

## Influences of perceived autonomy support on physical activity within the theory of planned behavior

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### Abstract

*Three studies tested the contribution of perceived autonomy support to the prediction of health-related intentions within the theory of planned behavior. Perceived autonomy support refers to the extent to which individuals perceive that significant others encourage choice and participation in decision-making, provide a meaningful rationale, minimize pressure, and acknowledge the individual's feelings and perspectives. Findings from Studies 1 and 2 demonstrated that perceived autonomy support predicted intentions to participate in physical activity behavior directly and indirectly via attitudes. Perceived autonomy support predicted intention even after statistically controlling for the effects from past behavior, descriptive norms, and perceived social support. Study 3 found that persuasive communications influenced perceptions of autonomy support, attitudes, and intentions. Overall, the findings support the incorporation of perceived autonomy support into the theory of planned behavior. Copyright © 2006 John Wiley & Sons, Ltd.*

Despite the considerable amount of research aimed at understanding the low levels of adherence to health behaviors, social psychologists confess to having limited knowledge of the mechanisms responsible for compliance (Haynes, McDonald, Garg, & Montague, 2003). Thus, there is still a need for theoretically guided research that furthers researchers' and practitioners' grasp of the nature of adherence to health behaviors. The theory of planned behavior is a social cognitive model of decision-making that provides a useful framework for predicting and explaining health behavior (Ajzen, 1991).

### THEORY OF PLANNED BEHAVIOR

According to the theory of planned behavior, optimal prediction of behavior can be attained from a person's intention, which is an indicator of how hard people are willing to try, and how much effort

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people plan to exert toward performance of behavior (Ajzen, 1991). Intention is in turn function of attitudes (a person's positive or negative evaluation of performing the behavior), subjective norms (an individual's belief that significant others may exert pressure on them to execute the behavior), and perceived behavioral control (the extent to which people believe that they can control performance of social behavior). According to Ajzen, the construct of perceived behavioral control can also predict behavior directly when behavior is not under complete volitional control and when perceived behavioral control is accurate in a sense that it reflects actual control.

Assumptions underlying the theory of planned behavior have been corroborated by numerous meta-analytic reviews across a number of different social behaviors (Armitage & Conner, 2001) and health behaviors (Hagger, Chatzisarantis, & Biddle, 2002). Indeed, tests of the theory of planned behavior have provided strong evidence for the overall predictive validity of intentions, and have shown that attitudes and perceived behavioral control explain a substantial proportion of the variance in intentions (Armitage & Conner; Hagger et al.). Notwithstanding this corroborating evidence, meta-analytic reviews have shown that the effect of subjective norms on intentions is small (Hagger et al.).

### **NORMATIVE EXTENSIONS AND MODIFICATIONS OF THE THEORY OF PLANNED BEHAVIOR**

In response to the typically lesser role of subjective norms in the theory of planned behavior, some researchers have argued that the operational definition of subjective norms insufficiently captures social influences (Grube, Morgan, & McGree, 1986). Empirical evidence indicates that descriptive norms, a social influence construct that reflects perceptions of significant others' behavior, predict intentions and/or behavior directly, and/or indirectly via perceived behavioral control (Nucifora, Gallois, & Kashima, 1993; Ravis & Sheeran, 2003). In addition, it has been suggested that descriptive norms should be incorporated as a main component of norms in the theory of planned behavior (Ajzen & Fishbein, 2005). Further, Grube et al. discovered a moderating effect of descriptive norms on the attitude-intention relationship. Their study revealed support for a contingent-consistency hypothesis by showing that the relationship between attitudes and intentions to smoke increased as descriptive norms increased. However, there are notable studies in which descriptive norms did not exert main or moderating effects on intentions and behavior (Conner & McMillan, 1999). Therefore, studies have not found consistently main or moderating effects from descriptive norms to intentions.

The logic behind incorporating descriptive norms in the theory of planned behavior is based on learning theories that posit that modeling the perceived behavior of others is an important source of social influence (Grube et al., 1986). For example, children may ignore parental disapproval of dieting because they model the dieting regime of their friends, whose opinions they highly value. In these cases descriptive norms and subjective norms may exert independent effects on intentions.

One limitation of the constructs of subjective norms and descriptive norms is that they do not differentiate between interpersonal influences from significant figures (i.e., parental influence) and group influences (i.e., peer influence). Like interpersonal influences, group influences do affect intentions and behavior, but in a different way. For example, social identity theory proposes that group norms and group identification influence intentions and behavior (Tajfel & Turner, 1986). In general, group norms indicate the perceived attitudes and behaviors of a behaviorally relevant group whereas group identification indicates the strength with which an individual identifies with a behaviorally relevant group. So far, research within the theory of planned behavior has supported an interaction between group norms and group identification such that the perceived behaviors and attitudes

sanctioned by a group (group norms) influences the attitudes, intentions, and behaviors displayed by an individual only to the extent that the individual identifies strongly with the group. When the individual does not identify with a group (i.e., when strength of identification is low), then group processes become less potent determinants of behavior, and personal variables such as attitudes and intentions become more influential of behavior (Terry & Hogg, 1996; Terry, Hogg, & White, 1999).

Social support is another social influence construct that has been examined for its utility to predict intentions within the theory of planned behavior (Courneya, Plotnikoff, Hotz, & Birket, 2000). Measures of social support indicate the extent to which significant others are perceived to assist performance of behavior (Courneya et al.). The rationale behind incorporating measures of social support in the theory of planned behavior is that for behaviors that are difficult to execute, assistance from others is helpful beyond personal perceptions such as attitudes and perceived behavioral control (Courneya et al.). Several studies have shown that social support predicts intentions directly and indirectly via perceived behavioral control (Courneya et al.; Povey, Conner, Sparks, James, & Shephard, 2000). Further, Povey et al. have demonstrated that social support moderates the effects of attitudes on intentions such that attitudes predict intentions only when participants perceive that significant others support performance of behavior. The present study examines the influence of another social support construct, *perceived autonomy support*, on intentions within the theory of planned behavior.

## PERCEIVED AUTONOMY SUPPORT AND THE THEORY OF PLANNED BEHAVIOR

In the theory of planned behavior, the construct of subjective norms reflects a *pressuring form* of social influence because subjective norms measure the perceived pressure from significant others (Ajzen, 1991). Consequently, the direct link between subjective norms and intentions assumes that the strength of intentions increases as perceived social pressure increases. Traditionally, however, research in social psychology suggests that perceived social pressure impedes rather than enhances motivation (Ryan & Deci, 2000). For example, Festinger and Carlsmith's (1959) cognitive dissonance theory predicts that when social pressure surpasses a critical point then social pressure has deleterious effects on intentions and attitudes. Therefore, subjective norms may not predict intentions because pressuring forms of social influence, reflected in the construct of subjective norms, do not always facilitate intentions. One approach that aims to understand the influences that social factors exert on intentions is self-determination theory, a theory that proposes the measurement of *non-pressuring forms* of social influence (Ryan & Deci)

A major tenet of self-determination theory is that the social context has a pervasive effect on the motivation and psychological well-being of individuals (Ryan & Deci, 2000). The theory differentiates between three types of interpersonal contexts. The interpersonal context is said to be *completely autonomy supportive* when significant others provide *choice* (e.g., when significant others encourage participation in decision-making), *rationale* (e.g., when significant others explain, in a meaningful way, why performance of an activity is important), and *acknowledgement of conflict* (e.g., when significant others acknowledge personal feelings and perspectives). The interpersonal context is said to provide *incomplete autonomy support* when two of the three factors that facilitate perceived autonomy support (e.g., choice, rationale or acknowledgement) are absent in the environment. The interpersonal context is said to be *controlling* when significant others pressure people to act in specified ways by using pressuring language during interpersonal communication (e.g., use of modal operators such as "should" and "must"), and also when significant others do not provide choice and rationale (Deci, Eghari, Patrick, & Leone, 1994).

