The Cognitive Processes by which Perceived Locus of Causality Predicts Participation in Physical Activity

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Abstract

The present study examined the cognitive processes by which perceived locus of causality influences participation in leisure time physical activity. Based on the theoretical tenets of self-determination theory, it was hypothesized that deliberative modes of information processing and past behaviour will account for the direct effects of perceived locus of causality on effort and physical activity. Data from self-report questionnaires were analysed using confirmatory factor analysis and path analysis. Results demonstrated that perceived locus of causality influences effort and physical activity participation via attitudes and perceived behavioural control. It was concluded that the addition of perceived locus of causality to the theory of planned behaviour increased the utility of the theory in predicting adherence to physical activity.

Keywords

past behaviour, physical activity, self-determination, theory of planned behaviour

AN IMPORTANT OBJECTIVE of human sciences is concerned with development of conceptual models that predict and explain human behaviour. Such models have demonstrated substantial predictive value and have helped practitioners identify which groups of individuals are likely to engage in socially desirable behaviours. One approach that social and health psychologists have adopted to understand health-related behaviour and psychological well-being is self-determination theory (Deci, Koestner, & Ryan, 1999; Deci & Ryan, 1985). Applications of this theory have led to identification of the most essential motivational constructs that underlie psychological well-being and motivation to engage in health-related behaviour (Ryan & Deci, 2000).

Self-determination theory assumes that human motivation and psychological well-being are associated with the satisfaction of three psychological needs; namely, the need for self-determination, competence, and relatedness (Deci, 1992). At a theoretical level, the concept of psychological needs is important because it helps researchers and practitioners to identify the motivational constructs that are necessary for motivation, well-being, and integrity (deCharmes, 1968; Ryan, 1995; White, 1960). For example, in the physical realm, people need water and food to satisfy biological needs. Similarly, in the psychological realm, people need a few motivational inputs for well-being and motivation to be sustained (Sheldon & Elliot, 1999). According to self-determination theory, a strong sense of competence, relatedness, and self-determination constitute the essential inputs that nurture well-being and motivation.

Empirically, the concept of 'psychological needs' is also important from an empirical perspective. Tests of hypotheses that stem from theoretical propositions relating to needs provide information about human nature (Deci, 1992), and about the direction and maintenance of behavioural change (Deci & Ryan, 1985; Ryan, 1995). For example, laboratory studies have shown that people persist with novel tasks to a greater extent and enjoy these tasks more when laboratory conditions support satisfaction of psychological needs than when laboratory conditions frustrate satisfaction of psychological needs (Deci et al., 1999). Moreover, it has been observed that the effects observed for psychological needs persist during post-treatment periods (e.g. free-choice periods, Deci & Ryan, 1985).

Deci and Ryan (1980) proposed that results from experimental studies could be explained in terms of changes that environmental factors produce on Perceived Locus of Causality (PLOC) (deCharmes, 1968). Field studies have supported the validity and reliability of self-report measures of PLOC and identified its antecedents and outcomes (Mullen, Markland, & Ingledew, 1997; Ryan & Connell, 1989; Williams, Freedman, Ryan, & Deci, 1996). The PLOC is usually measured through four different types of reasons (motives) for engaging in social behaviour (Deci & Ryan, 1985): External regulation (e.g. I do *x* because others say I should) and introjection (e.g. I do *x* because I feel bad about myself if I do not) indicate controlling types of intentional behaviour because extrinsic and introjected motives profess that personal behaviour is regulated by intrapersonal (e.g. guilt, shame) or interpersonal forces (e.g. pressure from significant others); in contrast, identification (e.g. I do *x* because I personally value the activity) and intrinsic motivation (e.g. I do *x* because it is enjoyable) are indicators of more autonomous types of intentional behaviour because motives of identification and intrinsic motivation profess that personal behaviour is regulated by personal values and interests. Using the concept of PLOC, Deci and Ryan (1985) explained experimental findings as follows. It was suggested that situational factors that support psychological needs facilitate an internal PLOC, people feel more self-determining (autonomous) and for this reason they enjoy and persist more with tasks. In contrast, when situational factors frustrate psychological needs, the PLOC becomes external, people feel less self-determining and for this reason, individuals do not enjoy, and do not persist, with tasks (Deci & Ryan, 1987).

Measures of PLOC have demonstrated utility in the study of health behaviours (Ryan & Connell, 1989; Sheldon & Elliot, 1999; Williams et al., 1996). For example, Williams et al. (1996) showed that PLOC predicted adherence to a dietary regimen, and actual weight loss over a 20-month period. In addition, it was shown that perceived autonomy support was an antecedent of PLOC. Straus and Ryan (1987) reported that

anorexics exhibited a more controlling style of self-regulation (introjection) than an experimental control group. Sheldon, Ryan, Rawsthorne, & Iliardi (1997) pointed out that people were satisfied with their roles to a greater extent when they experienced them as autonomous (authentic). Sheldon and Elliot (1999) pointed out that PLOC predicted psychological well-being, and effort that university students exerted towards completion of their personal projects. Similarly, Reis, Sheldon, Gable, Roscoe, and Ryan (2000) showed that daily satisfaction of self-determination was related to measures of subjective well-being. More importantly, the effects of daily need satisfaction to subjective well-being were greater in a group of individuals who scored high on trait measures of self-determination. Finally, in a sample of institutionalized senior citizens (nursing home resident), Kasser and Ryan (1999) pointed out that autonomous behavioural regulation was negatively associated with mortality and that autonomy support increased vitality and well-being.

Collectively, applications of self-determination theory showed that behavioural persistence (effort) and psychological well-being could be explained on the basis of psychological needs, and more specifically, on the basis of shifts in the PLOC. Empirical evidence lends support to the hypothesis that internal PLOC facilitates maintenance of behavioural change and psychological well-being.

The cognitive processes by which PLOC influences health behaviour

Deliberative process Although contemporary research has examined antecedents and outcomes of PLOC, few studies have examined how PLOC influences health behaviour. Cognitive approaches to human motivation have advocated that there are at least two ways through which cognitive elements can influence social behaviour (Bargh & Chartrand, 1999; Chaiken, 1980; Fazio, 1990). The first process is known as the deliberative (Fazio, 1990) or systematic (Chaiken, 1980) mode of information processing. This process is characterized by considerable cognitive work and effort. It involves scrutiny of available information and analysis of attributes of behaviour (e.g. costs and benefits). Deliberative processes involve active attempts to comprehend and evaluate messages or arguments and an assessment of validity of these arguments in relation to the message outcomes.

With respect to deliberative processes, Deci and Ryan (1980) advocated that PLOC impacts upon social behaviour through conscious information processing and choice. More specifically, it was postulated that: 'intrinsic motivation provides the needed energy for decision-making' (Deci & Ryan, 1980, p. 35). This postulation is based on the assumption that performance of a large number of cognitive activities draws energy from psychological needs. Hence, it can be hypothesized that PLOC influences health behaviour by motivating people to deliberate information relevant to the execution of health-related behaviour.

