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ANTECEDENTS OF CHILDREN'S PHYSICAL ACTIVITY INTENTIONS AND BEHAVIOUR: PREDICTIVE VALIDITY AND LONGITUDINAL EFFECTS

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This study examined the predictive validity and time-lagged relationships in a model of children's physical activity intentions, attitudes, perceived behavioural control (PBC), behaviour and past behaviour using the Theory of Planned Behaviour (TPB; Ajzen, 1985) as a framework. In Study 1, 386 children aged 12–14 years completed measures of intentions, attitudes, subjective norm, PBC and past behaviour. Their physical activity behaviour was assessed one week later. Structural equation analyses supported the construct and predictive validity of the TPB with the exception of subjective norms which did not predict intentions. In Study 2, 70 children completed measures of their physical activity attitudes, intentions, PBC and past behaviour. Attitudes, intentions, PBC and recent behaviour were re-assessed five weeks later. The cognitions demonstrated a moderate degree of stability over time and there were some cross-lagged effects between attitudes and PBC. Past behaviour demonstrated additive rather than attenuating effects. These results support the use of the TPB cognitions and past behaviour as a framework to examine children's physical activity behaviour.

KEY WORDS: Planned behaviour, attitudes, exercise, past behaviour.

INTRODUCTION

Physical activity is an important contributor to the health status of young people. Studies show that children and adolescents who participate in regular physical activity can gain psychological health (Calfas and Taylor, 1994) and skeletal health (Bailey and Martin, 1994) benefits. However, while the positive effects of regular physical activity participation are well established in children and adolescents, there is evidence to demonstrate that young people in many developed nations do not participate in enough physical activity of the type and intensity associated with health benefits (Cale and Almond, 1992; Sleap and Warburton, 1996). Since studies tracking the physical activity behaviour of individuals from childhood into adulthood indicate that regular activity patterns are established in early

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life (Armstrong and McManus, 1994), it is important for health psychologists to understand the psychosocial influences on children's physical activity behaviour. To this end, psychologists have adopted social cognitive models to help understand children's physical activity behaviour (Sallis *et al*., 1992). These models aim to identify and explain how expectations, judgements, beliefs and intentions lead to the enactment of physical activity behaviour. The adoption of such models may lead to identifying the necessary targets for intervention to positively affect children's physical activity behaviour.

The theory of planned behaviour (TPB; Ajzen, 1985, 1991) is a social cognitive framework that has demonstrated utility in the study of a wide variety of health behaviours (Conner and Armitage, 1998; Conner and Norman, 1996) including physical activity (Blue, 1995; Godin, 1994). The attraction of the model is its parsimonious ability to explain variance in both volitional and non-volitional behaviours. The focal concept of the model is the *intention* construct that reflects a person's motivational orientation towards a given behaviour. Intention is proposed to mediate the influence of two social cognitive variables, attitudes and subjective norms, on behaviour. An individual's attitude is a self-report of their positive and negative evaluation of the behaviour and subjective norm represents a judgement of significant others' expectations regarding the individual's participation in the behaviour. In addition, the construct of perceived behavioural control (PBC) enables the TPB to explain behaviours that are not totally under volitional control. PBC can reflect both internal aspects of control regarding an individual's subjective estimate of their *ability* to engage in the behaviour as well as external constraints on performing the behaviour such as barriers and resource availability.