A clear conclusion to emerge from previous field and experimental studies is that while complete autonomy support influences behavior indirectly via attitudes, incomplete autonomy support influences overt behavior directly but not attitudes (Deci et al.; Williams, McGregor, Zeldman, Freedman, & Deci, 2004). In addition, some studies have documented that complete autonomy support facilitates internalization of social behavior, which is evident when behavior is consistent with internal psychological states such as beliefs, attitudes, and emotions. In contrast, incomplete autonomy support was shown to facilitate inconsistency between thoughts, attitudes, and behavior (Koestner, Bernieri, & Zuckerman, 1992). The present study therefore aspires to make a unique contribution to the literature by examining effects of perceived autonomy support within the theory of planned behavior.

## STUDY 1

Study 1 investigated the contribution of perceived autonomy support to the prediction of intentions within the theory of planned behavior. Inclusion of perceived autonomy support in the theory of planned behavior is justified on the basis of evidence suggesting that non-pressuring forms of social influence, as indicated by the construct of perceived autonomy support, facilitate positive attitudes and intentions whereas pressuring forms of social influence, as indicated by subjective norms, exert deleterious effects on attitudes and intentions (Festinger & Carlsmith, 1959).

In accordance with Deci et al.'s (1994) findings, it was hypothesized that perceived autonomy support would exert positive direct and positive indirect effects (via attitudes) on physical activity intentions ( $H_1$ ). The positive direct effects are assumed to reflect partial internalization because (i) partial internalization is evident when behavioral change is independent from internal states such as attitudes and (ii) from a mathematical standpoint, direct effects support the independence of the effects that perceived autonomy support and attitudes exert on intentions. In contrast, the indirect effects of perceived autonomy support are considered to reflect complete internalization because (i) complete internalization is evident when behavioral changes facilitated in autonomy supportive environments are dependent on attitudes and (ii) mathematically, indirect effects support the dependence of the effects that perceived autonomy support and attitude exert on intentions (Deci et al.). Perceived autonomy support was not hypothesized to exert direct effects on physical activity behavior because perceived autonomy support facilitates intentional behavior and not automatically suggested non-intentional behavior (Deci, Koestner, & Ryan, 1999). In addition, perceived autonomy support was not hypothesized to exert any positive or negative indirect effects on intentional behavior via subjective norms because the constructs of subjective norms and perceived autonomy support belong to the same conceptual domain (i.e., social influence), and therefore "causal" links between these constructs cannot be assumed. Further, the construct of autonomy support was not hypothesized to influence intentions via perceived behavioral control because we used a measure of autonomy support that does not measure perceived provision of feedback, which ultimately influences perceptions of control (Deci et al., 1999; Williams et al., 2004). Nevertheless, for the sake of comparison, Study 1 tested indirect effects of perceived autonomy support on intentions via subjective norms and perceived control.

Finally, Study 1 estimated effects of perceived autonomy support in the context of a larger model that incorporated past behavior. Past behavior effects are important to specify because past behavior can help identify a number of alternative antecedents that may influence intentions, besides perceived autonomy support (Ajzen, 2002). Therefore, a conservative test of the effects of perceived autonomy support is afforded if it is shown that perceived autonomy support predicts intentions even after effects of past behavior are statistically controlled (Hagger et al., 2002).

## Method

### *Research Participants and Procedure*

One hundred and seventy-seven participants including pupils ( $n = 73$ , male = 28, female = 45,  $M$  age = 13.95,  $SD = 0.61$ ) and university students ( $n = 104$ , male = 41, female = 63,  $M$  age = 18.98 years,  $SD = 2.63$ ) participated in the study. Prior to data collection, we obtained informed consent from the university students and from the head teachers of the schools who were asked to act in *loco parentis* in accordance with APA ethical guidelines. A prospective design was employed with psychological variables being assessed at two points in time. In the first wave of data collection, a definition of vigorous physical activity performed during leisure-time, developed by Godin and Shephard (1985), was presented to research participants. This definition specified that vigorous physical activity referred to leisure-time activities performed at a vigorous intensity for at least 30 minutes at a time, 3 days per week, over the next 5 weeks. Participants were instructed to use this definition when answering questions. Next, the questionnaire assessed variables specified by the theory of planned behavior, past behavior, and perceived autonomy support. After 5 weeks, Godin and Shephard's definition of vigorous physical activities was provided to the research participants again and actual participation in physical activities during leisure-time was assessed. Prospective responses were matched with baseline responses using dates of birth and gender as matching indexes.

## Measures

### *Theory of Planned Behavior and Past Behavior*

Four items drawn from Ajzen (1991) were used to measure behavioral intentions on 7-point Likert-type scales anchored by "strongly agree" (7) to "strongly disagree" (1) (e.g., I intend to do active sports and/or vigorous physical activities, for at least 30 minutes, 3 days per week, during my leisure-time, over the next 5 weeks). Subjective norms were measured through two items, and on 7-point scales ranging from "strongly agree" (7) to "strongly disagree" (1) (e.g., Others who are important to me pressure me to do active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week, during my leisure-time, over the next 5 weeks). Attitudes were assessed by five bipolar adjectives in response to a common stem: "For me doing active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week, during my leisure-time, over the next 5 weeks. . . ." One adjective reflected moral evaluations (bad/good), two adjectives reflected instrumental evaluations (useful/useless, harmful/beneficial) and two adjectives reflected affective evaluations (unenjoyable/enjoyable, interesting/boring). All adjectives were measured on 7-point semantic differential scales (Ajzen, 1991).

Perceived behavioral control was assessed using 3 items on 7-point scales (e.g., "I feel in complete control over whether I exercise for at least 30 minutes, 3 days per week, during my leisure-time, over the next 5 weeks"). Past behavior was assessed on a single item using a 6-point scale, ranging from "not at all" (1) to "most of the days per week" (6) (Hagger et al., 2002). Research participants were asked to report how often they had been doing active sports, and/or vigorous physical activities for at least 30 minutes, during their leisure-time, the last 6 months.

### *Perceived Autonomy Support*

Perceived autonomy support comprised six items, and it was adapted from the Health Care Climate questionnaire (Williams et al., 2004). The items yield a score on a 7-point scale that indicates the degree

to which significant others (e.g., friends, family members, parents) provided choice, understood and accepted one's exercise decisions, and understood personal perspectives. An example item was: "I feel that others who are important to me have provided me with choices and options over whether or not to exercise for at least 30 minutes, 3 days per week, during my leisure-time, over the next 5 weeks." Participants responded on 7-point Likert scales anchored with "strongly disagree" (1) to "strongly agree" (7).

### Self-Report Physical Activity

After 5 weeks, participation in physical activity during leisure-time was measured using Godin and Shephard's (1985) Leisure-Time Exercise Questionnaire (LTEQ). The instrument contains three open-ended questions capturing the frequency of mild, moderate, and vigorous physical activity. Because the present study targeted vigorous physical activity only, participants were asked to report the extent to which they engaged in active sports and/or vigorous physical activities, for at least 30 minutes, during leisure time, over the past 5 weeks. Participants reported the average frequency of their participation on 6-point scale ranging from "not at all" (1) to "most of the days per week" (6). Independent evaluations of the LTEQ found it to be valid, reliable, easy to administer, and to display concurrent validity with objective activities and fitness indexes (Jacobs, Ainsworth, Hartman, & Leon, 1993).

## Results

### Preliminary Analysis

Table 1 presents descriptive statistics and reliability information for the psychological measures. Most of the measures attained satisfactory levels of internal consistency reliability with alpha coefficients approaching .70. Pearson's correlations indicated that behavioral intentions were positively associated with attitudes, perceived behavioral control, and subjective norms (see Table 1). Physical activity was also positively correlated with behavioral intentions, perceived control, and measures of perceived autonomy support. The correlation between past behavior and future behavior ( $r = .40$ ,  $p < .05$ ) was consistent with previous physical activity research because it was within credibility intervals reported in previous meta-analytic studies (Hagger et al., 2002).