The theory of planned behaviour (Ajzen, 1985; Ajzen & Madden, 1986) describes how people process information prior to engaging in deliberative, volitional behaviour. For this reason, this theory may be important in understanding the relationship between PLOC and deliberative modes of information processing. According to this theory, people process three types of beliefs during deliberation. There are beliefs about behavioural outcomes (behavioural beliefs), which guide behavioural decisions through attitudes. Attitudes reflect a summary evaluation of a psychological object or behaviour captured in attribute dimensions such as good–bad, harmful–beneficial, pleasant–unpleasant (Ajzen, 2001, p. 28). Direct attitudes are formed spontaneously as individuals process their behavioural beliefs (Ajzen, 2001). There are beliefs about normative expectations of others (normative beliefs), which guide decision making through subjective norms. Subjective norms reflect the influences that social pressures may exert on the execution of health-related behaviours. Finally, there are beliefs about behavioural barriers, which guide decision through perceived behavioural control. Behavioural control refers to the perceived ease or difficulty associated with execution of future behaviour.

Importantly, the theory of planned behaviour postulates that attitudes in combination with subjective norms and perceptions of control lead to the formation of behavioural intentions, which are an indicator of how hard people are

willing to try (Bagozzi & Kimmel, 1985), and of how much an effort people are planning to exert towards performance of health-related behaviour. Finally, the theory of planned behaviour asserts that when behaviour is not under complete volitional control, intentions will predict health behaviour indirectly via effort (Ajzen, 1985). The direct effects of intentions on effort reflect the motivational significance that decision making exerts on attempts to execute target behaviour. In addition, the theory predicts that when perceived control is realistic, perceived behavioural control will predict behaviour directly (Ajzen & Madden, 1986; Hausenblas, Carron, & Mack, 1997; Sheeran & Orbell, 1998; Sheppard, Hartwick, & Warshaw, 1998). The direct effects of behavioural control on behaviour reflect the power of barriers to interfere with successful execution of plans despite people's effort to execute their plans.

In a recent study of physical activity behaviour, Hagger, Chatzisarantis, and Biddle (in press) examined the relationship between PLOC and Ajzen and Madden's (1986) theory of planned behaviour. Hagger et al. (in press) showed that intrinsic motivation predicted attitudes and perceptions of control beyond underlying behavioural and control beliefs. Most important, it was documented that intrinsic motivation exerted an indirect effect on intentions via attitudes and perceptions of control. PLOC did not exert any effect on intentions via subjective norms. These results lend support in favour of the hypothesis that intrinsic motivation provides the needed impetus for decision making (Deci & Ryan, 1980). However, it is important to emphasize that these results do not indicate whether PLOC influences health behaviour because Hagger et al. (in press) did not employ measures of effort and physical activity participation.

Automatic processes Generally speaking, deliberative processes are slow and require sufficient motivation and processing time (Bargh & Chartrand, 1999; Chaiken, 1980; Fazio, 1990). When environmental circumstances undermine motivation and/or they demand a fast decision to be made, people rely less on deliberative and more on automatic (Zanna, 1990) or heuristic (Chaiken, 1980) modes of information processing. The automatic or economic mode of information processing constitutes the second class of processes by which cognitive elements can influence health behaviour. It involves use of simple rules (heuristics) that individuals have developed through past experiences and observations (e.g. scripts and schemata). For example, a heuristic may involve the employment of the rule that: 'people generally agree with people they like'. Heuristic analysis allows people to make fast decisions, and without expending much effort. However, over-reliance on heuristics can lead to acceptance of unreliable information.

Habit is an example of a behavioural response that is guided by automatic mental processes. It refers to frequently performed acts that become automatic responses to particular situations, which can be functional in obtaining certain goals or end states (Bargh, 1994; Deci & Ryan, 1980). Mundane activities that can be automatized, for example, include typewriting and tooth brushing. According to Bargh and Chartrand (1999), frequency and consistency of execution of behaviour in the past constitutes the main ingredient that nurtures development of habits. In accordance with this proposition, studies have used self-report frequency of past behaviour as an *indicator* of habit (see Bamberg, Ajzen, & Schmidt, 2001; Triandis, 1977). Research to date has indicated that there is a strong relationship between frequency of past behaviour and future behaviour (Oullette & Wood, 1998). In addition, studies have demonstrated that past behaviour exerts a direct effect on health behaviour after controlling for variables that are included in the theory of planned behaviour (Aarts, Verplanken, & van Knippenberg, 1998; Bozionelos & Bennett, 1999; Conner & McMillan, 1999; Hagger et al., in press; Hodgins & Orbell, 1998; Meanstead, & van Eekelen, 1998; Terry, Hogg, & White, 1999; Verplanken, Aarts, van Knippenberg, & Moonen, 1998). Moreover, some studies have demonstrated an interactive effect between intention and past behaviour such that intentions predicted future behaviour only when frequency of past behaviour was low (Aarts, Verplanken, & Van Knippenberg, 1988; Verplanken et al., 1998). This body of empirical evidence indicates that behaviour can be a function of automatic mental processes as well as of deliberative (controlled) modes of information processing.

With respect to automated mental processes, Deci and Ryan (1980) postulated that self-determined behaviour becomes automatic as a function of frequency and consistency of execution of behaviour in the past. For example, it has been speculated that automatized behaviours were acquired to facilitate competent and self-determined interactions with the environment. Through learning to drive, one is able to engage in a variety of other activities such as driving through the countryside for pleasure or driving a taxi-cab for money. Therefore, the theoretical tenets of self-determination theory also predict that the effects of PLOC on future behaviour may be direct and vary as a function of the extent to which behaviour has been performed in the past.

Hypotheses

The purpose of the present study is to examine whether PLOC influences effort and participation in physical activities indirectly via variables that are included in the theory of planned behaviour. Consistent with theoretical tenets of the theory of planned behaviour, it is hypothesized that physical activity will be function of intentions and perceived behavioural control (Ajzen & Madden, 1986). Moreover, in accordance with Ajzen's (1985) propositions, it is hypothesized that the amount of effort that people expend in planning physical activity will mediate the effects of intentions and perceived behavioural control to physical activity.

With respect to PLOC, it can be hypothesized that intrinsic motivation will predict effort and physical activity participation indirectly via attitudes and perceived behavioural control (H_1). The indirect effects of intrinsic motivation will lend support to the conclusion that motives of PLOC motivate physical activity through deliberative modes of information processing. However, if automatic behaviours were acquired to facilitate competent and self-determined interactions with the environment (Deci & Ryan, 1980), there will be direct effects of PLOC on effort, which will be accounted for by past behaviour (H_2).

