



The influence of autonomous and controlling motives on physical activity intentions within the Theory of Planned Behaviour

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Objectives. This study aimed to examine how general motives from self-determination theory (SDT; Deci & Ryan, 1985) influence intentions to engage in physical activity within the Theory of Planned Behaviour (TPB; Ajzen, 1985). It was hypothesized that the general motives will influence intentions only when mediated by the specific cognitions of attitude, subjective norms and perceived behavioural control (PBC) from the TPB.

Design. A cross-sectional study assessing psychological variables from two theoretical perspectives.

Method. Self-report questionnaires were administered to 1088 children aged 12–14 years. The children's intentions, attitudes, subjective norms and PBC towards participating in physical activity were assessed using a TPB questionnaire. A modified version of Ryan and Connell's (1989) perceived locus of causality (PLOC) inventory was used to measure controlling and autonomous motives for participating in physical activity.

Results. These data were analysed using structural equation modelling. The resulting well-fitting model demonstrated that attitude and PBC mediated the influence of autonomous motives to perform physical activity on physical activity intentions. The presence of autonomous motives resulted in the effects of the controlling motives being attenuated to zero.

Conclusions. The present results indicate that general autonomous motives to participate in physical activity act as sources of information when children make their judgments regarding their specific attitudes and PBC. Attitudes and PBC are necessary to translate these general motives from SDT into intentions in the TPB. In terms of targets for intervention, practitioners may positively influence intentions by providing a choice of physical activities to foster increased autonomy in children.

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There is increasing evidence to suggest that participation in regular physical activity delivers positive benefits to children's physical (Biddle, Cavill, & Sallis, 1998) and psychological health (Calfas & Taylor, 1994). Despite this, there is substantial evidence to indicate that children and adolescents, while being the most active segment of the population, are seldom engaged in physical activity of the frequency, intensity and duration associated with health benefits (Cale & Almond, 1992). Psychologists have therefore directed their attention to the psychological factors determining adherence to physical activity in younger people (De Bourdeaudhuij, 1998). In particular, the adoption of intentional models of social cognition has been a useful enterprise in the examination of physical activity behaviour in children (Atsalakis & Sleaf, 1996; Craig, Goldberg, & Dietz, 1996; Hagger, Cale, & Ashford, 1997).

One social-cognitive model that has been adopted to explain physical activity behaviour is the Theory of Planned Behaviour (TPB; Ajzen, 1985). The TPB assumes that humans are rational decision makers and base their actions on a consideration of their attitudes towards the behaviour, the social pressures to engage in that behaviour or subjective norms and their relative capacities or faculties to engage with this behaviour or perceived behavioural control (PBC). These manifest variables are underpinned by a set of determining behavioural, normative and control beliefs. The concept of key importance in the model is intention or an individual's stated orientation towards that behaviour. Intentions are supposed to reflect the relative strength of an individual's motivation to engage in the behaviour. Intention is viewed as the most proximal predictor of behaviour in the TPB and is hypothesized to mediate completely the influence of the cognitions of attitude, subjective norms and PBC on behaviour. Tests of the TPB in a physical activity context have demonstrated that the model has successfully accounted for a substantial proportion of the variance in physical activity intentions and behaviour in studies with children (Craig *et al.*, 1996; Hagger *et al.*, 1997) and adults (for a meta-analytic review see Hausenblas, Carron, & Mack, 1997).

While the TPB has demonstrated utility in predicting physical activity intentions and behaviour, it is limited for two reasons. First, it does not directly account for the influence of more superordinate, general cognitive influences on attitudes, subjective norms and perceived control. Bagozzi (1982) suggests that while the immediate determinants of behaviour have been identified in social-cognitive models like the TPB, such models do not reveal the origins of these constructs like global, goal-related motives. Secondly, the TPB does not describe how these general motives act as sources of information in the formation of intentions. Indeed, social-cognitive theorists recognize that social-cognitive constructs never account for all the variance in intentions and behaviour because other information-giving constructs may be responsible such as general motives and global goals (Bagozzi, 1982; Kuhl & Fuhrmann, 1998). To summarize, the TPB is a useful framework to explain volitional behaviours such as physical activity, but may not account for all the variance in intentions and behaviour because it does not include the influence of general motives on attitudes, subjective norms, perceived behavioural control and intentions.