Table 1. Descriptive statistics and correlations (Study 1,  $N = 177$ )

	<i>M</i>	<i>SD</i>	$\alpha$	1	2	3	4	5	6	7
1. Physical activity	3.37	1.39	—	1.00						
2. Intentions	4.49	1.67	.93	0.65*	1.00					
3. Attitudes	5.55	1.37	.81	0.41*	0.56*	1.00				
4. Perceived control	5.37	1.27	.79	0.38*	0.54*	0.51*	1.00			
5. Subjective norms	4.10	1.55	.65	0.11	0.17*	0.11	-0.07	1.00		
6. Autonomy support	4.47	1.10	.80	0.32*	0.45*	0.48*	0.31*	0.45*	1.00	
7. Past behavior	2.86	1.70	—	0.40*	0.48*	0.34*	0.30*	0.19*	0.34*	1.00

Note: \* $p < .05$ . All variables except for behavioral measures were measured on 7-point scales ranging from 1 to 7 with higher numbers indicating positive evaluations, positive subjective norms, stronger intentions, stronger perceived behavioral control, and stronger perceptions of autonomy support. Measures of behavior were measured on 6-point scales with higher numbers indicating frequent participation in physical activities.

A multivariate analysis of variance comparing a group of participants who were younger than 15 years old and a group of participants who were older than 15 years old did not reveal any statistically significant effect on attitudes ( $F(1, 176) = 2.57, p = .08, \eta^2 = .01$ ), intentions ( $F(1, 176) = 1.44, p = .23, \eta^2 = 0.01$ ), perceived behavioral control ( $F(1, 176) = 0.05, p = .83, \eta^2 = 0.00$ ), subjective norms ( $F(1, 176) = 1.51, p = .22, \eta^2 = 0.01$ ), perceived autonomy support ( $F(1, 176) = 2.06, p = .15, \eta^2 = 0.00$ ), and physical activity participation ( $F(1, 176) = 2.60, p = .07, \eta^2 = 0.02$ ). These results therefore provide evidence in support of collapsing the data across age.

*Prediction of Intentions and Physical Activity*

Path analysis was conducted to examine the effects that perceived autonomy support exerted on physical activity intentions and behavior within the theory of planned behavior (Bentler, 1989). Specifically, a path model (Model 1) was estimated that included the hypothesized relations among the theory of planned behavior constructs but also included direct and indirect effects, via attitudes, of perceived autonomy support on intentions (see Figure 1). In addition, past behavior was hypothesized to influence all of the theory of planned behavior components in order to control for the potential effects of other unmeasured variables on intentions (Ajzen, 2002). We created observed variables to represent constructs by taking the average score of items measuring attitudes, subjective norms, intentions, perceived behavioral control, perceived autonomy support, and past behavior. In accordance with recent criteria of good fit, a cut-off close to 0.95 for Comparative Fit Index (CFI) and a cut-off value close to 0.08 for the standardized root mean square residual (SRMSR) were used to evaluate the

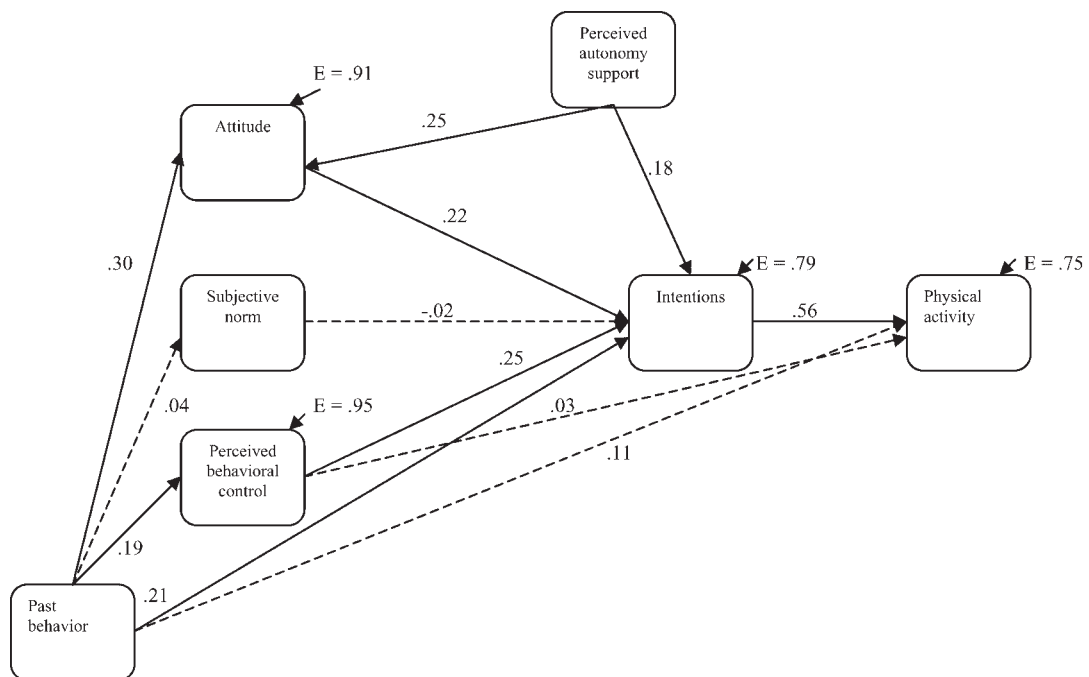


Figure 1. Path model showing relationships among the theory of planned behavior variables, perceived autonomy support and past behavior (Model 1 from Study 1)

Table 2. The Effects of perceived social support, perceived autonomy support and descriptive norms within the theory of planned behavior

Model	$\chi^2$	CFI	SRMSR	$\Delta\chi^2$	AIC	I-B	A-I	SN-I	PBC-I	PBC-B	PSS-PBC
1	14.23 (8)	0.97	0.06	—	1.77	0.56*	0.22*	-0.02	0.25*	0.03	
2	252.24 (18)	0.64	0.23	—	216.24	0.27*	0.58*	0.05	0.13*	0.37*	0.13*
3	181.9 (16)	0.75	0.17	70.33*	149.91	0.28*	0.45*	0.03	0.13*	0.37*	0.13*
4	32.54 (12)	0.97	0.07	59.37*	8.54	0.12*	0.40*	0.06	0.00	0.04	0.02
<i>Model</i>	<i>DN-PBC</i>	<i>PSS-I</i>	<i>DN-I</i>	<i>PAS-I</i>	<i>PAS-A</i>	<i>PB-B</i>	<i>PB-I</i>	<i>PB-A</i>	<i>PB-PBC</i>		
1				0.18*	0.25*	0.11	0.27*	0.29*	0.19*		
2	0.30*	0.17*	0.00								
3	0.30*	0.06	0.00	0.26*	0.54*						
4	-0.02	0.04	0.04	0.29*	0.48*	0.63*	0.32*	0.22*	0.60*		

Note: \* $p < .05$ . I, intention; A, attitude; SN, subjective norms; PBC, perceived behavioral control; PSS, perceived social support; DN, descriptive norms; PAS, perceived autonomy support; PB, past behavior.

adequacy of Model 1 (Fan, Thompson, & Wang, 1999; Ford, McCallum, & Tait, 1986; Hu & Bentler, 1999). The chi-square value is reported but it is not used to evaluate adequacy of Model 1 because it is relatively dependent on sample size (Rigdon, 1999). A maximum likelihood methodology was used to estimate parameters of Model 1 (Bentler, 1989).