It is important to stress here that Ajzen (2002) has recently argued that the direct effects of past behaviour on future behaviour do not necessarily reflect the operation of habit. Instead, it has been speculated that the direct effects of past behaviour on future behaviour may reflect stability in psychological determinants that are omitted by the theory of panned behaviour. Further, some researchers claim that the inclusion of past behaviour has no explanatory value as it does not tap the psychological determinants that are omitted from the model that would account for these past behaviour influences (Ajzen, 1991, 2002). However, it is also important to emphasize that the argument that the relationship between past and future behaviour reflects stability, i.e. in cognitive determinants or behaviour, does not refute the idea that past behaviour is an indicator of habit. Habits are not empty constructs but mental events the automatization of which is a function of the frequency and consistency with which they have been used in the past (Bargh, 1994). Hence, it can be argued that effects of past behaviour to future behaviour, that may be due to stability of psychological determinants, corroborate the view that past behaviour indicates effects from habit, given that stability of psychological determinants is an indicator of habit. Most important, past research has shown that the effect that past behaviour exerts on future behaviour is direct (Hagger et al., in press), and that it is not mediated by intentions and effort (Bagozzi & Kimmel, 1995). According to Bargh (1994), non-intentionality and effort constitute important criteria in identifying operation of automatic mental processes. In general, it is expected behaviours that are under control of automatic processes to be non-intentional and be executed without effort. Consequently, it can be suggested that although measures of frequency of past behaviour do not model the elements of habit, past behaviour is an indicator of habit given that frequency and stability of usage, i.e. in behaviour or in psychological determinants, are indicators of habit.

Method

Research participants and procedure

Previous research investigating the relationship between PLOC and the theory of planned behaviour targeted young people (Hagger et al., in press). To facilitate comparison between results of the present study and previous research, the present study also targeted young

people. Research participants were 168 pupils (Males = 85, Females = 83, Age = 13.53 years, *SD* = .05) studying in three state schools. Head teachers provided consent for the data collection. A prospective design was employed with psychological variables being assessed twice. Baseline measures included intentions (Ajzen & Fishbein, 1980), PLOC (Mullen et al., 1997), frequency of physical activity in the past six months (Bagozzi & Kimmel, 1995), perceived behavioural control and attitudes (Ajzen & Madden, 1986). Subjective norms were not included in the present analysis given that previous research indicated that subjective norms did not mediate effects of PLOC on intentions (Hagger et al., in press). Moreover, it has been shown that subjective norms are not the most theoretically relevant social influence construct for understanding exercise behaviour (Courneya & McAuley, 1995; Courneya, Plotnikoff, Hotz, & Birkett, 2000). After five weeks, participation in physical activities (Godin & Shephard, 1985) and perceived effort were assessed (Bagozzi & Kimmel, 1995). Two researchers conducted the data collection in quiet classroom conditions. Children were separated in a way that they could not copy responses. To preserve confidentiality, participants were not asked to report their names. Due to the absence of some pupils during the second wave of data collection, results of the present study are based on 140 observations (Male = 78, Female = 62). Prospective responses were matched with baseline responses by using dates of birth and gender.

Measures

Perceived locus of causality PLOC was assessed through reasons for engaging in physical activity (Mullen et al., 1997). External regulation (e.g. I exercise because others say I should), introjection (e.g. I exercise because I will feel guilty if I do not), identification (e.g. I exercise because it is important to make the effort) and intrinsic motivation (e.g. I exercise because it is fun) were measured on seven- point scales anchored by not true at all (1) and very true (7). A Relative Autonomy Index (RAI) was calculated using the following formula: external regulation x (–2) + introjection x (–1) + identification + intrinsic motivation x (2). This index indicates the relative autonomy of regulation of physical activity with positive scores reflecting an autonomous forms of behavioural regulation (Goudas, Biddle, & Fox, 1994; Goudas, Biddle, & Underwood, 1995).

Perceived behavioural control Perceived behavioural control was assessed on seven-point scales (Ajzen & Madden, 1986). Examples included: 'it is really up to me whether or not I exercise . . .'; 'if I wanted to I could exercise'.

Frequency of past behaviour Past behaviour was assessed during the first wave of data collection. Participants were asked to report whether they had been engaged in active sports, and/or vigorous physical activities during the last six months. Past behaviour was measured on a 6-point scale, anchored by (1) 'not at all' to (6) 'most of the days per week' (Bagozzi & Kimmel, 1995).

Intentions Intentions were assessed on a seven-point scale anchored by strongly agree (7) to strongly disagree (1). Example: 'I intend to do active sports and/or vigorous physical activities . . .' (Ajzen & Fishbein, 1980).

Attitudes towards physical activity Attitudes were assessed on seven-point semantic differential scales (Ajzen & Driver, 1992; Ajzen & Fishbein, 1980). One adjective reflected moral evaluations (bad/good), two adjectives reflected instrumental evaluations (useful/useless, harmful/beneficial) and two adjectives reflected affective evaluations (unenjoyable/enjoyable, boring/interesting).

Perceived effort and self-report physical activity Perceived effort was measured during the second wave of data collection. Participants reported how much effort they exerted in terms of maintaining willpower, planning, energy, trying, and discipline in the past five weeks (e.g. How hard did you try to exercise over the last five weeks? How hard did you try in terms of planning your exercise sessions over the last five weeks?). All types of effort were measured on seven-point scales (Bagozzi & Kimmel, 1995).

Physical activity was assessed through an adaptation of Godin and Shephard (1985) Leisure-Time Exercise Questionnaire during the second wave of data collection (Biddle, Goudas, & Page, 1994). This asked how many

times the individual engaged in vigorous exercise for at least 30 minutes in the past five weeks. In keeping with definitions of leisure activities (Biddle & Chatzisarantis, 1999), the questionnaire did not include physical activity that was performed during normal school time. This is because in most European countries, physical education is compulsory and therefore cannot be classified as a leisure activity.

Specifically, participants were requested to consider an average week (seven days), and to report how many times per week they engaged in vigorous physical activity over the last five weeks. Participants reported how often they participated in physical activity after they had been presented with the definition of vigorous physical activity. Vigorous activity included all active sports training, practices and competition, but not snooker, darts or similar sedentary sports. It also included physical activities that were active, like continuous swimming, cycling, aerobics and running, but not street play or walking to school. Participants' responses were recorded on a eight-point scale ranging from 0 to 8. Independent evaluations of the Leisure-Time Exercise Questionnaire have found it to be valid, reliable, easy to administer and to display concurrent validity with objective activity, and fitness indices (Jacobs, Ainsworth, Hartman, & Leon, 1993). Further, previous research showed that applications of the theory of planned behaviour predicted measures of physical activity as measured by the Leisure-Time Exercise Questionnaire (Biddle et al., 1994; Chatzisarantis & Biddle, 1998; Chatzisarantis, Biddle, & Meek, 1997; Courneya, Bobick, & Schinke, 1999; Courneya, Friedenreich, Arthur, & Bobick, 1999; Courneya & Hellsten, 1998).

