total effect: −0.096 Indirect effect through Implementation intention: 0 Coping planning: −0.078 Implementation intention and coping planning in sequence: −0.018
Effect of behavioral intention on pro-environmental mode use (or public transport use)[†]	Total effect: 0.077 Indirect effect through Implementation intention: 0.077	Total effect: 0.190 Indirect effect through Implementation intention: 0.094 Coping planning: 0.078 Implementation intention and coping planning in sequence: 0.018
Explained variance in car use	$R^2 = 0.12$	$R^2 = 0.18$
Explained variance in pro-environmental mode use (or public transport use)	$R^2 = 0.08$	$R^2 = 0.18$

Note:
[#] The values of coefficients and explained variances adopt the estimation of the modified model in the present research.
[†] The effect counts the paths with *p*-values less than 0.05, and is shown in a standardized form.

mediation of implementation intention (0.077). The differences in the effects on behavior may imply the importance of coping planning mediating the effects not only of behavioral intention but also of implementation intention on behavior. Finally, the model of the present research exhibited the higher explained variances in car use and pro-environmental mode use. This result might relate to the mediations of the two volitional constructs, and the longitudinal data including past behavior as the predictors of current behavior in the present research.

4. Discussion

4.1. Conclusions and implications

It was known that implementation intention (or action planning) is mediating the effect of behavioral intention on travel behavior, such as public transport use (Bamberg, 2013), car use reduction (Taniguchi & Fujii, 2007), and bicycle parking behavior modification (Fujii, 2005). However, the present research found that coping planning is further mediating the effect of implementation intention on travel behavior change. Specifically, it was empirically indicated that behavioral intention influences implementation intention, which in turn influences coping planning, which in turn influences behavior changes in car use reduction and pro-environmental mode use increase. Apart from these influences, this research also found significant direct paths from behavioral intention to coping planning for both behavior changes, and from implementation intention to pro-environmental mode use increase. These findings indicated that behavioral intention had a direct effect on coping planning in addition to an indirect effect mediated by implementation intention; and implementation intention had a direct effect on behavior change in addition to an indirect effect mediated by coping planning. However, further empirical and theoretical research is needed for understanding these additional statistical results.

These findings also shed light on soft transport strategies intervening in behavior change process. The volitional strategy, such as personalized action and coping plans applied in this research, aiming at volitional factors could be further examined and extended, in addition to the motivational strategy more frequently applied in previous VTBC programs (Fujii & Taniguchi, 2006). Moreover, this research suggested that formulating coping plans on identifying and overcoming barriers may enhance behavioral intention. The finding probably explains why coping plan intervention is often regarded as more effective than action plan intervention (Schwarzer, 2008).

Through this research, the divergent functions of implementation intention and coping planning in travel behavior change could be implied. Specifically, implementation intention had direct impact on increasing pro-environmental mode use, namely, triggering attempts at infrequently used modes in daily commuting. Thus, enhancing implementation intention may be conducive to "action initiative" in travel behavior. However, enhancing it may reduce car use as habitual behavior only through the facilitation of coping planning, whereas facilitating coping planning itself could lead to reducing car use and increasing pro-environmental mode use. Thus, facilitating coping planning appears to be conceive to both "action initiative" and "habit breaking" in travel behavior. This perspective corresponds to the studies that treat implementation intention (or action planning) as conducive to short-term behavioral adoption, and coping planning as beneficial for long-term behavioral maintenance (Sniehotta et al., 2006; Ziegelmann et al., 2006); and that view implementation intention and coping planning as different but complementary roles in goal pursuit (Carraro & Gaudreau, 2015). However, this perspective in the travel behavior domain needs more empirical evidence.

In general, for behavior change theories, this research with the incorporation of coping planning into the behavior change model elucidated how implementation intention, previously applied in diverse areas for facilitating automatic and deliberate behavior, functions in behavior change, and meanwhile clarified its association with coping planning. In addition, for VTBC program practice, the elucidation of the effects of personalized action and coping plans on the volitional phase expanded the psychological foundation for PTP intervention.

4.2. Limitations and future research

This research will provide insight into the volitional phase of travel behavior change, whereas the validity of the findings, and the relations with other behavioral theories and cognitive constructs need future research to clarify. For example, the effects of implementation intention and coping planning formations on a more longitudinal travel behavior change are worth tracking and comparing with other types of VTBC programs. In addition, there is still room for improving the volitional phase model in this research. For one reason, not all representative model fit indices were satisfactory. For another more fundamental reason, there may be other constructs functioning in the volitional phase, one set of which is probably self-efficacy (Bandura, 1997). This concept refers to the beliefs in one's own capabilities, mainly derived from mastery experiences and social persuasion, to organize and execute the courses of action. It has been further divided into three constructs: task (for a preparation state), maintenance (for an initial action state), and recovery self-efficacies (for a cycling between action and relapse). These self-efficacies seem to function in different sub-phases of volitional phase, demanding different practical exercise and attempts (Bandura, 1997; Schwarzer et al., 2011). Hence, aside from planning constructs, the self-efficacies might be the other volitional determinants of travel behavior change; particularly to, for instance, the category of commuters whose daily trips have been deadlocked in a single pattern for a long term without believing that changing

their own travel behavior is possible. Hence, future research should consider the possibility that other volitional constructs function in the volitional phase of travel behavior change.

Furthermore, an obvious weakness of this research, in terms of a complete behavior change process, is that a motivational phase was not included in analysis and modeling. Travel behavior change process in future research should additionally incorporate the important motivational constructs explicitly identified by previous research (Bamberg et al., 2007; Cools et al., 2011; Haustein et al., 2009; Nordlund & Garvill, 2003; Zhang et al., 2016). This consideration is not only to illustrate a complete behavior change process, but to clarify the relationships between motivational and volitional constructs. To date there have been rare cases integrating motivational and volitional phases in travel behavior research. One such case is Bamberg (2013) in which the motivational phase involving behavioral intention formation was clearly disclosed, whereas the volitional phase relatively needed more discussion. In this vein, the present research could be a complement to the previous uncovered portion. Hence, based on the present and previous research, future investigation should pay further attention to both motivational and volitional constructs and their associations, to facilitate the understanding of travel behavior change mechanisms and to underlie the foundation of soft transport policy measures.

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