Estimation of Model 1 revealed a satisfactory reproduction of observations from parameters of the model (see Table 2). Parameters of Model 1 indicated that intentions predicted physical activity behavior ( $\beta = .56$ ,  $p < .05$ ), whereas attitudes ( $\beta = .22$ ,  $p < .05$ ) and perceived behavioral control ( $\beta = .25$ ,  $p < .05$ ) predicted intentions (see Figure 1). Consistent with previous physical activity research (Hagger et al., 2002), subjective norms did not predict intentions ( $\beta = -.02$ ,  $p = .89$ ) whereas past behavior exerted a statistically significant effect on intentions ( $\beta = .27$ ,  $p < .05$ ) but not on physical activity behavior ( $\beta = .11$ ,  $p = .34$ ). In accordance with initial hypotheses, Model 1 supported statistically significant direct effects ( $\beta = .18$ ,  $p < .05$ ) of perceived autonomy support on physical activity intentions (see Figure 1). Sobel tests also supported statistically significant indirect effects of perceived autonomy support on intentions via attitudes ( $\beta = .05$ ,  $z = 2.92$ ,  $p < .05$ ) (Sobel, 1982). The construct of perceived autonomy support improved prediction of intentions by two per cent. In addition, removing the direct ( $\Delta\chi^2(1) = 5.19$ ,  $p < .05$ ) and indirect effects ( $\Delta\chi^2(1) = 8.34$ ,  $p < .05$ ) of perceived autonomy support on intentions significantly reduced the fit of Model 1. Interestingly, Sobel tests revealed that the indirect effect of subjective norms on intentions via attitudes ( $\beta = -.010$ ,  $z = 0.23$ ,  $p = .91$ ) and of perceived autonomy support on intentions via perceived behavioral control ( $\beta = .00$ ,  $z = 0.12$ ,  $p = .99$ ) and via subjective norms ( $\beta = .00$ ,  $z = 0.11$ ,  $p = .99$ ) were statistically non-significant (Sobel).<sup>1</sup>

## Summary

In accordance with initial hypotheses, Study 1 documented that perceived autonomy support influenced intentions directly and that the indirect effects of perceived autonomy support on intentions were via attitudes and not via perceived behavioral control or subjective norms. Interestingly subjective norms

<sup>1</sup>We also conducted a multi-group analysis to investigate whether the path coefficients in Model 1 were equal across participants who were younger than 15 years old and participants who were older than 15 years old. Results from this analysis revealed that all hypothesized paths were equal across groups ( $\chi^2(27) = -29.44$ ,  $p < .05$ ; CFI = 0.99; SRMSR = 0.09). In addition, a Lagrange multiplier test did not detect improvement in model fit if any of the 12 paths were hypothesized not to be equal across groups ( $\Delta\chi^2(12) = 3.33$ ,  $p > .05$ ).



did not predict intentions either directly or indirectly via attitudes. Most important, the path analysis showed that past behavior predicted intentions and that the effects of perceived autonomy support on intentions were statistically significant after controlling for the effects of past behavior on intentions. Therefore, a conclusion that emerges from Study 1 is that the construct of perceived autonomy support helps identify the influences that significant others exert on physical activity intentions, and for this reason it may be important to include the construct of perceived autonomy support in the theory of planned behavior.

## STUDY 2

Study 2 was designed to evaluate predictive validity of perceived autonomy support within an extended theory of planned behavior model that takes into consideration other social influence variables included in previous studies: descriptive norms and perceived social support. It was hypothesized that perceived autonomy support would exert positive direct and positive indirect effects (via attitudes) on intentions even after effects from descriptive norms and perceived social support were statistically controlled ( $H_1$ ). The rationale behind this hypothesis was based on the premise that the constructs of perceived autonomy support, descriptive norms, and perceived social support measure distinct types of social influence, and consequently influence intentional behavior in different ways (Hagger & Chatzisarantis, 2005). That is, while descriptive norms and perceived social support have been shown to influence intentions via perceived behavioral control (Courneya & McAuley, 1995), the indirect effects of perceived autonomy support were mediated by attitudes (Deci et al., 1994). Finally, as in Study 1, we controlled for the effects of past behavior.

### Method

#### *Research Participants and Procedure*

Research participants were 165 high school pupils (male = 86, female = 79,  $M$  age = 14.56 years,  $SD = 0.77$ ). Prior to data collection, we obtained informed consent from the head teachers of the schools who were asked to act in *loco parentis*, in accordance with APA guidelines. The procedure and research design of Study 2 was similar to the procedures and design adopted in Study 1. However, the samples of Study 1 and 2 were independent.

### Measures

Study 2 utilized the same measures as Study 1 to assess components of the theory of planned behavior, past behavior, perceived autonomy support, and physical activity behavior. An exception was the construct of subjective norms, which was assessed through three items (e.g., "Others who are important to me approve of me doing active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week, during my leisure-time, over the next 5 weeks"). Descriptive norms were assessed through two items on 7-point scales ranging from "completely false" (1) to "completely true" (7) (e.g., "Most people who are important to me will do active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week, during their leisure-time, over the next 5 weeks") (Conner & Sherlock, 1998). Perceived social support was assessed through two items on 7-point Likert scales

ranging from “strongly disagree” (1) to “strongly agree” (7) (e.g., “Others who are important to me assist me to do active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week during my leisure-time, over the next 5 weeks”) (Courneya et al., 2000; Povey et al., 2000).

## Results

### *Preliminary Analysis*

Most of the measures attained satisfactory levels of internal consistency (see Table 3), although the Cronbach alpha for the subjective norms was below the stipulated minimum ( $\alpha = .63$ ). Pearson's correlations supported positive relationships between behavioral intentions with attitudes, perceived behavioral control, subjective norms, descriptive norms, perceived social support, and perceived autonomy support (see Table 3). Physical activity was also positively correlated with behavioral intentions, perceived control, and with measures of descriptive norms, perceived social support, and perceived autonomy support.

### *Prediction of Intentions and Physical Activity*

A three-step path analytic procedure was employed to address study hypotheses (Mulaik & Millsap, 2000). Specifically, we initially estimated a model (Model 2) that tested the hypothesized relationships among the theory of planned behavior constructs and also included direct and indirect effects (via perceived behavioral control) of perceived social support and descriptive norms on intentions. Next we assessed the contribution of perceived autonomy support to the prediction of intentions by estimating a competing model (Model 3) that was similar to Model 2 with the exception that it estimated direct and indirect effects (via attitudes) from perceived autonomy support to intentions. Finally, we evaluated and controlled for the influence of past behavior on intentions by estimating a competing Model 4 that was identical to Model 3, only including the hypothesized effects of past behavior on all variables specified by the theory of planned behavior. In all path models, we created observed variables to represent constructs by calculating averages score. Akaike's Information Criterion (AIC; Akaike, 1987) and the chi-square difference test ( $\Delta\chi^2$ ) were used to compare the competing hypothesized models (Rigdon, 1999). The model that obtains the lowest AIC is considered to demonstrate the best fit (Rigdon, 1999).

Table 3. Descriptive statistics and correlations (Study 2,  $N = 165$ )

	<i>M</i>	<i>SD</i>	$\alpha$	1	2	3	4	5	6	7	8	9
1. Behavior	3.57	1.44	—	1.00								
2. Intention	5.05	1.26	.92	0.51*	1.00							
3. Attitude	4.99	0.671	.84	0.43*	0.64*	1.00						
4. Subjective norm	4.03	0.792	.63	0.35*	0.27*	0.30*	1.00					
5. Perceived behavioral control	4.72	0.823	.79	0.42*	0.41*	0.47*	0.09	1.00				
6. Descriptive norm	3.22	1.16	.87	0.43*	0.17*	0.13	0.16*	0.30*	1.00			
7. Perceived social support	4.43	1.50	.86	0.39*	0.37*	0.38*	0.45*	0.11	0.25*	1.00		
8. Perceived autonomy support	4.94	0.990	.86	0.33*	0.58*	0.51*	0.38*	0.31*	0.15*	0.60*	1.00	
9. Past behavior	3.43	1.66	—	0.74*	0.45*	0.37*	0.46*	0.35*	0.50*	0.35*	0.29*	1.00

Note: \* $p < .05$ . All variables except for behavioral measures were measured on 7-point scales ranging from 1 to 7 with higher numbers indicating positive evaluations, positive subjective norms, positive descriptive norms, stronger intentions, stronger perceived behavioral control, stronger perceptions of autonomy support, and stronger perceptions of social support. Measures of behavior were measured on 6-point scales with higher numbers indicating frequent physical activity participation.