Results

Preliminary analysis

Measures of effort and behavioural intentions may lack discriminant validity given that it can be argued that these are similar constructs. Likewise, intrinsic motivation and attitudes may lack discriminant validity because of similarities in the content of items used to measure these constructs. Further, it can be argued that PLOC lacks discriminant validity with measures of perceived behavioural control (e.g. it is really up to me . . . , if I wanted to I . . .) because items of behavioural control appear to measure relative autonomy. Moreover, researchers have postulated that perceptions of control carry significant amounts of functional autonomy to the perceiver (Biddle, 1999; Hagger et al., in press; Skinner, 1996). For such reasons, it is important to examine discriminant validity between PLOC, attitudes, behavioural control, effort and behavioural intentions.

The present study used confirmatory factor analysis to examine discriminant validity between measures (Mulaik & Millsap, 2000). In confirmatory factor analysis, models are specified and evaluated on the basis of differences between empirical and model-implied covariance matrices. Adequacy of models is investigated through fit indices which examine the extent to which the model-implied covariance matrix can reproduce the empirical covariance matrix satisfactorily. Comparative Fit Index (CFI) and Standardized Root Mean Square Residual (SRMSR) were used to evaluate the adequacy of models because simulation studies have shown that these fit indices are least influenced by sample size (Fan, Thompson, & Wang, 1999). Given that with small sample sizes ($N <$ 250) all fit indices display a downward bias (Fan et al., 1999), a cut-off value close to .93 for CFI and a cut-off value close to .08 for the SMRSR were set as criteria of acceptable fit (see Hu & Bentler, 1999). Further, the present study ascertained discriminant validity by comparing a model which assumed discriminant validity, with a series of nested equivalent models that assumed lack of discriminant validity. Akaike's Information Criterion (AIC) and Freedman's test of ranked residuals were employed in facilitating model comparisons.

Discriminant validity was first examined through specification of a model (Model 1) in which indicators of PLOC, attitudes, and behavioural control loaded on six latent factors (Mulaik & Millsap, 2000). A six latent-factor model was specified in order to account for the uni-dimensional attitudes and perceived behavioural control (PBC) constructs, and for the four dimensions of PLOC. In addition, Model 1 specified correlations between the latent factors but did not specify cross-loadings and correlations at the residual space of indicators. As shown in Table 1, the fit indexes indicated that parameters of Model 1 reproduced the observed

covariance matrix adequately. Loadings of indicators of PLOC, attitudes, and perceived behavioural control were significant and positive ($p <$ .01). In addition, the average magnitude of the standardized loadings for the factors was .73, which exceeds considerably the widely accepted minimum of .40 (Ford, MacCallum, & Tait, 1986). The correlations between PLOC, attitudes and perceived behavioural control were significantly positive but the factors were unique from a statistical standpoint because the correlations plus twice each standard error summed to a value of less than one (Bagozzi & Kimmel, 1995).

Discriminant validity was examined further through specification of an alternative exploratory model (Model 2) in which indicators of perceived behavioural control cross-loaded onto the latent factor of intrinsic motivation (Mulaik & Millsap, 2000). Lederman's (1937) inequality equation indicated that Model 2 was identified because the number of factors of Model 2 was lower than 15.85. As it is shown in Table 1, although Model 2 reached criteria of acceptable fit, the AIC of Model 1 was lower than the AIC of Model 2. In addition, Friedman's test of ranked residuals (Rigdon, 1999) revealed that Model 2 did not display lack of fit (Q = .23, χ^2 (1) = 1.33, p = .28). Finally, a third exploratory model (Model 3), which let indicators of attitudes cross-load on the intrinsic motivation factor, did not exhibit a substantially better fit than Model 1 (see Table 1). The Friedman's test of ranked residuals indicated that, in comparison to Model 3, Model 1 did not display unacceptable lack of fit (Q = .24, χ^2 (1) = 1.66, p = .18). Therefore, Model 1 has to be accepted as reflecting a true model (Mulaik & Millsap, 2000), because it reproduced the empirical covariance matrix adequately, and withstood a higher chance of rejection than the respective exploratory models (Models 2 and 3).

Confirmatory factor analysis also demonstrated that a two-factor model explained covariance between indicators of effort and intentions satisfactorily (see Table 1). Further, a uni-factorial congeneric model (Model 5), assuming lack of discriminant validity, did not explain observations satisfactorily. Finally, although a two-factor exploratory model exceeded recent criteria of good fit (Model 6), the Friedman test of ranked residuals indicated that the two-factor confirmatory model (Model 4) displayed acceptable lack of fit (Q = .01, χ^2 (1) = 0.66, p = 1.0). The average magnitude of the standardized loadings for the factors was also .85, which again exceeded considerably the widely accepted minimum of .40 (Ford et al., 1986). The correlation between the latent factors of effort and intentions was .51, but the factors were unique from a statistical point of view because the correlation was significantly different from unity at .001 alpha level (Bagozzi & Kimmel, 1995). These results support the discriminant validity of measures of effort and intentions.

Table 2 presents correlation coefficients between all psychological measures. Correlations supported positive relationships between intentions, attitudes, internal PLOC, and perceptions of control. The correlations between external PLOC with attitudes and perceptions of control were positive but those correlations were not as large as those between internal PLOC with variables of the theory of planned behaviour. Further, correlations indicated that intentions, and perceptions of control were positively associated with physical activity and effort. Finally, measures displayed satisfactory

Table 1. Fit indexes of confirmatory factor analysis and path analysis models

Model	χ^2	*d.f.*	*CFI*	*SRMSR*	*AIC*
1. Six-factor model	420.12	193	.93	.068	36.12
2. Exploratory model: Control cross-loads to intrinsic motivation	419.63	191	.94	.068	37.63
3. Exploratory model: Attitude cross-loads to intrinsic motivation	418.38	189	.94	.063	40.38
4. Two-factor model of effort and behavioural intentions	7.55	8	1.0	.039	–8.44
5. Uni-factorial congeneric model of intentions and effort	73.453	9	.73	.156	55.45
6. Exploratory model: Effort cross-loads to intentions	4.49	2	1.0	.015	.494
7. Path model predicting effort and physical activity	35.07	22	.98	.080	–8.93
8. Path model including past behaviour	23.45	22	.99	.050	–20.55

Table 2. Means, standard deviations and zero-order correlations between study variables

	Mean	*SD*	*Alpha*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1. Past behaviour	4.2	1.3	_	1.0									
2. Intentions	5.7	1.6	.93	.58	1.0								
3. Physical activity	4.2	1.3	_	.63	.61	1.0							
4. Attitude	5.8	1.0	.90	.34	.58	.38	1.0						
5. External regulation	2.5	1.4	.81	.05	.08	.16	.17	1.0					
6. Introjection	2.7	1.5	.72	.04	.16	.12	.28	.51	1.0				
7. Identification	4.2	1.4	.77	.43	.53	.41	.36	.23	.37	1.0			
8. Intrinsic motivation	4.6	1.6	.81	.36	.49	.35	.54	–.14	.06	.63	1.0		
9. Effort	4.7	1.4	.88	.50	.61	.74	.49	.14	.08	.55	.53	1.0	
10. Control	5.8	1.1	.78	.38	.35	.34	.38	.22	.21	.18	.30	.35	1.0

levels of internal consistency because alpha coefficients were greater than .70 (Kline, 1993).