An approach that may help to address the influence of general motives on the TPB cognitions is to incorporate an 'organismic' approach within the TPB. Adopting constructs from self-determination theory (SDT; Deci & Ryan, 1985), an organismic theory based on human motives, may demonstrate that individuals can base their intentions towards physical activity on the higher, more general motives generated by their *psychological need* for self-determination. Deci and Ryan suggest that the salient aspects from social cognitive theories can be adopted alongside constructs from SDT to

form a 'more complete motivational theory' (p. 229). It would also address the proposal of Bagozzi (1982) who states that social-cognitive frameworks address only the 'what' questions associated with intentional behaviour rather than the 'why'. Consequently, while a social-cognitive approach like the TPB is advantageous as it helps to identify exactly what cognitive factors underlie decisions made to act, it may be limited because it is context-specific and can lack generalizability across behaviours. Incorporating a SDT approach to such social-cognitive models may assist in helping to identify *why* individuals form intentions, attitudes, subjective norms and judgments about control over the behaviour.

Studies examining SDT have adopted the perceived locus of causality (PLOC) continuum, which is the collective name given to the set of four independent scales designed to measure an individual's autonomous motives. While these four constructs are independent and achieve discriminant validity, they are characterized as lying adjacent to each other on a single perceived locus of causality continuum. The continuum reflects the degree of autonomy that the four scales represent relative to each other. A diagram of the continuum and the order of the PLOC constructs is shown in Fig. 1. Towards the high autonomy end of the continuum lies the intrinsic motivation scale that is characterized by engaging in the target behaviour for enjoyment, pleasure and fun. Adjacent to the intrinsic motivation construct, although less extreme, lies the *identification* scale which represents participation in the behaviour due to personally held values such as learning new skills. Although separate constructs, intrinsic motivation and identification are expected to be positively correlated.

The external regulation and introjection scales are situated adjacent to the highly controlling end of the PLOC continuum. External regulation is situated on the extreme of the controlling end of the continuum and is strongly and negatively correlated with intrinsic motivation. External regulation is characterized by the feeling that one is forced to perform the behaviour due to external reinforcement such as gaining rewards or avoiding punishment. Adjacent to external regulation but less extreme is the introjection scale, which is characterized as participation in the behaviour when felt under pressure by perceived external sources resulting in feelings of guilt and shame. The external regulation and introjection scales are also expected to be positively correlated.

An important feature of the motives on the PLOC is that they are operationalized as general orientations or loci towards performing the behaviour. Conceptually, these motives do not, therefore, make reference to specific contexts and correspondence in contrast to the constructs of the TPB. Consequently, these motives may have utility in identifying the over-arching influences on specific cognitions like attitudes and subjective norms in the TPB. However, while the distinction between the SDT and TPB constructs can be achieved conceptually, it is important to support this empirically. In particular there is a need to ensure that the underlying system of beliefs that determine the TPB constructs of attitude and subjective norms does not overlap with the SDT constructs as measured by the PLOC.

This distinction was tested empirically in a preliminary study using data from three samples to examine whether the PLOC constructs accounted for unique variance in the manifest attitude, subjective norm and PBC constructs. Methods for eliciting the salient beliefs and construction of the belief-based and manifest TPB items are described elsewhere (Hagger, Chatzisarantis, & Biddle, 1998). Three stepwise multiple regression analyses were conducted with the manifest measures of attitudes, subjective norms and PBC as the dependent variable in each analysis. The beliefs items were entered on the first step of each analysis and the PLOC variables on the second step. The results of these