As before, all hypothesized models were estimated using the maximum likelihood method (Bentler, 1989).

Table 2 presents results from this path analysis. As it is shown, Model 2 exhibited a poor fit<sup>2</sup> (Hu & Bentler, 1999) (see Table 3). Parameters of Model 2 supported a statistically significant direct effect ( $\beta = .17, p < .05$ ) of perceived social support on intentions. As in Study 1, subjective norms did not predict intentions directly. Sobel (1982) tests indicated that the indirect effect of perceived social support on intentions via perceived behavioral control to be marginally significant ( $\beta = .02, z = 1.68, p = .08$ ). In addition, while the Sobel test supported indirect effect of descriptive norms on intentions via perceived behavioral control ( $\beta = .040, z = 1.99, p < .05$ ), this was not the case for the direct effect of descriptive norms.

Model 3 resulted in a significant increase in goodness of fit indexes (see Table 2) and in a statistically significant lowering of the chi-square value ( $\chi^2$ ). The AIC of Model 3 was also lower than the AIC of Model 2 suggesting that consideration of effects from perceived autonomy support to intentions improved the fit of Model 3 substantially. In accordance with the hypothesis of Study 2 ( $H_1$ ), parameters of Model 3 supported statistically significant direct effects of perceived autonomy support on intentions ( $\beta = .26, p < .05$ ) after controlling for descriptive norms and perceived social support. The Sobel (1982) test also supported indirect effects of perceived autonomy support on intentions via attitudes ( $\beta = .25, z = 4.53, p < .05$ ). Most important, Model 3 did not support statistically significant direct effects from perceived social support to intentions ( $\beta = .02, p = .18$ ) after the direct effects from perceived autonomy support to intentions were taken into consideration. However, Sobel (1982) tests pointed out that descriptive norms ( $\beta = .05, z = 2.01, p < .05$ ) and perceived social support ( $\beta = .02, z = 1.84, p = .07$ ) exerted statistically significant indirect effects on intentions via perceived behavioral control. These results therefore demonstrate that the direct effects of perceived social support on intentions can be subsumed by perceived autonomy support.

Model 4 also exceeded recent criteria of good fit (Hu & Bentler, 1999) and indicated a significant improvement in fit indexes (see Table 2). Parameters of Model 4 supported the statistically significant effects of past behavior on intentions, physical activity participation, attitudes, and perceived behavioral control (see Table 2 and Figure 2). Most important, Sobel (1982) tests indicated that the indirect effects (via perceived behavioral control) of perceived social support ( $\beta = .00, z = 0.15, p = .92$ ) and descriptive norms ( $\beta = .00, z = 0.13, p = .89$ ) on intentions became statistically non-significant after the effects of past behavior were taken into consideration. Interestingly, the direct ( $\beta = .29, p < .05$ ) and indirect effects ( $\beta = .19, z = 4.52, p < .05$ ) (via attitudes) of perceived autonomy support on intentions remained statistically significant after past behavior effects were taken into consideration. Finally, estimation of indirect effects of subjective norms on intentions via attitudes ( $\beta = .00, z = 0.04, p = .97$ ) and of perceived autonomy support on intentions via perceived behavioral control ( $\beta = .00, z = 0.03, p = .95$ ) and via subjective norms ( $\beta = .01, z = 0.12, p = .79$ ) revealed no statistically significant effects.

## Summary

Perceived autonomy support was found to predict intentions directly and indirectly (via attitudes and not via perceived control or subjective norms) even after the effects of past behavior, descriptive norms, and perceived social support were taken into consideration. In addition, Study 2 demonstrated that perceived social support and descriptive norms influenced intentions only when effects from past

<sup>2</sup>Moderated regression analysis did not reveal moderating effects of subjective norms, descriptive norms, social support, or perceived autonomy support on the attitude-intention relationship (Aiken & West, 1991).

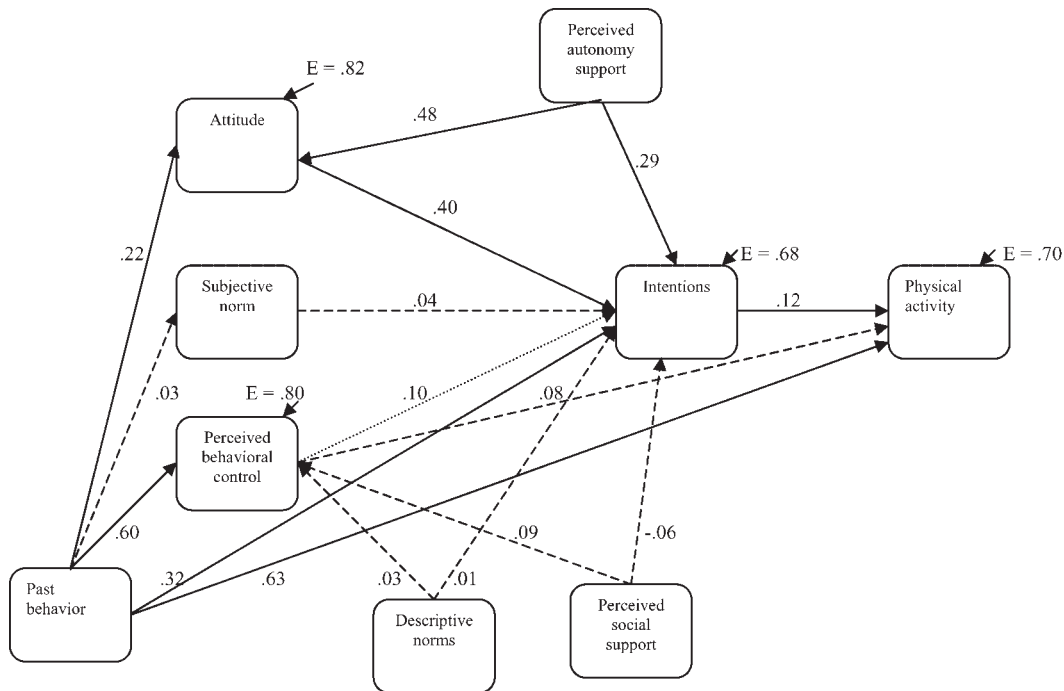


Figure 2. Path model showing relationships among the theory of planned behavior variables, perceived autonomy support, past behavior, perceived social support and descriptive norms (Model 4 from Study 2)

behavior and from perceived autonomy support were not taken into consideration. At this juncture, Models 2, 3, and 4 clearly show that the only variables that predict intentions after the effects of past behavior are taken into consideration are attitudes and perceived autonomy support. These results therefore, strengthen the case for inclusion of the construct of perceived autonomy support in the theory of planned behavior.

### STUDY 3

Study 3 adopted an experimental design to investigate effects of autonomy support on attitudes and intentions. We used persuasive appeals to conduct three different manipulations of autonomy support reflecting the three different contexts proposed by self-determination theory: complete autonomy supportive contexts, incomplete autonomy supportive contexts, and controlling contexts (see also Deci et al., 1994). In addition, the research design of Study 3 incorporated a control group that did not include any persuasive appeal but asked participants to participate in physical activities. In Study 3, we expected to replicate Deci et al.'s pattern of results. However, we focused on intentions rather than overt behavior.