While a number of studies have adopted the TPB in the prediction of physical activity intentions and behaviour in adults (for meta-analyses see Hagger *et al*., 2000; Hausenblas *et al*., 1997), there have been few empirical studies using the TPB in the area of children's physical activity. Nevertheless, there is some research evidence to indicate that the TPB may be a useful framework to explain the cognitive influences of children's physical activity intentions and behaviour (Atsalakis and Sleap, 1996; Hagger *et al*., 1997; Craig *et al*., 1996). Importantly, there is evidence suggesting that the determinants of exercise behaviour in children and adults differ and may change during development. For example, Shephard and Godin (1986) showed that subjective norms are a more important influence on exercise behaviour in 12 to 14 years olds than in adolescents. Research also indicates that while young children aged 9 to 11 years tend to have very positive attitudes towards exercise (Theodorakis *et al*., 1991), older children tend to drop out of physical activity participation at about the age of 14 onwards (Biddle *et al*., 1998; Cale and Almond, 1992). Godin and Shephard (1986) suggest that it may be the contribution of changes in normative pressures and "a progressive focusing of the attention of the child on behaviour patterns which they perceived to be expected at the end of childhood, including a reduction of habitual physical activity" (p. 444) that result in this dropout. It may be that both attitudes and subjective norms become more negative with age. Children who are resilient to this change in attitudes may be those who have more positive intentions to exercise as adults (Hagger *et al*., 1998). These lines of evidence suggest that it is important to examine the determinants of prospective physical activity behaviour amongst children, *per se*, rather than extrapolate from research concerning adults exercise patterns. Therefore the first aim of the present study is to examine the construct and predictive validity of the TPB in physical activity with children.

An interesting development in the application of social cognitive models such as the TPB to health behaviour is the role past behavioural experience plays in the formation of

the situation-specific cognitions and intentions prior to action (Conner and Armitage, 1998; Sutton, 1994). Some studies suggest that having established a regular pattern physical activity in the past is an important determinant of future physical activity behaviour in adults (Armstrong and McManus, 1994). In addition, past physical activity behaviour has been shown empirically to account for a large proportion of the variance in future behaviour in adults across a number of health behaviours (Conner and Armitage, 1998). It has also been shown to attenuate or extinguish the effects of the cognitive determinants of physical activity behaviour postulated by the TPB, namely intention, attitude, subjective norms and PBC (e.g. Bagozzi and Kimmel, 1995; Godin *et al*., 1991). Studies that demonstrate this effect have suggested that these constructs are formed largely on the basis of past experience of the target behaviour. Despite this there is little evidence to date that has examined the role of past physical activity behaviour in the prediction of the physical activity intentions and behaviour of children and young people. Consequently, a second aim of the present investigation is to test how previous experience influences children's physical activity intentions, attitudes, PBC and behaviour. It is expected that past behaviour will attenuate the influence of attitude, subjective norms and PBC on intention and the influence of intention on behaviour, but some unique effects will remain.

STUDY 1

The purpose of this study was to examine the construct and predictive validity of the TPB in a sample of children and in a physical activity context. In addition, it aimed to examine the effect of past physical activity behaviour on the TPB variables.

METHOD

Participants

Participants were 431 secondary school pupils (205 boys, 226 girls) aged 12 to 14 years from three high schools in the English counties of Cheshire, Leicestershire and Nottinghamshire. Letters were written to schools selected from registers of schools held by the Department of Education at Loughborough University, England and the research team followed up positive responses. The research team sought and obtained the consent from all of the lesson teachers nominated by the headteachers to use their lesson time for the study. Children from these classes were issued with letters explaining that their children would be participating in the research and parents who did not want their child to participate were asked to fill out a proforma and return it to the school. No proformas were returned.

Measures

Theory of planned behaviour questionnaire. Development of a TPB questionnaire followed the procedures published by Ajzen and Fishbein (1980) and Ajzen and Madden (1986).

Intentions. Intention to participate in physical activity was assessed by responses to three statements: "I plan to do physical activities at least three or more times during my free time in the next week", "I expect I will do physical activities at least three or more times during

my free time in the next week" and "I intend to do physical activities at least three or more times during my free time in the next week". Responses were given using the *likely–unlikely* word pair on seven-point semantic differential scales. The Cronbach's α coefficient for this scale was .70.

Attitudes and subjective norms. Attitude was measured using three items scores on seven-point scales: "My doing physical activities at least three or more times in the next week is . . . " Participants responded to the statement on three scales using the *good–bad*, *exciting–boring* and *fun–unpleasant* endpoints, reflecting the child's affective attitude towards engaging in physical activity. It is important to note that these scales do not tap the more instrumental aspects of a child's attitude like whether participants feel the behaviour is "useful"/"useless" or "satisfactory"/"unsatisfactory". The Cronbach's α coefficient for the attitude scale was .82. Subjective norm was measured using a single item: "Most people important to me think I should do physical activities at least three or more times in the next week" which was evaluated on a scale using the *likely–unlikely* word pair.