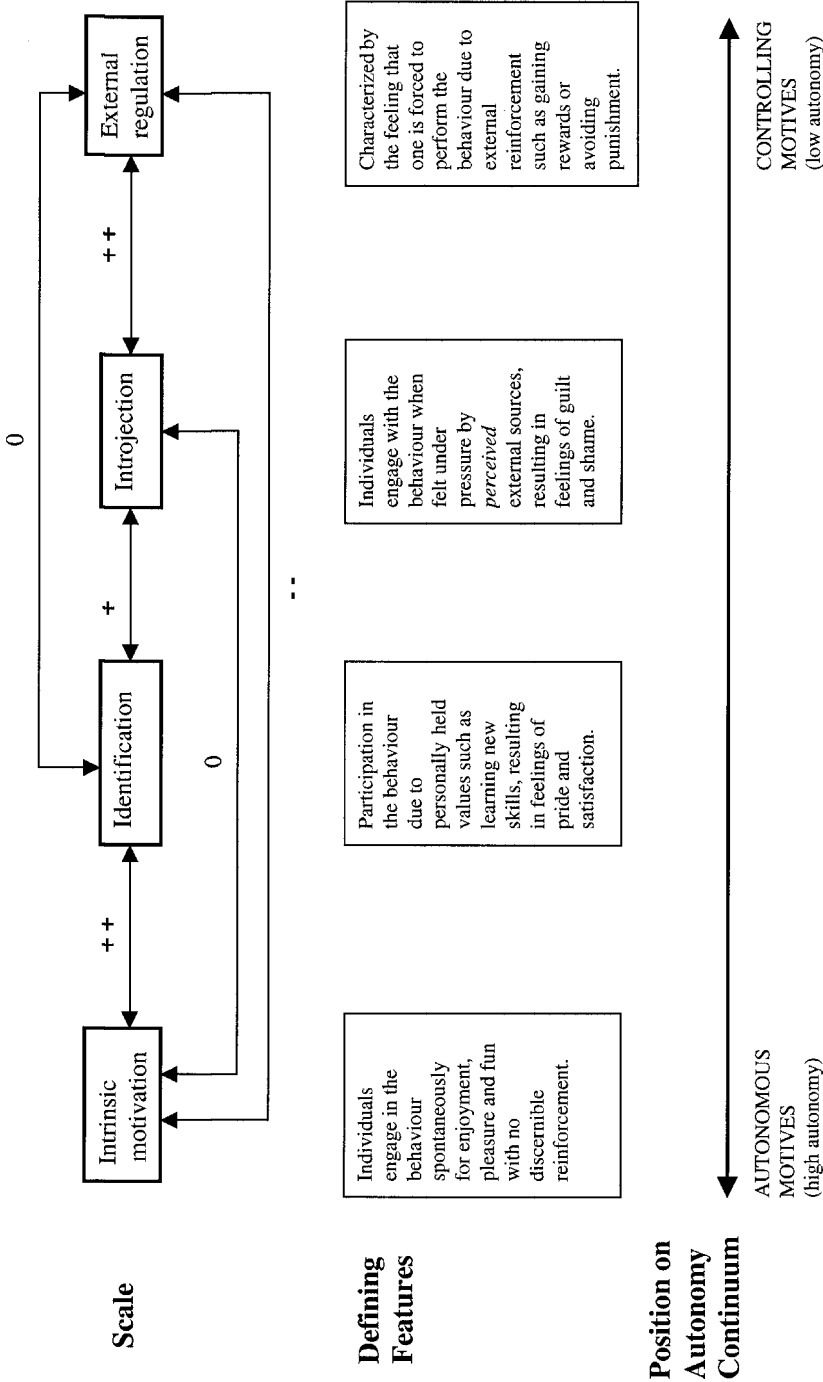


Figure 1. Diagram of perceived locus of causality continuum.

- Note. ++ = Strong positive correlations expected between these scales;
 + = Weak positive correlations expected between these scales;
 -- = Strong negative correlations expected between these scales;
 - = Weak negative correlations expected between these scales;
 0 = No correlation expected between these scales.

analyses are summarized in Table 1. Results indicated that the beliefs accounted for small proportions of the explained variance in subjective norms and PBC but a large proportion in attitudes. Introducing the PLOC constructs slightly mediated some of the influence of beliefs on the dependent variables, but the effects were largely additive supporting the unique influence of the higher motives on attitudes, subjective norms and PBC.

Table 1. Summary of regression analysis from preliminary study showing prediction of TPB constructs of attitude, subjective norm and PBC by beliefs entered at step 1 and PLOC constructs entered at step 2

Dependent variable		Independent variable	N	R ²	ΔR ²
Attitude	Step 1	Behavioural beliefs	58	.62	
	Step 2	PLOC		.68	
Subjective norm	Step 1	Normative beliefs	497	.19	.06*
	Step 2	PLOC		.24	
PBC	Step 1	Control beliefs	538	.03	
	Step 2	PLOC		.23	

* $p < .05$; ** $p < .01$.

In addition to the conceptual and empirical support for the discriminant validity of the PLOC motives and the TPB system of beliefs, two studies have provided further support for the independent predictive validity of SDT constructs within the TPB (Chatzisarantis, Biddle, & Meek, 1997; Sheeran, Norman, & Orbell, 1999). Chatzisarantis and co-workers (1997) demonstrated empirically that leisure-time physical activity intentions are formed on the basis of the autonomous or controlling motives derived from psychological needs. Findings showed that subjective norms predicted intentions to perform physical activity only in participants that reported their motives for participation as controlling, suggesting that norms were construed by the participants as representing external, controlling forces. In contrast, attitudes and PBC had equal and significant influences on intentions regardless of the motives reported. The authors suggested that the attitude and PBC constructs encompassed both the informational (autonomous) and controlling dimensions of behavioural motives.

Similarly, Sheeran and colleagues (1999) used SDT as a basis for testing the hypothesis that intentions formed on attitudes reflect autonomous motives to engage in a behaviour and are more predictive of behaviour than intentions based on subjective norms or controlling motives. The investigators used within-participants correlations for a number of volitional behaviours to demonstrate that participants with high and significant within-participants correlations between attitude and intentions had stronger intention-behaviour relationships than participants with significant subjective norm-intention correlations. The authors claimed that intentions based primarily on attitudes represented more autonomous or personal motives towards engaging in this behaviour.