In particular, we hypothesized that participants who attended autonomy supportive persuasive appeals (complete and incomplete appeals) would perceive the environment as more autonomy supportive relative to participants who did not attend any persuasive appeal (control group) and relative to participants who attended a persuasive appeal that pressure them to exercise (controlling appeal)

( $H_1$ ). In addition, it was hypothesized that participants who attended complete and incomplete autonomy supportive persuasive appeals would report stronger intentions and more positive attitudes than participants in the control group and participants who attended a controlling appeal ( $H_2$ ). This is because previous research showed autonomy support to influence behavior (Deci et al., 1994; Ryan, Koestner, & Deci, 1991) and attitudes (Festinger & Carlsmith, 1959) relative to control groups and/or relative to participants who attended a controlling appeal. However, we also expected to find differences between participants who attended complete and incomplete appeals. That is, we hypothesized that while participants who attended a complete persuasive appeal would report more positive attitudes than participants who attended an incomplete appeal ( $H_3$ ), this would not be necessarily the case with regard to intentions. With respect to intentions, we hypothesized that participants who attended an incomplete persuasive appeal would not differ from participants who attended a complete persuasive appeal on intentions ( $H_4$ ). This latter hypothesis was based on previous research on internalization that showed that while complete autonomy support changed attitudes and behavior by equal amounts, incomplete autonomy support changed behavior but not attitudes (Deci et al., 1994; Koestner et al., 1992). Therefore, we expected the effects of complete autonomy support on attitudes and intentions to be symmetric, whereas the effects of incomplete autonomy support on attitudes and intentions to be asymmetric.

## Method

### *Research Participants and Procedure*

Participants were 79 high school students (male = 40, female = 39,  $M$  age = 14.53,  $SD$  = 0.70). Prior to data collection, we obtained informed consent from the head teachers of the schools who were asked to act in *loco parentis*, in accordance with the Psychological Society's guidelines. The experiment employed an one-way factorial design with four groups: a control group ( $n$  = 20, male = 10, female = 10,  $M$  age = 14.60,  $SD$  = 0.88), a group of participants who attended a controlling appeal ( $n$  = 20, male = 10, female = 10,  $M$  age = 14.60,  $SD$  = 0.60), a group of participants who attended an incomplete autonomy supportive persuasive appeal ( $n$  = 19, male = 10, female = 9,  $M$  age = 14.57,  $SD$  = 0.61), and a group of participants who attended a complete autonomy supportive persuasive appeal ( $n$  = 20, male = 10, female = 10,  $M$  age = 14.55,  $SD$  = 0.76). The study was presented as a study of students' opinion about health issues. The sample in Study 3 was independent of the samples used in Studies 1 and 2.

Upon arrival, participants were seated at a desk and informed that they would watch a video, read materials related to health behaviors, and answer a questionnaire. Participants were also offered the option to withdraw from the study any time without any negative repercussions. The target activity involved an aerobic bench-stepping exercise, 3 days per week, for at least 20 minutes each time, over the next 2 months, during leisure-time. We chose bench-stepping as the target activity because a pilot study has shown that bench-stepping was not a very popular form of activity among young people. Participants then watched a video in which a person practiced bench-stepping for a minute. After watching the video, the experimenter informed each participant that the study required from him/her to actually practice bench-stepping while wearing an instrument called a *Caltrac* that tracks the intensity and duration of physical movement. This procedure aimed to prevent false commitment and make participants' decisions harder, more responsible, and realistic (see also Festinger & Carlsmith, 1959; Green, 1974). Immediately after, the experimental manipulations were conducted. All manipulations took the form of written text contained in a questionnaire. Participants were assigned randomly in the control versus experimental conditions by using a draw.

*Experimental Manipulations*

*Control condition* In this condition, participants were asked to practice bench-stepping, 3 days per week, for at least 20 minutes each time, over the next 2 months, during their leisure-time. Perceptions of autonomy support were not manipulated in this condition.

*Incomplete autonomy support* This experimental condition aimed to increase perceived choice only by prompting participants to read the following text and sign a consent form (see also Fazio, Zanna, & Cooper, 1977):

Now, you are to make a decision about whether or not to practice bench-stepping, for 3 days per week, for at least 20 minutes each time, over the next 2 months during your leisure-time. The choice is up to you.

The consent form read (see also Fazio et al., 1977):

I understand the nature of the study in which I am being asked to participate.

I truly choose to actually practice bench-stepping, 3 days per week, for at least 20 minutes each time, over the next 2 months, during my leisure-time.

*Complete autonomy support* This experimental condition manipulated perceived choice in the same way as in the incomplete autonomy support condition. However, in addition to manipulating perceived choice, rationale about practicing bench-stepping, and acknowledgement of feelings and perspectives were manipulated. The text that provided rationale for practicing bench-stepping read (see also Deci et al., 1994):

Doing this activity has been shown to be useful. Practicing bench-stepping on a regular basis improves co-ordination. People who practice bench-stepping are very good at moving, running, and learning new, difficult movements.

The text that acknowledged personal feelings and perspectives read (see also Deci et al., 1994):

I know that doing this activity is not much fun. Many participants have told me that it can be pretty boring, stressful, and frustrating. So I can perfectly understand and accept that you might not find stepping on a bench a very interesting activity.<sup>3</sup>

*Controlling condition* This experimental condition aimed to pressure participants practice bench-stepping and undermine perceived choice by forcing participants sign a consent form and by making use of controlling modal operators in communicating information (see also Deci et al., 1994). In this condition, acknowledgement of personal feelings and rationale regarding practicing bench-stepping were not manipulated. The text that undermined freedom of choice read:

Now you do not have much choice and you *should* practice the bench-stepping, 3 days per week, for at least 20 minutes each time, over the next 2 months, during your leisure-time.

<sup>3</sup>The order of manipulation of perceived choice, of rationale, and of acknowledgement of feelings associated with practicing bench/stepping was randomized across participants. An analysis of variance did not reveal a main effect of the order of manipulation on attitudes and intentions ( $F(3, 75) = 0.980, p > .05$ ).

## Measures

Immediately after the manipulations, all participants completed measures of attitudes toward practicing bench-stepping, perceived autonomy support, and intentions (Ajzen, 1991; Williams et al., 2004). We used the same measures as in Studies 1 and 2 to assess perceived autonomy support and intentions. However, measures of perceived autonomy support referred to the experimenter rather than significant others as a source of support. Attitudes were assessed by three bipolar adjectives in response to a common stem: "For me, practicing bench-stepping, 3 days per week, for at least 20 minutes each time, over the next 2 months during my leisure time. . . ." One adjective reflected moral evaluations (bad/good), one adjectives reflected instrumental evaluations (harmful/beneficial) and one adjective reflected affective evaluations (dull/interesting). All adjectives were measured on 11-point semantic differential scales ranging from (−5) to (+5) (Festinger & Carlsmith, 1959). Upon completion of the experiment, all participants were informed that the Caltracs would not be provided to them because the experiment had actually been completed, and that participants did not have to actually practice bench-stepping in the next 2 months.

## Results

### *Preliminary Analysis*

Measures attained satisfactory levels of internal consistency reliability (see Table 4). Two contrast codes were created to represent the experimental manipulations (Kerlinger & Pedhazur, 1973). An *incomplete autonomy support* contrast represented membership in the incomplete autonomy supportive condition versus the three other conditions. A *complete autonomy supportive* contrast represented membership in the complete autonomy supportive condition versus the other three conditions. Correlations supported positive relationships between behavioral intentions and attitudes, complete autonomy support contrast, incomplete autonomy support contrast, and self-reported perceived autonomy support. Attitudes were positively associated with the complete autonomy support contrast and self-reported perceived autonomy support.