Past behaviour. Previous physical activity behaviour was measured using a single item with the statement: "How often have you performed physical activities that make you out of breath in the past six months". Responses were provided on a seven-point scale ranging from "never" to "at least seven times per week".

Perceived behavioural control. Four items measured this variable: "Do you think it will be easy or difficult for you to participate in physical activities which make you out of breath three or more times in the next week?" measured with *easy–difficult* scale end points; "It is mostly up to me whether I do physical activities three or more times in the next week" measured with *true–false* scale end points; "If I wanted to I could do physical activities three or more times in the next week" measured with *true–false* scale end points; "There is very little I can do to make sure I do three or more physical activities in the next week" measured with *agree–disagree* scale end points – the scores were reversed for this item. The Cronbach's α coefficient for this scale was .45.

Administration

Prior to the completion of the questionnaire, the researcher explained that the questionnaire was part of a survey to find out what people of their age thought about the activities they did in their free time. It was explained that there were no "right" or "wrong" answers, that nobody else would see the questionnaires and that they did not have to put their names on the questionnaires. The participants were then told how to use the semantic differential scales to respond to the items. The target behaviour, physical activity, was defined for the participants as "activities which make you out of breath or huff and puff for at least 20 minutes at a time". The children were reminded throughout the administration period of the type, intensity and duration of the physical activity behaviour under scrutiny and that it was free-time physical activity that the questionnaires were seeking to tap. The participants were also reminded that the questionnaire required individual responses with no consultation with others and that they were anonymous. The questionnaire was administered in the presence of the class teachers in quiet classroom conditions. All the items were read aloud and then time was given for the participants to ask any questions and make their responses.

Follow-up Behaviour

One week later children completed Cale's (1994) physical activity recall questionnaire, an interview-administered self-report measure of physical activity behaviour that aims to maximise children's accuracy of recall of physical activity information. Such self-report physical activity questionnaires have been used successfully to quantify physical activity behaviour in other TRA/TPB-based studies (Craig *et al*., 1996; Godin and Shepherd, 1986). The recall questionnaire is interview-based and quantifies physical activity from the activities reported by the children in the previous week. The interview segments the child's day into three parts (trichotomous) and has activity lists for each part. Children indicate the time they spent in each activity. Probing, open-ended questions are used to prompt the child for additional activity information. The interview assumes a metabolic equivalent (MET) intensity level for each activity on the interview lists. These are used to weight the time estimates given by the children and are used to calculate an overall energy expenditure estimate for the child. In addition, time spent in moderate intensity activities (> 6METs) is also provided. The interview was conducted in quiet classroom conditions with each child individually and each interview lasted about 6 minutes.

Evidence for the accuracy and validity of the interview measure used in the present study comes from Cale (1994). She reports strong correlations between energy expenditure estimates from the children's physical activity interview measure with concurrent data from heart rate monitors ($r = .61$, $p < .01$) and with concurrent data from the observation of children's physical activity behaviour ($r = .79$, $p < .01$). Such concurrent validity evidence from so-called "gold standard" physical activity measures provides a stronger case for the use of the interview method in population studies (Hagger, 1998).

The initial administration of questionnaires yielded 431 returned questionnaires, 29 of which were incomplete or spoiled. A further 20 children did not participate in the final interviews leaving a final sample of 386 children (185 boys, 201 girls).

RESULTS

Descriptive statistics and inter-item correlations for the TPB variables are provided in Table 1.

The hypotheses pertaining to the theoretical relationships between the TPB variables were examined by structural equation modelling using the EQS computer program (Bentler, 1989). A robust Maximum Likelihood (ML) estimation method was used using the Satorra-Bentler scaled χ^2 statistic to prevent contamination by the individual variables that demonstrated kurtosis.