The present study aims to extend these findings by examining the influence of autonomous and controlling motives to participate in physical activity on attitudes, subjective norms and PBC in the TPB and how such motives influence intentions. The differing levels of specificity of the constructs involved in the SDT approach and the TPB approach imply that the relationship may be one of a hierarchical pattern of influence

from general to specific. It is therefore expected that general, superordinate motives from SDT will influence the specific, correspondence-tied cognitions from the TPB at the decision-making level.

It is hypothesized that autonomous motives, represented by the PLOC constructs of intrinsic motivation and identification, will predict both attitudes and PBC (H1) and that these cognitions will mediate the influence of autonomous motives on intention (H2). This mediation hypothesis is based on the proposition that motives are superordinate to attitudes, subjective norms and PBC due to their level of generality and assist in the formation of intentions by affecting these specific-level cognitions. The premise here is that the higher, general autonomous motives to perform physical activity, intrinsic motivation and identification, act as sources of information to assist individuals in their rating of the specific cognitions (attitudes and PBC) regarding the short-term prospective performance of the physical activity behaviour. It is also expected (H3) that external regulation and introjection will exert a significant but negative influence on attitudes and PBC. This is based on the fact that controlling motives are unlikely to have a positive influence on attitudes and PBC because the latter variables reflect personal agency rather than pressures to comply. Finally, it is hypothesized that introjected motives will exert a positive influence on subjective norms (H4). It may be that subjective norms completely mediate the effect of introjection on intentions as subjective norms are generally construed as representative of external pressures to engage in the behaviour (Chatzisarantis & Biddle, 1998).

Method

Participants

The participants in the study were 1088 children (537 girls, 551 boys) aged between 12 and 14 years from 14 schools in the English counties of Leicestershire, Nottinghamshire and Cheshire. All participants were volunteers. Consent from parents, teachers and the children was obtained prior to data collection. The children were told they were participating in a survey to find out their opinions about their activities outside of school.

Measures

Theory of Planned Behaviour (TPB) questionnaire

Procedures for the development of the TPB questionnaire published by Ajzen and Fishbein (1980) were followed. Intentions to participate in physical activity were assessed from responses to 3-item statements (e.g. 'I plan to do physical activities that make my heart beat faster or make me out of breath at least three times in my own time during the next week'). Responses were given on 7-point semantic differential scales anchored by the 'likely'–'unlikely' bipolar adjectives. Attitudes were measured by responses to the item statement: 'My doing physical activities at least three times in my own time in the next week is . . .' Participants responded to the statement on three scales using the 'good'–'bad', 'exciting'–'boring' and 'fun'–'unpleasant' end-points. Subjective norms were measured from a single item using the statement: 'Most people important to me think I should do physical activities at least three times in my own time in the next week' which was evaluated on a scale using the 'likely'–'unlikely' word pair.

Perceived behavioural control (PBC) was measured from two items: 'Do you think it would be easy or difficult to do physical activities which make you out of breath at least three times in your own time in the next week?' which was measured on a scale using the 'easy'–'difficult' end-points and 'How much control do you have over your ability to participate in physical activities which make you out of breath at least three times in your own time in the next week?' which was measured on a scale anchored by the 'complete control'–'very little control' terms. All the scales used to measure intention, attitude, subjective norms and PBC items were of the 7-point semantic differential type.

Perceived Locus of Causality (PLOC) inventory

Ryan and Connell's (1989) PLOC inventory was used to assess autonomous and controlling motives based on the SDI. The scale items were modified for use in the physical activity domain. The reasons for engaging in physical activity outside of school were delivered from a separate study in which children were asked to list the reasons why they did physical activities outside of school (Hagger, 1998). These reasons were used to form four items in each of the causality categories—*intrinsic motivation*, *identification*, *introjection* and *external regulation*—and were measured on 4-point Likert scales ranging from 'very true' to 'not true at all'. Each reason was preceded by a common stem which contextualized locus of causality and directed the respondent to the target behaviour: 'I participate in physical activity in my spare time because . . .'. The *intrinsic motivation* scale included reasons such as 'to have fun' and 'to enjoy myself' and the *identification* scale included reasons like 'it gives me a sense of satisfaction' and 'it lets me learn new things'. The *external regulation* scale was characterized by items such as 'I am supposed to' and 'others want me to do it' while the *introjection* scale incorporated items such as 'I will feel bad about myself if I don't' and 'it bothers me when I don't'. Each reason was then given followed by the scale. The reasons were arranged so that no items from the same scale were adjacent to each other.