### *Main Analysis*

An one-way analysis of variance supported a statistically significant effect of experimental conditions on self-reported perceived autonomy support ( $F(3, 75) = 7.78, p < .05, \eta^2 = 0.08$ ). Consistent with

Table 4. descriptive statistics and correlations (Study 3,  $N = 79$ )

	<i>M</i>	<i>SD</i>	$\alpha$	1	2	3	4	5
1. Intentions	4.49	1.82	.93	1.00				
2. Attitude	−0.57	3.22	.73	0.60*	1.00			
3. Incomplete autonomy support (contrast code)	—	—	—	0.26*	0.07	1.00		
4. Complete autonomy support (contrast code)	—	—	—	0.25*	0.20*	−0.19*	1.00	
5. Perceived autonomy support (self-report)	4.29	1.79	.84	0.81*	0.65*	0.19*	0.27*	1.00

*Note:* \* $p < .05$ . Intentions and self reported measures of perceived autonomy support were measured on 7-point scales ranging from 1 to 7 with higher numbers indicating positive evaluations, strong perceptions of autonomy support and strong intentions. Attitudes were measured on 11-point scale ranging from −5 to 5 with higher values reflecting more positive attitudes. The constructs of complete and incomplete autonomy support are dummy variables.

Table 5. The Effects of experimental conditions on attitudes and intentions

		<i>M</i>	<i>SE</i>
<i>Dependent Variables</i>	<i>Experimental conditions</i>		
Attitudes	Control	-1.75	0.72
	Controlling persuasive appeal	-2.00	0.65
	Incomplete persuasive appeal	0.157	0.50
	Complete persuasive appeal	1.90	0.58
Intentions	Control	3.65	0.36
	Controlling persuasive appeal	3.25	0.42
	Incomplete persuasive appeal	5.64	0.28
	Complete persuasive appeal	5.45	0.39

initial hypothesis ( $H_1$ ), planned comparisons revealed that participants who attended incomplete ( $M = 5.13$ ,  $SE = 0.39$ ) and complete ( $M = 5.38$ ,  $SE = 0.63$ ) autonomy supportive persuasive appeals perceived the experimenter as more autonomy supportive than participants in the control group ( $M = 4.33$ ,  $SE = 0.32$ ) ( $t(1, 77) = 2.23$ ,  $p < .05$ ) and participants who attended a controlling appeal ( $M = 3.60$ ,  $SE = 0.22$ ) ( $t(1, 77) = 4.77$ ,  $p < .05$ ). In addition, a trend was evident for participants who attended a controlling persuasive appeal to perceive the experimenter as less autonomy supportive than participants in the control group ( $t(1, 77) = 1.91$ ,  $p = .059$ ).

A multivariate analysis of variance revealed statistically significant multivariate ( $F(6, 134) = 5.52$ ,  $p < .05$ ,  $\eta^2 = 0.08$ ) and univariate effects of experimental conditions on attitudes ( $F(3, 75) = 8.73$ ,  $p < .05$ ,  $\eta^2 = 0.08$ ) and intentions ( $F(3, 75) = 10.72$ ,  $p < .05$ ,  $\eta^2 = 0.06$ ). Consistent with initial hypothesis ( $H_2$ ), planned comparisons revealed that participants who attended complete and incomplete autonomy supportive appeals reported stronger intentions ( $t(75) = 5.62$ ,  $p < .05$ ) and more positive attitudes ( $t(75) = 4.68$ ,  $p < .05$ ) than participants who attended a controlling appeal and participants in the control group (see Table 5). In accordance with the third ( $H_3$ ) and fourth hypotheses ( $H_4$ ), planned comparisons showed that while participants who attended a complete autonomy supportive appeal reported more positive attitudes than participants who attended an incomplete appeal ( $t(75) = 2.26$ ,  $p < .05$ ), participants who attended a complete and an incomplete appeal did not differ on intentions ( $t(75) = -0.37$ ,  $p = .86$ ). The effect size describing the difference between participants who attended a complete and an incomplete appeal on attitudes conformed to Cohen's (1988) medium effect size ( $d = 0.48$ ) and it was larger than the effect size describing the difference between the same two groups on intentions ( $d = 0.10$ ).<sup>4</sup>

#### *Additional Analysis*

Recall that previous research (Deci et al., 1994) and results from Study 3 are suggestive of an indirect effect of *complete* autonomy support on intentions (via attitudes) and a direct effect of *incomplete* autonomy support on intentions. Unfortunately, analysis of variance cannot test such mediating effects and for this reason in Study 3 we conducted a path analysis. Specifically, a path model (Model 5) was estimated in which direct effects from incomplete autonomy support on intentions and indirect effects (via attitudes) from complete autonomy support on intentions were specified (see

<sup>4</sup>In accordance with previous research (Deci et al., 1994), moderator analysis showed that the relationship between attitudes and intentions to be positive ( $\beta = .47$ ,  $p = .07$ ) for participants who attended a complete autonomy supportive appeal, and negative ( $\beta = -.32$ ,  $p = .28$ ) for participants who attended an incomplete appeal. Nevertheless, the two effects did not differ significantly at  $p < .05$ .



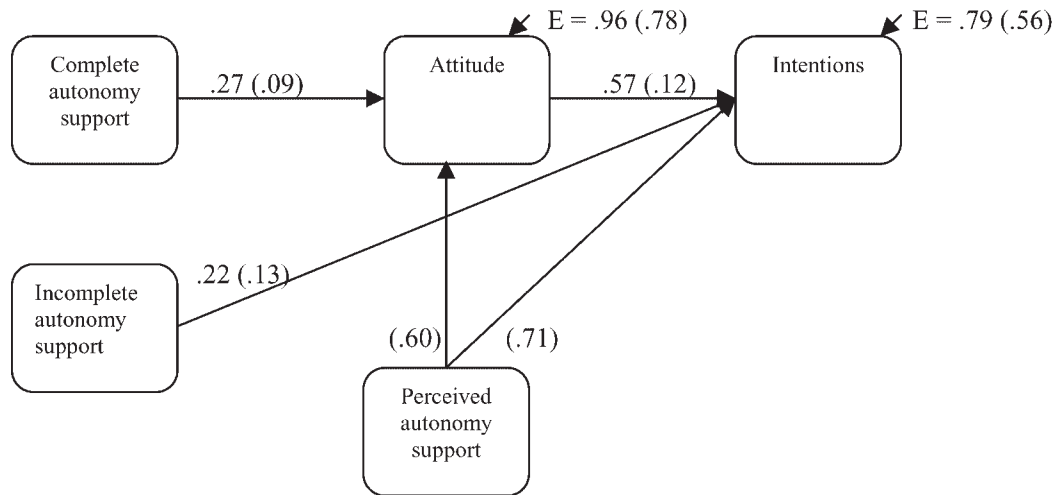


Figure 3. Path models showing direct and indirect effects of measures of autonomy support, on intentions (Models 5 and 6 from Study 3). Note. In parenthesis are parameters of Model 6 whereas outside of the parenthesis are parameters of Model 5

Figure 3). A maximum likelihood methodology was used to estimate parameters of Model 5. Since the experimentally induced autonomy support measures were categorical in nature, a polychoric covariance matrix was used as input (Bentler, 1989). As in Studies 1 and 2, observed variables (average scores) were used to represent attitudes and intentions.

Estimation of Model 5 revealed a satisfactory reproduction of observations from parameters of the model (Hu & Bentler, 1999,  $\chi^2(2) = 6.48, p < .05$ ; CFI = 0.94; SRMSR = 0.07). Parameters of Model 5 (presented outside of the parenthesis in Figure 3) supported statistically significant direct relationships between attitudes and intentions ( $\beta = .57, p < .05$ ) and between incomplete autonomy support with intentions ( $\beta = .23, p < .05$ ). Sobel (1982) tests also supported a statistically significant indirect effect from complete autonomy support to intentions via attitudes ( $\beta = .15, z = 2.34, p < .05$ ). Interestingly, specification of direct effects from complete autonomy support to intentions and from incomplete autonomy support to attitudes did not improve the fit of the model significantly ( $\Delta\chi^2(2) = 1.93, p = .23$ ).