The relationships between the variables were represented by a series of structural equations and the fit of the data to the hypothesised model was estimated using the robust ML method. In the present study overall model goodness-of-fit of the data to the model was assessed from multiple criteria as recommended by Marsh and Hocevar (1985). The fit criteria were: (1) the goodness of fit index (GFI; Joreskog and Sorbom, 1988); (2) the comparative fit index (CFI; Bentler, 1990); (3) the Tucker-Lewis index (TLI; Bentler, 1990); and (4) the standardised root mean square of the model residuals (SRMSR). The three fit indices are scaled from .00 to 1.00 and should be equal to or greater than .95 for adequate fit of model with the data and the SRMSR should be .08 or less to represent acceptable goodness-of-fit (Hu and Bentler, 1999).

Table 1 Means, standard deviations and inter-item correlations for TPB variables in Study 1

	M	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1. Behaviour	37.01	5.69	–											
2. Intention 1, Expectation	6.66	.76	.15*	–										
3. Intention 2, Intention	6.14	1.22	.25*	.40*	–									
4. Intention 3, Plan	2.27	1.19	.25*	.37*	.49*	–								
5. Attitude 1, Fun-unpleasant	6.06	1.16	.24*	.41*	.68*	.54*	–							
6. Attitude 2, Exciting-boring	5.70	1.28	.28*	.31*	.58*	.53*	.75*	–						
7. Attitude 3, Good-bad	6.27	.94	.25*	.30*	.51*	.61*	.56*	.57*	–					
8. Subjective norm	6.02	1.00	.10	–.01	.08	.07	.05	.03	.10	–				
9. PBC 1, There is very little . . .	5.71	1.27	.13	.08	.27*	.29*	.30*	.30*	.28*	.07	–			
10. PBC 2, If I wanted to . . .	6.20	1.32	.01	.05	.19	.12	.11	.10	.10	.02	.13	–		
11. PBC 3, Up to me	4.90	2.19	.02	.12	.09	.14	.09	.02	.05	.07	.12	–.02	–	
12. PBC 4, Easy-difficult	6.63	.87	.09	.16*	.27*	.28*	.25*	.21*	.22*	.06	.23*	.39*	.16*	–
13. Past behaviour	5.63	.81	.20*	.13	.31*	.33*	.32*	.27*	.34*	.08	.29*	.18*	.15*	.36*

*Correlations significant at $p < .01$.

Firstly, a non-standard structural equation model was estimated with relations in place to test the pattern of relationships in the TPB as proposed by Ajzen (1985). This model exhibited satisfactory goodness-of-fit statistics ($\chi^2 = 90.8$ 0, $df = 46$, GFI = .96, CFI = .96, TLI = .95, SRMSR = .032). In the model, intention was a moderate and significant predictor of behaviour (path coefficient = .32, $p < .01$). The attitude-intention (path coefficient = .79, $p < .01$) and PBC-intention (path coefficient = .19, $p < .01$) relationships were significant, but the influence of subjective norms on intentions was non-significant. The subjective norms variable was not a latent construct and therefore regression of intention on subjective norms may have been attenuated by the inclusion of measurement error. Previous studies using subjective norms measures with multiple items have also demonstrated the same effects in children (Theodorakis *et al.*, 1991) and in adults (Godin and Gionet, 1991) suggesting that the role of subjective norms in children's physical activity behaviour may be limited. However, a limitation of these studies is that multiple composite scores of the items were used rather than latent constructs. The non-significant influence of subjective norms on intentions is contrary to expectations and it may be that normative influences, and in particular parental pressure, may not be as influential as expected. Testing the alternative representation of the TPB presented by Ajzen (1985) that hypotheses a direct pathway between PBC and behaviour demonstrated that this path was non-significant. This corroborates the first version of this theory that proposes that intention completely mediates the influence of PBC on behaviour.