Pilot study

A questionnaire including all the study measures was initially piloted on an independent sample of 48 children of similar demographic composition to the present study from a Leicestershire school. The children were asked to complete the questionnaires and were then given the opportunity with the assistance of the class teachers to provide the researchers with feedback relating to their understanding of the questions asked. The teachers and children gave the researchers feedback on the questionnaire in a plenary session. The consensus was that the children were able to understand the questions and capable of using the full range of the scales provided.

Procedure

The questionnaires were subsequently administered to the sample in the present study under quiet classroom conditions in relatively small numbers (fewer than 100). The target behaviour of physical activity was defined for the children as all the activities that 'make you out of breath' or 'make your heart beat faster' that they did in their own time and not including school physical education. Each item was then read aloud by the investigator and time given for each child to ask questions and provide their response.

Data analyses

The study hypotheses were evaluated using structural equation modelling with the robust maximum likelihood estimation method and were analysed with the EQS v.5.0 computer program (Bentler, 1989). The models were evaluated on the basis of their goodness of fit in relation to the null or 'totally free' model. The goodness-of-fit index (GFI), the comparative fit index (CFI) and the non-normed fit index (NNFI) were used to evaluate the adequacy of the models in explaining the data. According to Bentler (1990) if these indices exceed .90 they represent an adequate fit of the hypothesized model with the data.

Results

Measurement model

Following Joreskog's (1993) recommendations, the individual CFA measurement models for each variable were estimated to ensure that each factor was adequately explained by the hypothesized set of scale items. Separate measurement models were estimated for each of the TPB and PLOC constructs in the current model with the exception of the PBC factor that had too few items (2) and subjective norm that was only represented by a single item. The analyses produced well-fitting models with adequate factor loadings and error estimates. There was one exception to this finding and this was the introjection factor ($\chi^2 = 454.75$, d.f. = 2; GFI = .85, CFI = .72, NNFI = .15). This factor exhibited low factor loadings and standard error estimates for its two indicators. Introducing a correlation parameter between the error estimates for the items improved model fit adequately, but indicated that these particular items were not representative of the hypothesized factor. As a consequence these items were eliminated from further analyses.

A CFA was then performed, with all the latent factors made to correlate with each other and with the non-latent subjective norms variable. The CFA model demonstrated adequate fit with the data ($\chi^2 = 359.94$, d.f. = 75; GFI = .96, CFI = .95, NNFI = .93). According to Bagozzi and Kimmel (1995), discriminant validity of constructs is supported if their correlations are significantly different from unity. Adopting an alpha level of .05, two constructs will be significantly different from each other if the correlation is less than 1.00 by an amount exceeding 1.96 times the standard error of the correlation. An examination of the factor intercorrelation matrix from the CFA revealed that all of the latent factors and measured constructs satisfied this criterion supporting the discriminant validity of these constructs, with the exception of the intrinsic motivation and identification factors.

On the issue of discriminant validity of the intrinsic motivation and identification factors, we recently conducted a meta-analysis of the intercorrelation matrices of the PLOC constructs from 18 independent studies in physical activity and exercise (Chatzisarantis, Biddle, Hagger, & Wang, 2001). The average reweighted correlation coefficient between intrinsic motivation and identification after correction for the statistical artefacts of sampling and measurement error was .73 with a confidence interval (CI) that included unity (CI, lower bound = .36 and CI, upper bound = 1.10). Therefore these data from the meta-analysis corroborate the finding from the present study that the intrinsic motivation and identification constructs do not achieve discriminant validity. As a consequence the CFA was re-estimated with the items from these scales explained by a single intrinsic motives factor. This analysis resulted in a

model that exhibited satisfactory fit with the data ($\chi^2 = 988.05$, d.f. = 206; GFI = .93, CFI = .93, NNFI = .91). The new intrinsic motives factor was well conceived as evidenced by the high factor loadings and it achieved discriminant validity with the introjection and external factors. The intercorrelations between the latent factors and single item measures, standard errors and the alpha reliability coefficients for the scales are shown in Table 2.

Structural equation model

To test the hypothesized relations between the TPB and PLOC variables, a structural equation model was estimated. Intentions were hypothesized to be a function of attitudes, subjective norms and PBC as proposed by the TPB. Addressing the primary aim of the present study (H1), the intrinsic motives construct was hypothesized to predict the attitude, subjective norm and PBC variables. A direct path from intrinsic motives to intention was also estimated to test the mediation hypothesis (H2). In addition, the influence of controlling motives on the TPB variables (H3) was tested by estimating paths from external regulation and introjection to the attitude, subjective norm and PBC variables. The hypothesis that external regulation and introjection would directly influence intentions (H4) was also tested. It must be noted that the intrinsic motives, external regulation and introjection variables were expected to account for the covariances between the TPB constructs of attitude, subjective norm and PBC. These constructs may help explain the shared variance between these constructs noted by Ajzen (1985). In addition, the PLOC constructs of intrinsic motives, external regulation and introjection were set to covary as is standard practice in models adopting related measures (Bentler, 1990).