We also specified a Model 6 that was identical to Model 5 except that it estimated direct and indirect effects (via attitudes) from self-reported perceived autonomy support to intentions (see Figure 3). Model 6 examined utility of self-reported perceived autonomy support to model effects of experimentally induced autonomy support. If perceived autonomy support models the effect of experimentally-induced autonomy support on intentions satisfactorily, then the total effects (direct plus indirect effects) of experimentally-induced autonomy support on intentions should be considerably attenuated. In Model 6, we averaged items measuring perceived autonomy support to represent the construct of perceived autonomy support. Estimation of Model 6 produce a well-fitting model ( $\chi^2(2) = 0.57, p > .05$ ; CFI = 1.00; SRMSR = 0.01). Sobel (1982) tests showed that the indirect effect (via attitude) of experimentally-induced complete autonomy support on intentions was reduced from .15 (in Model 5) to a statistically non-significant .01 ( $z = 0.23, p = .89$ ) (in Model 6). In addition, self-report measures of perceived autonomy support indicated that the direct effect of experimentally-induced incomplete autonomy support on intentions was reduced from .23 (in Model 5) to a statistically significant .13 (in Model 6).

## Summary

Results from Study 3 emphasize that persuasive appeals successfully changed participants' perceptions of autonomy support. In addition, the analysis of variance clearly demonstrated that while participants who attended autonomy supportive appeals reported the strongest intentions and the most positive attitudes (relative to control groups), there were differences between participants who attended complete and incomplete appeals. Specifically, we found that while participants who attended a complete autonomy supportive persuasive appeal reported more positive attitudes than participants who attended an incomplete appeal, those two groups did not differ on intentions. Most important, the path analysis replicated results from Studies 1 and 2 with experimental data and indicated that complete autonomy support influenced intentions indirectly via attitudes, that incomplete autonomy support influenced intentions directly, and that self-reported measures of perceived autonomy support explained the influence of experimentally-induced autonomy support on intentions (Deci et al., 1994).

## GENERAL DISCUSSION

The present study demonstrated that the construct of perceived autonomy support can usefully identify the influences that social factors exerted on intentions within the theory of planned behavior. Specifically, Studies 1 and 2 are the first to demonstrate direct and indirect effects (via attitudes) from perceived autonomy support to intentions within the theory of planned behavior. Most important, Studies 1 and 2 provided conservative tests of the effects of perceived autonomy support by pointing out that perceived autonomy support influenced intentions even when effects from past behavior, descriptive norms, and perceived social support were taken into consideration. Most important, perceived autonomy support was the only social influence construct that predicted intentions once effects of past behavior were statistically controlled. Therefore, it can be concluded that the effects from perceived autonomy support are robust and cannot be subsumed by a number of other potential antecedents of intentions.

Not only have the present studies demonstrated effects from perceived autonomy support within the theory of planned behavior but they contributed also to the understanding of these effects more thoroughly. For instance, Study 3 has documented that persuasive communications that support personal autonomy have successfully changed participants' physical activity intentions and attitudes by changing participants' perceptions of autonomy support. In addition, the path Model 5 indicated that while incomplete autonomy support influences intentions directly, complete autonomy support influences intentions indirectly via attitudes. Most important, the analysis of variance in Study 3 shows that the direct effect of incomplete autonomy support on intentions are due to the fact that incomplete autonomy support influences intentions to a greater extent than it influences attitudes. Likewise, the indirect effects of complete autonomy support on intentions are due to the fact that complete autonomy support influences intentions and attitudes by equal amounts. Finally, Model 6 has documented that both actual and perceived autonomy support influenced intentions and that perceived autonomy support modeled the effect of actual autonomy support on intentions. Accordingly, these results are important and suggest that self-report measures of perceived autonomy support are sensitive in measuring the effects that actual manipulations of autonomy support have on people's perceptions about autonomy support.

Theoretically, the indirect relationship between perceived autonomy support and intentions via attitudes is in accordance with tenets of self-determination theory and with Liska's (1984) proposition that social factors do influence intentions via attitudes. It also corroborates the conclusion that when

contexts provide complete autonomy support, intentions become concordant with the affective system and they ensue from the affective system. In contrast, when contexts provide incomplete autonomy support, intentions are less concordant with affective attitudes and become direct function of the environment (Deci et al., 1994). Notably, the construct of subjective norms does not identify the influences that social factors exert on attitudes given that Studies 1 and 2 showed that the effects from subjective norms to attitudes and intentions were not statistically significant (see Studies 1 and 2). Therefore, a conclusion that emerges from the present findings is that the construct of subjective norms underestimates the influences that significant others can exert on intentions, for it does not capture the effects that social factors exert on intentions via attitudes (Liska; Terry & Hogg, 1996). In contrast, the construct of perceived autonomy support helps identify the influences that significant others exert on intentions, and for this reason it may be important to include the construct of perceived autonomy support in the theory of planned behavior.

The findings concerning effects of perceived autonomy support on intentions raise a number of interesting theoretical issues. One such issue concerns proximal determinants of intentions and physical activity behavior. That is, applications of the theory of planned behavior have focused primarily on the effects that pressuring forms of social influence exert on intentions (e.g., subjective norms, descriptive norms). For example, Fishbein (1993) suggested that descriptive norms represents a perceived social pressure construct. Current results suggest that it may be fruitful to consider both pressuring and non-pressuring forms of social influence within the theory of planned behavior.

There are several advantages in making the distinction between pressuring and non-pressuring forms of social influence. First, the distinction between pressuring and non-pressuring forms of social influence integrates a large body of literature investigating effects of choice on attitudes, intentions, and behavior (Festinger & Carlsmith, 1959). Second, researchers can determine exactly whether pressuring or non-pressuring forms of social influence affect social behaviors. Third, incorporation of pressuring and non-pressuring forms of social influence can determine content of interventions. For example, results of our Study 3 suggest that practitioners need to provide the general public with choice over regulation of physical activity, and to explicitly acknowledge people's perspectives associated with regular participation in physical activity when communicating the benefits of physical activity (Deci et al., 1994). For instance, the message of a communication is more likely to be processed into a positive attitude (Deci et al.) and remembered when neutral language (e.g., "may," "could") and not controlling language (e.g., "should," "must") is used during interpersonal communication.

## Limitations and Conclusions

One limitation of the present series of studies is concerned with measurement of the social support construct. As in many other studies of social support, our measure of social support (Study 2) was general and did not capture specific forms of social support (Courneya et al., 2000; Povey et al., 2000). However, it can be predicted that our limited measure of social support does not jeopardize results considerably given that predictions from Study 2 are comparable with predictions obtained in other studies that used more sophisticated measures of social support.

In addition, self-report measures of perceived autonomy support can be limited in a sense that they do not measure provision of competence feedback, which ultimately strengthens perceptions of control. For this reason, future experimental research may examine alternative processes by which perceived autonomy support influences intentions within the theory of planned behavior. Moreover, the present studies focused on interpersonal influence whereas group influences have not been examined (Terry et al., 1999). Further, we did not investigate the cognitive processes by which autonomy support influences attitudes. Autonomy support may influence the types of beliefs that people attend during

information processing. Autonomy support can also influence intentions via other motivational constructs proposed by self-determination theory such as intrinsic motivation (Chatzisarantis, Hagger, Biddle, Smith, & Sage, 2006; Ryan & Deci, 2000). Finally, it has to be acknowledged that effects of all manipulations were assessed on self-reported measures taken in a single session. Therefore, future research may usefully employ a prospective or panel design to examine the effects of perceived autonomy support on attitudes and intentions.

In conclusion, a unique contribution of the present studies is the resolution of the problems surrounding the lack of prediction exhibited by the subjective norms variable in the theory of planned behavior by introducing perceived autonomy support. Findings support the notion that people's attitudes toward physical activity and intentions can be based upon their perception that the context is one that supports free-choice and autonomy. The present studies also underline the need for health practitioners and others concerned with the promotion of physical activity not to impose their own understanding to people, but to base policy and interventions on people's own perspectives, practices, and understanding of physical activity.

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