The influence of past behaviour in the model was examined by introducing past behaviour as a predictor of all the TPB variables, effectively *controlling* for the influence of past behaviour. This resulted in a model that also demonstrated good fit with the data ($\chi^2 = 100.70$, $df = 53$, GFI = .96, CFI = .97, TLI = .95, SRMSR = .033). The structure of the model and path coefficients are shown in Figure 1. Past behaviour was a significant predictor of attitudes (path coefficient = .37, $p < .01$) and PBC (path coefficient = .53, $p < .01$). Importantly, the influences of past behaviour in the model were largely additive and did not attenuate the relationships in the model. Further, the influence of previous engagement in physical activity seemed to have no significant effect on prospective physical activity behaviour.

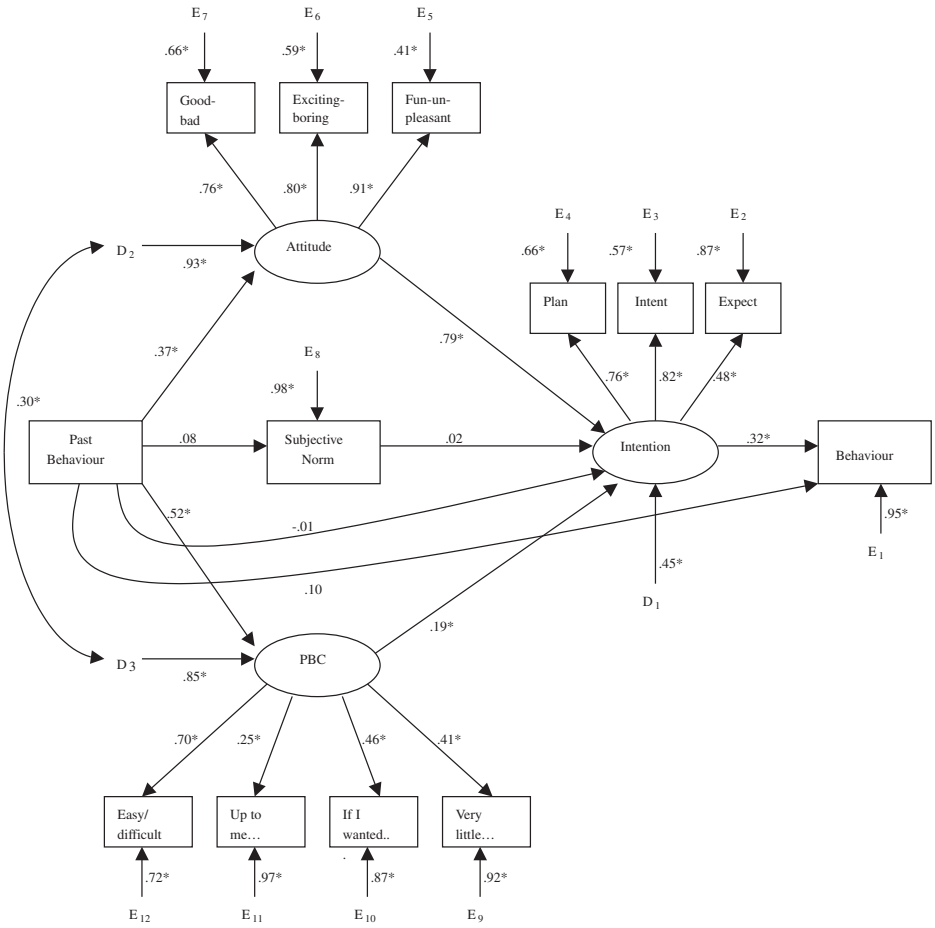

Figure 1 Structural equation model showing relations between the TPB variables and past behaviour. *Path significant at $p < .01$. *Covariances in the model excluded for clarity*: Subjective norm error term (E_8)↔Attitude disturbance term (D_2) = .0 4, ns; Subjective norm error term (E_8)↔PBC disturbance term (D3) = .06, ns.

STUDY 2

While Study 1 supplied some important confirmatory data to support the construct and predictive validity of the TPB in children's physical activity behaviour, it is important to examine the stability and reciprocity of these effects to make such findings more robust. Indeed, some researchers have contended that while the TPB provides a useful framework for describing the determinants of action, such as performing physical activity, it is incomplete (e.g. Bagozzi, 1981). This is because the theory does not account, firstly, for the elative instability of the constructs over time and, secondly, for the reciprocal effects of the constructs within the model.