The final model demonstrated adequate fit with the data ($\chi^2 = 1037.55$, d.f. = 209, GFI = .92, CFI = .92, NNFI = .91). The structural path coefficients are shown in Fig. 2.

As expected, the attitude and PBC variables both had a significant influence on intentions while, contrary to hypotheses, subjective norms did not. Further, the intrinsic motives construct was a strong predictor of attitude, subjective norms and PBC and therefore H1 can be accepted. Further, the direct effect of intrinsic motives on intention was non-significant corroborating the mediation hypothesis (H2). The indirect effect of intrinsic motives on intention mediated by attitude (Indirect effect = .30) and by PBC (indirect effect = .32) resulted in a total effect of .62. These indirect effects accounted for a large proportion of the factor correlation between intrinsic motives and intention ($r = .71$), the remainder being accounted for by the small non-significant direct effects (see Table 2). In total, 67.5% of the variance in intention was accounted for by the model variables.

Turning now to the role of external regulation and introjection in the model, it can be seen that neither variable had a significant effect on any of the TPB variables and hypotheses H3 and H4 should therefore be rejected. However, the inclusion of the intrinsic motives variable may have resulted in the former variable swamping the effects of external regulation and introjection in the model. To test this premise, the model was re-estimated fixing all the paths between intrinsic motives and the other variables in the model, leaving only the disattenuated effects of external regulation and introjection. In this model, the significant and negative paths from external regulation to intention and attitude and the significant and positive paths from introjection to intention, attitude and subjective norms were restored. This indicated that the intrinsic motives variable was responsible for attenuating the effects of external regulation and introjection in the final model.

Table 2. Alpha coefficients and intercorrelations between model constructs

Scale	α	1	2	3	4	5	6	7
1. Intention (3 items)	.75	—						
2. Attitude (3 items)	.86	.72** (.05)	—					
3. Subjective norm (1 item)	—	.35** (.07)	.30** (.05)	—				
4. PBC (2 items)	.28 ²	.74** (.08)	.58** (.05)	.32** (.08)	—			
5. Intrinsic (8 items)	.88	.71** (.03)	.75** (.03)	.35** (.04)	.71** (.04)	—		
6. Introjection (2 items)	.78 ²	.31** (.03)	.30** (.02)	.19** (.03)	.29** (.03)	.45** (.02)	—	
7. External (4 items)	.68	-.25** (.03)	-.25** (.02)	-.01 (.03)	-.26** (.03)	-.28** (.01)	.12** (.02)	—

** $p < .01$.

Note. ² Represents the bivariate correlation between two items. Standard errors in parentheses.