Path analysis

This part of the analysis employed path analysis to examine the cognitive processes by which PLOC influences effort and physical activity participation. Initially, a path model (Model 7) was specified whereby intrinsic motivation predicted effort and physical activity indirectly via attitudes, perceptions of control, and intentions (see Fig. 1(a)). This model was identical to the model tested by Hagger et al. (in press) except for the additions of effort and physical activity. Further, Model 7 specified direct paths from intrinsic motivation to effort and physical activity (Sheldon & Elliot, 1999). Direct paths from intrinsic motivation to effort and physical activity were specified as a means of evaluating the contribution of intrinsic motivation to the prediction of physical activity (H_2). It is important to stress here that Model 7 did not include past behaviour so that effects not attenuated (reduced) by past behaviour could be estimated. Examination of the fit indices revealed that Model 7 reproduced the observed covariance

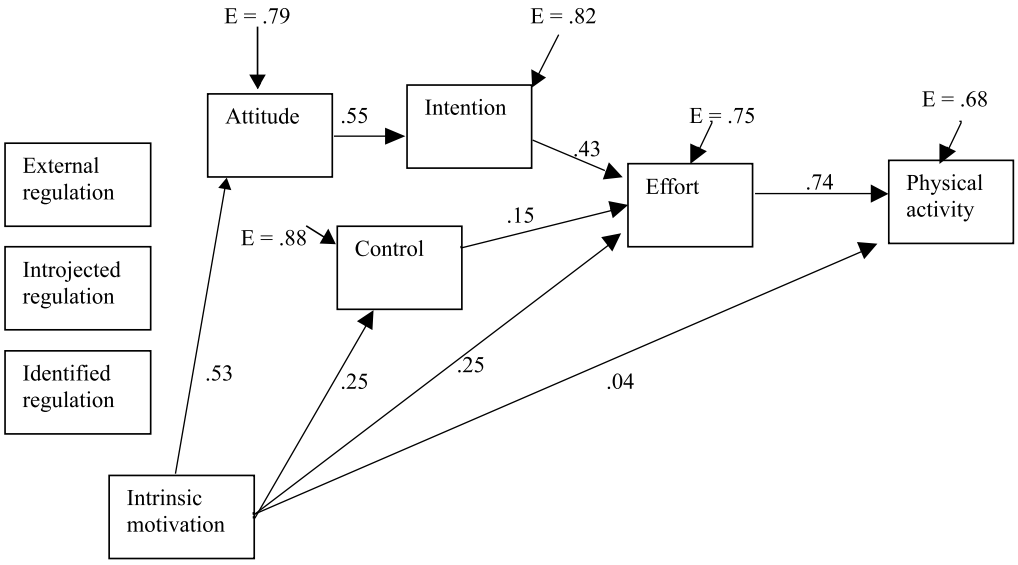

Figure 1a. A path model predicting effort and physical activity.

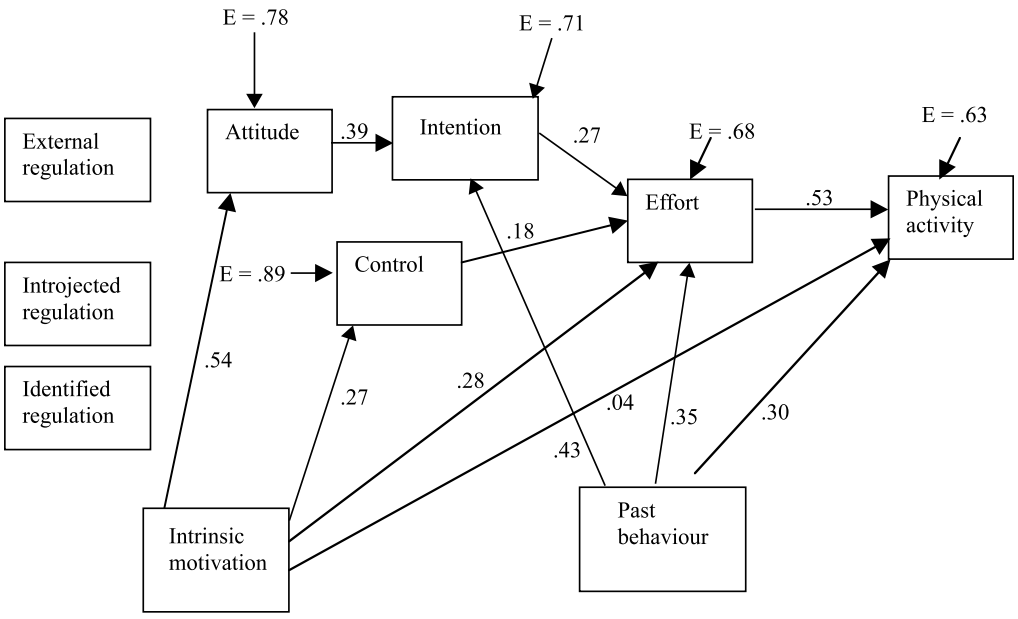

Figure 1b. A path model including past behaviour.
Note: For simplicity, zero paths from past behaviour to attitudes and perceived behavioural control are not displayed. In addition, the correlations between independent variables were estimated

matrix satisfactorily. The CFI was greater than .93 and the SRMSR was lower than .08 (see Table 1).

Parameters of Model 7 indicated that intentions and perceptions of control exerted indirect effects on physical activity participation via effort (see Fig. 1(a)). These indirect effects are consistent with the theory of planned behaviour (Ajzen, 1985), which postulates that intentions are stronger predictors of effort than of actual execution of behaviour. Perceived behavioural control did not exert a direct relationship with physical activity. With respect to PLOC, parameters of Model 7 indicated that intrinsic motivation exerted two types of effect on effort. The first effect was indirect via attitudes and perceptions of control. The second type of effect was direct. The indirect effects of intrinsic motivation on effort support the hypothesis that deliberative modes of information processing mediate the effects of PLOC on effort (H_1).

To examine whether past behaviour reduced the direct effects of intrinsic motivation on effort (H_2), a second model was specified (Model 8) in which past behaviour was hypothesized to predict attitudes, perceived control, intentions, effort, and physical activity directly (see Fig. 1(b)). As shown in Table 1, Model 8 exceeded criteria of good fit. Investigation of parameters of the model revealed that past behaviour predicted intentions, effort, and physical activity participation directly. Past behaviour did not predict attitudes and perceived behavioural control. Further, inconsistent with the initial hypothesis (H_2), past behaviour did not reduce the direct effects of intrinsic motivation on effort. This is because the fit of Model 8 did not reduce significantly after the path coefficient in Model 8, from intrinsic motivation to effort, was fixed at the value that Model 7 estimated ($\Delta\chi^2 = .457$, $p > .05$).