In terms of stability, Ajzen and Fishbein (1980) and Ajzen (1985) stressed that predictions in the model would be optimal if the constructs of intention, attitudes, subjective norms and PBC were assessed in close temporal proximity to the measure of behaviour.

This is because time lag is likely to result in the addition of new information that would temper the ability of the cognitions to explain behaviour over time. Studies examining the lack of change in the TPB relationships have focussed on two salient dimensions of stability, namely, *intra-individual stability* and the *stability of individual differences*, often termed *covariance stability* (Hertzog and Nesselroade, 1987). Sheeran *et al*. (1999) assessed the intra-individual stability of the TPB constructs, which inquired whether individuals showed consistency in their own TPB cognitions over time. Their findings demonstrated that intra-individual stability contributed to the strength of the intention-behaviour and past–future behaviour relationships. This suggests that lack of change in within individuals results in more robust predictions of behaviour. However, it does not provide evidence to support whether there are "interindividual differences in intraindividual change" (Hertzog and Nesselroade, 1987, p. 94)

In contrast, change may also occur in the mean scores and in the distributions of the scores of social cognitive variables over time, rather than within individuals alone. Such changes, termed *covariance stability*, can be studied by examining the degree to which social cognitive variables between individuals show similar change patterns longitudinally. This is tested by examining the regression coefficient of a social cognitive construct on itself across two time points. According to Hertzog and Nesselroade (1987) it is important to examine these "stability" coefficients because they provide "summary statements about the relative change in a population of individuals" (p. 94). Examining the covariance stability or *synchronicity* of the intentions, attitudes and PBC variables using a longitudinal approach may provide further evidence as to the degree of stability of these constructs exhibit beyond the boundary condition of correspondence set out by Ajzen (1985). Such a test may also help explain the unique contribution of the constructs to intention after controlling for past cognitions.

In terms of cross-lagged effects in the TPB, Liska (1984) and Kahle and Beatty (1987) used a panel design to show that the influence of attitudes and intentions across time may be reciprocal. Such cross-lagged relationships examine how a social cognition like attitude at one point in time can account for another cognition, like intention, at a second, later point in time. Hertzog and Nesselroade (1987) state that these time-lagged effects cannot be shown in cross-sectional data. Such reciprocal effects have seldom been studied and would provide a useful insight into the determinants of physical activity behaviour over time. Therefore, an additional aim of the present study is to adopt a longitudinal design in order to estimate the cross-lagged relationships between intentions, attitudes and PBC whilst controlling for synchronicity and stationarity. The autoregressions of the variables on each other over time is a control for synchronicity and the inclusion of attitude-intention and PBC-intention relationships at both time points controls for stationarity in the relationships. If the cross-lagged coefficients in this controlled model are significant, we have sharp confirmation of the existence of reciprocal relationships between attitudes, intentions and PBC in children's physical activity.

In summary, this study aimed to establish how the covariance stability of children's physical activity attitudes and PBC influence future intentions and behaviour and to test the predictive validity of these variables over time. In addition, cross-lagged relationships between attitudes, intentions and PBC were hypothesised. It was expected that reciprocal cross-lagged effects would exist between the intention, attitude and PBC variables. Finally, while past behaviour demonstrated predictive validity in the TPB in Study 1, the present study aimed to extend these findings by examining the influence of children's past physical activity behaviour on the TPB variables over time. It was expected that past

behaviour would attenuate the synchronous and cross-lagged influences of attitude and PBC on intention.

METHOD

Participants

Participants were 154 children (83 boys, 71 girls) aged 12 to 14 years from a school in Leicestershire in England. The school was selected from a register for teaching schools held at Loughborough University, England. The headteacher and class teachers involved in data collections all gave prior permission for the research to be conducted in the school. Parents of the children were issued with a letter and given an opportunity to return a proforma to excuse their child from the data collection sessions. No proformas were returned.