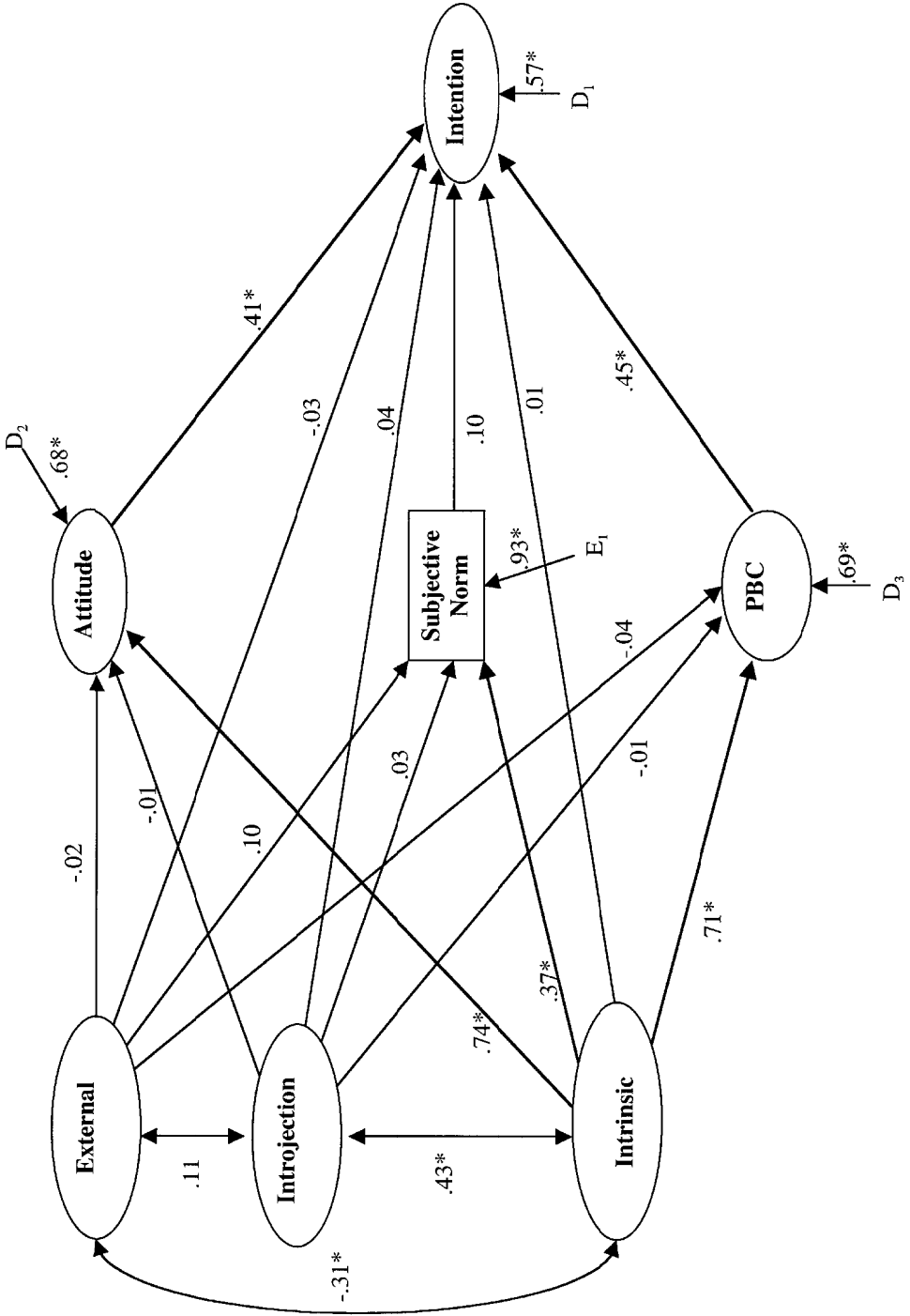


Figure 2. Final structural equation model showing relations between the TPB variables and PLOC constructs. Note. *Path significant at $p < .01$.

Discussion

The aim of the present study was to examine how higher order motives related to SDT theory influence children's intentions to participate in physical activity. It was hypothesized that autonomous motives would influence intention only through the mediation of the immediate determinants of intentions: attitude, subjective norms and PBC. The structural equation model confirmed the mediation hypothesis and demonstrated that intrinsic motives influenced intentions by influencing attitudes and PBC. Subjective norms did not predict intention which is contrary to the hypothesized relationships in the TPB. Analogously, controlling motives did not have any effect on the model variables and an alternative model fixing the influence of intrinsic motives to zero indicated that the influences of external regulation and introjection were extinguished by the contribution of intrinsic motives.

The role of autonomous motives in predicting intentions

It can be seen that the intrinsic motives construct exerts a strong influence on intentions (total effect = .72), but only do so when mediated by the immediate, situation-specific cognitions of attitude and PBC. Viewed another way, the immediate predictors of physical activity intentions in the TPB are necessary to translate autonomous motives into intentions. This means that the high correlations observed between intrinsic motives and intentions in the present and other studies (Chatzisarantis *et al.*, 1997) are spurious as they do not account for the necessity of attitudes and PBC. This lends evidence in favour of the hypothesis that general motives within the domain of physical activity may serve as useful sources of information when young people consider their attitudes toward and control over doing physical activity in future.

In addition, the present study corroborates the proposal by Deci and Ryan (1985) that organismic approaches such as SDT can be incorporated into existing cognitive frameworks to provide a better insight into the origins of the cognitive predictors of intentions. Specifically, Deci and Ryan state that autonomous motives are most likely to be motivationally adaptive because they are related to personally held values and goals. Children are more likely to form a positive attitude towards a volitional behaviour like physical activity if they believe it will help them fulfil their goals in that domain. The results from the present study support this theory by showing that an increase in intrinsic motives was associated with an increase in attitude and a concomitant positive influence on intention. This finding illustrates that a chain of influence occurs in motivated behaviour commencing with general motives to engage in physical activity (intrinsic motives), filtered by specific expectations (attitudes) and ending with behavioural intentions.