Investigation of total effects of PLOC on effort and physical activity (see Table 3) revealed that the most important variable in predicting effort was past behaviour followed by intrinsic motivation, intentions and perceptions of control. The most important variable in predicting physical activity was again past behaviour followed by intrinsic motivation and intentions. Most importantly, comparisons

Table 3. Total and indirect effects in model 4

	Total Past behaviour	*Total Control*	*Total Intrinsic*	*Total Attitude*	*Indirect Intrinsic*
Effort	.48	.19	.23	.09	.14
Physical activity	.56	.11	.20	.05	.09

between total, direct and indirect effects indicated that the direct effects of intrinsic motivation on effort were larger than the indirect effects of intrinsic motivation on effort. These findings confirm the partial mediation of effects of intrinsic motivation on effort by deliberative modes of information processing. Therefore, it can be concluded that the effects of intrinsic motivation on effort are unique, from a statistical point of view, because they are direct and independent from the extent to which people exercised during the preceding six months.

With respect to the role of external PLOC in the model, it can be seen that the positive correlations between external regulation and introjection with attitudes and perceptions of control (see Table 2) do not translate into path coefficients in the path model of Fig. 1(b). This may be due to the fact that intrinsic motivation negated the effects of external regulation and introjection in the model (Hagger et al., in press). To examine this possibility, Model 8 was re-estimated by fixing all the paths from intrinsic motivation to attitudes and perceptions of control, and freeing the paths from external regulation and introjection to attitudes and perceptions of control. In this re-estimated model, significant negative effects of external regulation on attitudes (–.20) and significant positive effects of introjection to attitudes (.43) were established. There was no effect from external regulation (.11) and introjection (.11) on perceptions of control. Hence, it can be concluded that there are indirect effects from external PLOC on effort via attitudes, and these in turn are negated by intrinsic motivation.

Discussion

The purpose of the present study was to examine the cognitive processes by which PLOC influences effort and participation in physical activities. As expected (H_1), PLOC exerted an indirect relationship with effort and physical activity via attitudes, perceived behavioural control, and intentions. This result is consistent with the findings of Hagger et al. (in press), who reported that intrinsic motivation exerted indirect relationships with intentions via attitudes and perceptions of control. Therefore, it can be postulated that positive attitudes and perceptions of control assist motives of PLOC to translate into physical activity. Motives will not motivate effort and physical activity if children infer, following deliberation, that execution of physical activity is difficult and/or if they contemplate negative outcomes of physical activity.

The indirect effects of PLOC on effort also lend evidence in favour of Fazio's (1990) and Chaiken's (1980) dual models of information processing, which view deliberative processes to be a function of motivation. For example, Chaiken (1980) showed that people were more likely to systematically analyse an issue and express a desire to be well informed on the topic when the issue at hand was personally important. In contrast, when the issue was not personally relevant, people spent less time in thinking about it. The present study corroborates Chaiken's (1980) findings because parameters of Model 7 indicate that motives (e.g. interest and perceived importance of physical activity) facilitate deliberation of execution of physical activity.

It is also important to emphasize that not all types of motives made a unique contribution to the prediction of attitudes and perceptions of control. The path analysis indicated that external regulation was negatively associated with attitudes. In addition, it was shown that intrinsic motivation negated the effects that external regulation and introjection exerted on attitudes. These results corroborate the view that PLOC does not only predict likelihood of systematically seeking and analysing information relevant to initiation and regulation of physical activity. The results indicate that motives of PLOC can predict the direction of decision making. Children are more likely to contemplate execution of physical activity and dwell on the positive

aspects of physical activity when PLOC is internal than when PLOC is external to the self (see also Hagger et al., in press). Collectively, the indirect effects observed, in the present study, for PLOC indicate that a motivational analysis of decision-making processes is fruitful because motives of PLOC predict whether children contemplate physical activity as well as motives can predict the outcome of deliberative processes.

Turning now to the relationships between PLOC and past behaviour, the parameters expressed in Model 8 indicated that the effects of intrinsic motivation on effort were direct and independent of past behaviour. Hence, it is evident that intrinsic motivation impacts on effort even for people who did not exercise repeatedly in the past six months. Although this result is inconsistent with Deci and Ryan's (1980) reasoning (H_2) about relationships between frequency of past behaviour and autonomous behaviour, the unique effects of intrinsic motivation are consistent with evidence reported by previous laboratory studies (Deci et al., 1999). More specifically, a large number of experimental studies has successfully changed participants' levels of intrinsic motivation in the context of *novel* activities (Deci & Ryan, 1985). When past experience was not controlled for experimentally, field studies have indicated a direct effect of PLOC on effort (Sheldon & Elliot, 1999) and goal attainment (Williams et al., 1996). Therefore, the direct effect observed in the present study for intrinsic motivation is consistent with previous empirical studies, and indicates that the effects of PLOC are independent of past behaviour.

The unique effect of intrinsic motivation on effort indicates the importance of incorporating PLOC in the theory of planned behaviour. In general, the theory of planned behaviour does not make any hypotheses about factors that produce changes in people's intentions and behaviour. The residual variance of effort and behaviour—controlling for behavioural control, intentions and past behaviour—is usually taken to mean random error. For example, Ajzen proposed that factors that cause changes in intentions: 'are more or less random events that affect some individuals at any given time. Their effects on intentions of different people are therefore likely to balance out, leaving the aggregated measure of intentions relatively unchanged' (1985, p. 23). Contrary to Ajzen's (1985) predictions, Model 8 indicates that the amount of effort that children expend in maintaining planning of physical activity varies as a function of PLOC. In general, children are more likely to maintain planning over time when the behaviour is perceived to be intrinsically motivating.

It is interesting to note that the effects observed in the present study for intrinsic motivation concur with results that are reported in recent intervention studies. Bamberg et al. (2001) reported that an intervention, based on the theory of planned behaviour, changed people's choices of travel mode successfully. However, in that study, post-intervention effect sizes were not reported. Hennessy, Bola, Hoxworth, Iatesta, Rhodes, and Zenilman (1999) reported that an intervention programme, based on the theory of reasoned action, health belief model, and self-efficacy changed self-efficacy during the intervention period (condom use). However, it was reported that self-efficacy declined rapidly during post-intervention period. In direct contrast, interventions and laboratory studies that took PLOC into consideration showed a marked maintenance of behavioural change during post-treatment periods. For example, laboratory studies showed that people persist with tasks during post-treatment periods (e.g. free choice periods; Deci et al., 1999) when environmental conditions support psychological needs. Williams et al. (1996) showed that PLOC predicted adherence to a low calorie weight-loss programme and actual weight loss for over a 20-month period. Therefore, it is important to include PLOC in the theory of planned behaviour given that PLOC predicts and facilitates maintenance of physical activity planning.