Measures

Intention and attitude. Measures of intention and attitude were identical to Study 1 with the exception of the time frame which was changed from one week to five weeks. Subjective norms were not considered as they were not influential in Study 1.

Perceived behavioural control. Since the measure of PBC in Study 1 demonstrated inadequate factor loadings for some of the variables and a low Cronbach's α, a measure of PBC was adopted to bring the items more into line with the dominant perceived ease–difficulty item. Therefore the items published by Manstead and van Eekelen (1998) were used. Therefore two further items with the statements: "I am certain I can participate in physical activities that make me out of breath at least three times per week in the next five weeks" and "How confident are you that you can participate in physical activities that make you out of breath at least three times per week in the next five weeks?" were included alongside the perceived ease–difficulty item from Study 1.

Past behaviour. Previous physical activity behaviour was measured at time 1 using the single item adopted in Study 1.

Physical activity behaviour. Physical activity behaviour at time two was quantified by responses to an item assessing physical activity behaviour. Children were asked how often they had participated in physical activity in the past five weeks and responses were given on a scale ranging from "never" to "seven times per week".

Administration. In line with procedures from Study 1, the psychometric measures were completed in classroom conditions under the guidance of the researcher. The target behaviour of free-time physical activity was initially defined and the researcher read each item aloud to ensure the participants understood them. The participants were permitted to ask questions whenever they wished and were given ample time to make their responses. Of the 154 questionnaires collected on the first wave, 15 were spoilt and 3 were incomplete leaving 136 participants eligible for the second wave. The measures were administered on a second occasion under exactly the same conditions after a five-week period. There were two variations in the measures administered at time two in comparison to time one. At time

two the measure of six-month past behaviour was excluded and the self-report measure of physical activity behaviour in the past five-weeks included. Of the 136 participants eligible from the first wave, 86 (48 boys, 38 girls) completed the second questionnaire. However, 10 were spoilt and 6 were incomplete leaving a final sample size of 70 children (39 boys, 31 girls).

RESULTS

Descriptive statistics and scale inter-correlations for the intention, attitude, PBC, behaviour and past behaviour variables at both time-points are provided in Table 2.

As the sample size in the present study was relatively small, the data were analysed using observed rather than latent constructs in a path analysis model using the EQS computer program (Bentler, 1989) and a ML estimation method. The variables were produced from the mean composite of the items pertaining to each construct. The use of observed composite items in the path analysis enabled the examination of the hypothesised paths of the model as before. It must, however, be recognised that the use of non-latent constructs does not control for measurement error present in the path coefficients and may inflate the model relationships.

The path analysis was conducted using the EQS computer program and used the same criteria for model fit as reported in Study 1. Physical activity intentions, attitudes and PBC were made to predict each other across the two time points. The regression of these variables on themselves over time is a test of covariance stability and tests of the relative change in the distribution of individual differences in these variables over time (Hertzog and Nessleroade, 1987). In addition, cross-lagged effects between attitudes, intentions and PBC were also estimated to test reciprocal effects while controlling for synchronicity and stationarity. Estimating these reciprocal relationships tested whether attitudes were an antecedent of PBC and vice versa.

Relations between intentions, attitudes and PBC were also estimated according to those stipulated in the TPB at both time points. The error terms between attitudes and PBC were also made to covary as stipulated by Ajzen (1985). This controlled for the stationarity in the relationships of the model over time. This model exhibited good fit with the data ($\chi^2 = 4.63$, $df = 5$, GFI = .98, CFI = 1.00, TLI = 1.00, SRMSR = .022). An alternative model was then estimated to control for the influence of past behaviour at time 1. This model also met all criteria for an adequate fit with the data ($\chi^2 = 9.75$, $df = 5$; GFI = .97, CFI = .99, TLI = .94, SRMSR = .023). The final model and path coefficients are shown in Figure 2.