Aside from the influence of intrinsic motives on attitudes, intrinsic motives also affect intentions when mediated by PBC. Theoretically, this corroborates the view that competence and autonomy are intrinsically related constructs as proposed by Deci and Ryan (1985) and Skinner (1995). Perceived control over behaviour is viewed as a reflection of an individual's perceived competence (Skinner, 1995). Therefore, children reporting high control over their ability to do physical activity in their spare time have a high estimate of their competence. It can be seen that competence appraisals serve as necessary and intermediate perceptions prior to making decisions to act on the basis of autonomous motives. Deci and Ryan (1985) suggest that control is a function of autonomy and that control is only likely to satisfy competence and motivate action toward a given task under conditions of high autonomy. These data support this theory

since PBC is influenced by intrinsic motives and influences intentions only via the mediation of this variable. Therefore, PBC is a necessary mediator of the influence of autonomous motives on the physical activity intentions of children.

Finally, these findings indicate that, for the present sample, controlling motives are not influential, and any controlling motives are negated by the influence of more autonomous motives. This may be because children view physical activity in their spare time as a personal endeavour and do not base their decisions on controlling motives. Further evidence for the lack of contribution of controlling intentions can be seen that situation-specific pressures to engage in physical activity, subjective norms, do not influence intentions.

Limitations of the study

The structural equation model estimated in the present study had three strong points: (1) it was based on theory, (2) it demonstrated good fit with the data and (3) it was performed on a relatively large representative sample of children. However, some of the factors were not optimally represented. In particular, two factors, PBC and introjection, were defined by two indicators. While it is common for structural models to be estimated with two-indicator latent variables, such factors may lack precision if the factor is dominated by one indicator (Byrne, 1994).

In the present model, this was true for the PBC factor that was predominantly defined by the item: 'How much control do you have over your ability to participate in physical activities which make you out of breath three or more times in the next week?' The reason for this may lie in the relative diversity of the concept of PBC. Indeed, previous researchers have often found that item statements making reference to 'perceived difficulty' in engaging in the behaviour do not correlate well with statements referring to 'control' (Manstead & van Eekelen, 1995; Parker, Manstead, & Stradling, 1995). Recently, researchers have attempted to make this distinction in terms of self-efficacy perceptions and perceived control over behaviour (Armitage & Conner, 1999; Manstead & van Eekelen, 1998; Terry & O'Leary, 1995) and it may be that the PBC concept is multidimensional. It should therefore be acknowledged that the relationships of intention and intrinsic motives with PBC in the present study should be considered in terms of PBC defined by the dominant indicator. Future studies incorporating the SDT in a cognitive framework such as the TPB will distinguish between PBC and self-efficacy.

One criticism that may be levelled at the present model is that it accounts only for attitudes, subjective norms and PBC derived from direct measures rather than adopting the more differentiated belief-based measures proposed by attitude researchers (Ajzen, 1985). This may attract some reservations concerning the prediction of attitudes and PBC from the intrinsic motives construct as the relationship may be influenced by some of the determinant outcome expectancies relating to the behaviour. However, we have presented evidence to support the unique influences of the PLOC constructs on the attitude, subjective norm and PBC constructs independent of the underlying belief systems. In addition, the intrinsic motives construct maintained both differential predictive validity in the model through its unique effect on PBC and discriminant validity in the measurement model. These analyses provide important evidence to support the pattern of relationships observed in the present study. Nevertheless, future studies will include expectancy-value conceptualizations of children's physical activity attitudes concurrently with direct measures of the PLOC and TPB variables to provide further confirmation of the effects of higher motives on attitudes and intentions.

Conclusion and recommendations for future research and practice

In conclusion, the adoption of a SDT approach in the TPB is a useful endeavour for two reasons. First, it provides a rationale behind the origins of the cognitions of intention, attitude and PBC within the TPB and, secondly, it demonstrates that higher motives act as superordinate constructs that influence intentions via the mediation of attitudes and PBC. Future research will focus on a number of issues that arise from the current study. First, how do autonomous motives to perform physical activity affect intentions and the TPB cognitions prior to the enactment of actual physical activity behaviour? While organismic motives may affect intentions via the mediation of attitude and PBC, the process in the translation of intentions into action needs to be addressed. Further, the relative stability of intentions, attitudes and PBC has received little attention, and longitudinal studies may establish whether autonomous motives create more stable intentions over time and hence more stable behavioural patterns. This is particularly relevant to physical activity where adherence is vital to maintain health benefits.

In terms of practical recommendations arising from this research, practitioners involved in promoting physical activity to children such as health psychologists, physical educators and exercise promoters can focus on a number of motivational aspects to encourage positive motives and intentions to exercise. They may highlight the important reasons for doing health-related activity to enhance attitudes towards physical activity. A priority may also be providing children with a choice over the activities they perform so that they can identify the sport or activity that suits them best. Such an endeavour will provide children with sensations of competence and is a key area for intervention. This might influence intention to perform physical activity in the future in two ways: first, by fostering motives based on self-determination and free choice and, secondly, by priming their perceptions of competence regarding the behaviour that may result in improved judgments of behavioural control.

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