The present study had a number of strengths. It was prospective and obtained data from a population that has received relatively little attention from researchers (children). It also provides data that links motivation with cognition. However, the study was not without some limitations. The first limitation concerns the operational definition of habit. It has been proposed that habit should be measured in relation to situations where behaviour occurs. In addition, it has been proposed that questionnaires should prompt people to indicate their

behavioural choices in those situations as quickly as possible (Aarts et al., 1998; Verplanken et al., 1998). Further, it has been argued that the effects of past behaviour on future behaviour may not reflect habit but common method factors or stability in the configuration of factors that guide health behaviour (Bamberg et al., 2001). However, it is important to emphasize that previous studies have shown that past behaviour and future behaviour do not share method factors (Bamberg et al., 2001). In addition, the argument that the relationship between past and future behaviour reflects stability does not refute the idea that the effects of past behaviour reflect operation of habit. Aarts and Dijksterhuis (2000) showed that the automaticity of behaviour depends on the stability of the factors that guide behaviour. Moreover, although multi-method measures of habit may assess habit more accurately, frequency of past behaviour constitutes the main ingredient of habit (Bargh & Chartrand, 1999). Moreover, Bamberg et al. (2001) found that measures of habit obtained through the fast response procedure did not add to the prediction of travel mode choice beyond past behaviour. In summary, insufficient measures of habit and common method factors do not fully explain why past behaviour does not reduce the effects of intrinsic motivation on effort.

In conclusion, results of the present study indicate that the cognitive process by which PLOC influences physical activity is deliberative and independent of past behaviour. In addition, the present study shows that a motivational analysis of decision-making processes is beneficial given that motives of PLOC predict: (i) whether people contemplate execution of physical activity; (ii) the direction of the decision-making process; and (iii) changes in the amount of effort that children expend in maintaining planning of physical activity.

References

Aarts, K., & Dijksterhuis, A. (2000). Habits as knowledge structures: Automaticity in goal-directed behavior. *Journal of Personality and Social Psychology*, *78*, 53–63.

Aarts, H., Verplanken, B., & van Knippenberg, A. (1998). Predicting behavior from actions in the past: Repeated decision-making or a matter of habit? *Journal of Applied Social Psychology*, *3*, 1038–1053.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl, & J. Beckmann (Eds.), *Action-control: From cognition to behavior* (pp. 11–39). Heidelberg: Springer.

Ajzen, I. (2001). Nature and operation of attitudes. *Annual Review of Psychology*, *52*, 27–58.

Ajzen, I. (2002). Residual effects of past on later behavior: Habituation and reasoned action perspectives. *Personality and Social Psychology Review*, *6*, 107–122.

Ajzen, I., & Driver, B. L. (1992). Application of the theory of planned behaviour to leisure choice. *Journal of Leisure Research*, *24*, 207–224.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. New Jersey: Prentice Hall.

Ajzen, I., & Madden, T. J. (1986). Prediction of goal directed behavior: Attitudes, intentions and perceived behavioral control. *Journal of Experimental Social Psychology*, *22*, 453–474.

Bagozzi, R. P., & Kimmel, S. K. (1995). A comparison of leading theories for the prediction of goal directed behaviors. *British Journal of Social Psychology*, *34*, 437–461.

Bamberg, S., Ajzen, I., & Schmidt, P. (2001). Choice of travel mode in the theory of planned behavior: The roles of past behavior, habit and reasoned action. *Basic and Applied Social Psychology*, *4*, 18–35.

Bargh, J. (1994). The four horsemen of automaticity: Awareness, efficiency, intentions and control. *Handbook of Social Cognition*, 2nd edn (p. 1040). Hillsdale, NJ: Erlbaum.

Bargh, J., & Chartrand, J. (1999). The unbearable automaticity of being. *American Psychologist*, *7*, 462–479.

Bentler, P. M. (1989). *EQS structural equations program manual*. Los Angeles, CA: BMDP Statistical Software.

Biddle, S. J. H. (1999). Motivation and perceptions of control: Tracing its development and plotting its future in exercise and sport psychology. *Journal of Sport and Exercise Psychology*, *21*, 1–23.

Biddle, S. J. H., & Chatzisarantis, N. L. D. (1999). Motivation for a physically active lifestyle through physical education. In Y. Vandeen Auweele, F. Bakker, S. J. H. Biddle, M. Durand, & R. Seiler (Eds.), *Psychology for physical educators*, (pp. 5–26). Champaign, IL: Human Kinetics.

Biddle, S. J. H., Goudas, M., & Page, A. (1994). Social-psychological predictors of self-reported actual and intended physical activity in a university workforce sample. *British Journal of Sports Medicine*, *28*, 160–163.

Bozionelos, G., & Bennett, P. (1999). The theory of planned behaviour as predictor of exercise. *Journal of Health Psychology*, *4*, 517–529.

Chaiken, S. (1980). Heuristic versus systematic

information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology*, *39*, 752–766.

Chatzisarantis, N. L. D., & Biddle, S. J. H. (1998). Functional significance of psychological variables that are included in the theory of planned behavior: A self-determination theory approach to the study of attitudes, subjective norms, perceptions of control and intentions. *European Journal of Social Psychology*, *28*, 303–322.

Chatzisarantis, N. L. D., Biddle, S. J. H., & Meek, G. A. (1997). A self-determination theory approach to the study of intentions and the intention–behavior relationship in children's physical activity. *British Journal of Health Psychology*, *2*, 343–360.

Conner, M., & McMillan, B. (1999). Interaction effects in the theory of planned behaviour: Studying cannabis use. *British Journal of Social Psychology*, *38*, 195–222.

Courneya, K. S., Bobick, T., & Schinke, R. (1999). Does the theory of planned behavior mediate the relation between personality and exercise behavior? *Basic and Applied Social Psychology*, *21*, 317–324.

Courneya, K. S., & Friedenreich, C. (1997). Determinants of exercise during colorectal cancer treatment: An application of the theory of planned behavior. *Oncology Nursing Forum*, *24*, 1715–1723.

Courneya, K. S., Friedenreich, C., Arthur, K., & Bobick, T. (1999). Understanding exercise motivation in colorectal cancer patients: A prospective study using the theory of planned behavior. *Rehabilitation Psychology*, *44*, 68–84.

Courneya, K. S., & Hellsten, A. (1998). Personality correlates of exercise behavior, motives, barriers and preferences: An application of the five factor model. *Personality and Individual Differences*, *24*, 625–633.

Courneya, K. S., & McAuley, E. (1995). Cognitive mediators of the social influence–exercise adherence relationship: A test of the theory of planned behavior. *Journal of Behavioral Medicine*, *18*, 499–515.

Courneya, K. S., Plotnikoff, R. C., Hotz, S. B., & Birkett, N. J. (2000). Social support and the theory of planned behavior in the exercise domain. *American Journal of Health Behavior*, *24*, 300–308.

DeCharmes, R. (1968). *Personal causation: The internal affective determinants of behavior*. New York: Academic Press.

Deci, E. L. (1992). On the nature and functions of motivation theories. *Psychological Science*, *3*, 167–171.

Deci, E., Koestner, R., & Ryan, R. (1999). A meta-analytic review of experiments examining the effects of extrinsic reward on intrinsic motivation. *Psychological Bulletin*, *6*, 627–668.

Deci, E. L., & Ryan, R. M. (1980). Self determination theory: When mind mediates behavior. *The Journal of Mind and Behavior*, *1*, 33–43.

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

Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology*, *53*, 1024–1037.

Fan, X., Thompson, B., & Wang, L. (1999). Effects of sample size, estimation methods and model specification on structural equation modelling. *Structural Equation Modelling: A Multidisciplinary Journal*, *1*, 56–83.

Fazio, R. H. (1990). Multiple processes by which attitudes guide behavior: The mode model as an integrative framework. *Advances in Experimental Social Psychology*, *23*, 75–109.

Ford, J., MacCallum, R., & Tait, M. (1986). The application of factor analysis in psychology: A critical review and analysis. *Personnel Psychology*, *39*, 291–314.

Godin G., & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Science*, *10*, 141–146.

Goudas, M., Biddle, S., & Fox, K. (1994). Perceived locus of causality, goal orientations and perceived competence in school physical education classes. *British Journal of Educational Psychology*, *64*, 453–463.

Goudas, M., Biddle, S., & Underwood, M. (1995). A prospective study of the relationships between motivational orientations and perceived competence with intrinsic motivation and achievement in a teacher education course. *Educational Psychology*, *5*, 89–96.

Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (in press). The influence of autonomous and controlling motives on physical activity intentions within the theory of planned behaviour. *British Journal of Health Psychology*.

Hausenblas, H. A., Carron, A. V., & Mack, D. E. (1997). Application of the theories of reasoned action and planned behavior to exercise behavior: A meta analysis. *Journal of Sport and Exercise Psychology*, *19*, 36–41.

Hennessy, M., Bola, G. A., Hoxworth, T., Iatesta, M., Rhodes, F., & Zenilman, J. M. (1999). Using growth curves to determine the timing of booster sessions. *Structural Equation Modelling: A Multidisciplinary Journal*, *6*, 322–342.

Hodgins, S., & Orbell, S. (1998). Can protection motivation theory predict behaviour? A longitudinal theory exploring the role of previous behaviour. *Psychology and Health*, *13*, 237–250.

Hu, L., & Bentler, P. (1999). Cut-off criteria for fit indexes in covariance structure analysis:

Conventional criteria versus new alternatives. *Structural Equation Modelling: A Multidisciplinary Journal*, *1*, 1–55.

Jacobs, D. R., Ainsworth, B. E., Hartman, T. J., & Leon, A. S. (1993). A simultaneous evaluation of ten commonly used physical activity questionnaires. *Medicine and Science in Sports and Exercise*, *25*, 81–91.

Kasser, V. G., & Ryan, R. M. (1999). The relation of psychological needs for autonomy and relatedness to vitality, well-being, and mortality in a nursing home. *Journal of Applied Social Psychology*, *29*, 935–954.

Kline, P. (1993). *The handbook of psychological testing*. London: Routlege.

Lederman, W. (1937). On the rank of the reduced correlation matrix in multiple factor analysis. *Psychometrica*, *2*, 85–93.

Meanstead, A., & van Eekelen, S. (1998). Distinguishing between perceived behavioral control and self-efficacy in the domain of academic achievement intentions and behaviors. *Journal of Applied Social Psychology*, *25*, 1375–1392.

Mulaik, A., & Millsap, R. E. (2000). Doing the four-step right. *Structural Equation Modelling: A Multidisciplinary Journal*, *7*, 36–73.

Mullen, E., Markland, D., & Ingledew, D. K. (1997). A graded conceptualization of self-determination in the regulation of exercise behavior: Development of a measure using confirmatory factor analysis. *Personality and Individual Differences*, *23*, 745–752.

Oullette, L., & Wood, W. (1998). Habit and intention in every day life: The multiple processes by which past behavior predict future behavior. *Psychological Bulletin*, *124*, 54–74.

Reis, H. T., Sheldon, K. M., Gable, S. L., Roscoe, J., & Ryan, R. M. (2000). Daily well-being: The role of autonomy, competence, and relatedness. *Personality and Social Psychology Bulletin*, *26*, 419–435.

Rigdon, E. E. (1999). Using the Friedman method of ranks for model comparison in structural equation modelling. *Structural Equation Modelling: A Multidisciplinary Journal*, *3*, 219–232.

Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality*, *63*, 397–427.

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization. *Journal of Personality and Social Psychology*, *5*, 749–761.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development and well being. *American Psychologist*, *1*, 68–78.

Schmidt, F. (1996). Statistical significance testing and cumulative knowledge in psychology: Implications for training researchers. *Psychological Methods*, *2*, 115–129.

Sheeran, P., & Orbell, S. (1998). Do intentions predict condom use? Meta-analysis and examination of six moderator variables. *British Journal of Social Psychology*, *37*, 231–250.

Sheldon, K. M., & Elliot, A. (1999). Goal striving, need satisfaction and longitudinal well-being: The self-concordance model. *Journal of Personality and Social Psychology*, *3*, 482–497.

Sheldon, K. M., Ryan, R. M., Rawsthorne, L. J., & Illiardi, B. (1997). Trait self and true self: Cross-role variation in the big five personality traits and its relations with psychological authenticity and subjective well-being. *Journal of Personality and Social Psychology*, *75*, 1380–1393.

Sheppard, B., Hartwick, J., & Warshaw, P. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research*, *15*, 325–343.

Skinner, E. (1996). A guide to constructs of control. *Journal of Personality and Social Psychology*, *71*, 549–570.

Straus, J. & Ryan, R. M. (1987). Autonomy disturbances in subtypes of anorexia nervosa. *Journal of Abnormal Psychology*, *96*, 254–258.

Terry, D. J., Hogg, M. A., & White, K. M. (1999). The theory of planned behavior: Self-identity, social identity and group norms. *British Journal of Social Psychology*, *38*, 225–244.

Triandis, H. C. (1977). Interpersonal behavior. Monterey, CA: Brookes/Cole.

Verplanken, B., Aarts, H., van Knippenberg, A., & Moonen, A. (1998). Habit versus planned behavior: A field experiment. *British Journal of Social Psychology*, *37*, 111–128.

White, R. W. (1960). Competence and the psychosexual stages of development. In R. W. Dienstbier (Ed.), *Nebraska Symposium on Motivation*, vol. 8 (pp. 97–141). Lincoln, NE: Nebraska University Press.

Williams, G., Freedman, Z., Ryan, R. M., & Deci, E. L. (1996). Motivational predictors of weight loss and maintenance. *Journal of Personality and Social Psychology*, *70*, 115–126.