Table 2 Means, standard deviations, Cronbach α and inter-scale correlations for the TPB variables from Study 2

	Mean	*SD*	α	*1*	*2*	*3*	*4*	*5*	*6*	*7*
1. Behaviour, time 2	4.10	1.36	–	–						
2. Intention, time 1	5.71	1.60	.83	.59	–					
3. Intention, time 2	5.05	1.74	.77	.58	.63	–				
4. Attitude, time 1	5.74	1.08	.82	.35	.61	.55	–			
5. Attitude, time 2	5.29	1.34	.91	.51	.59	.70	.74	–		
6. PBC, time 1	5.81	1.14	.89	.38	.39	.41	.57	.57	–	
7. PBC, time 2	5.39	1.12	.85	.34	.30	.46	.57	.71	.67	–
8. Past behaviour	4.20	1.30	–	.60	.63	.47	.35	.31	.20	.17

All correlations significant at $p < .01$

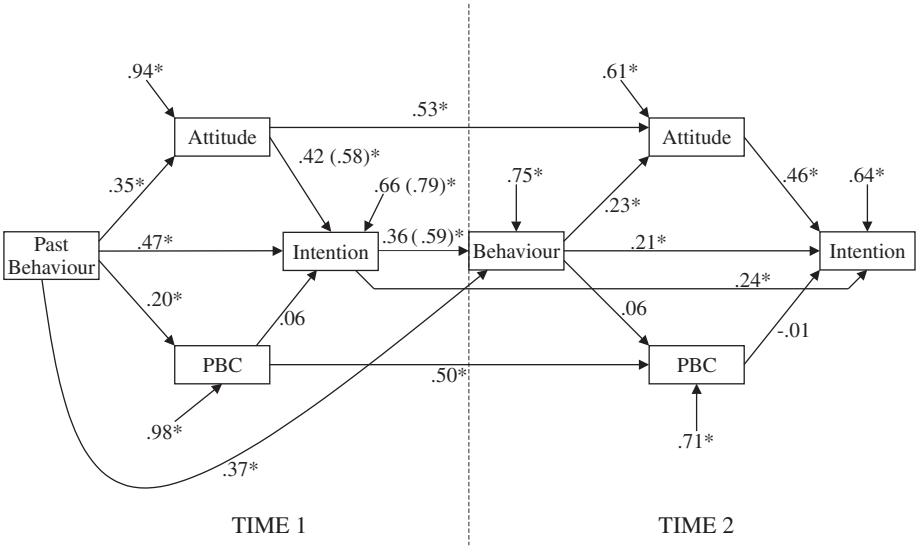

Figure 2 Path analysis showing relations between intentions, attitudes, PBC, behaviour and past behaviour across time. *Path significant at $p < .01$. *Free path coefficients in the model excluded for clarity*: Attitude(T1)→PBC(T2) = .36, $p < .01$; PBC(T1)→Attitude(T2) = .15, $p < .01$; Intention(T1)→PBC(T2) = −.20, $p < .01$; Intention (T1)→Attitude(T2) = .08, ns; Attitude(T1)→Intention(T2) = .00, ns; PBC(T1)→Intention(T2) = .02, ns. *Covariances in the model excluded for clarity*: Attitude error term (T1)↔PBC error term (T1) = .54, $p < .01$; Attitude error term (T2)↔PBC error term (T2) = .45, $p < .01$.

Any changes in the path coefficients as the result of controlling for past behaviour are shown in parentheses.

Overall the model demonstrates that children exhibit some degree of behavioural and cognitive stability, providing evidence that they have a tendency to adhere to a regular physical activity "lifestyle". This may be indicative of the beginnings of an ordered lifestyle in the same way that their school, and later occupational, lifestyle is organised.

Focussing on time 1, it can be seen that children's intentions to engage in physical activity are a function of their attitudes but not PBC. Further, intention completely mediates the influence of attitudes on behaviour corroborating the hypothesised ordering of attitude and intention in the TPB. The inclusion of past behaviour significantly attenuates the influence of attitude on intentions and attenuates the intention-behaviour relationship. This was confirmed by the lack of overlap in the 95% confidence intervals of the standardised coefficients. In addition, the inclusion of past behaviour increases the explained variance in intention from 37.5% to 56.4%.

Focussing on the overall time-lagged model, the intention, attitude and PBC variables demonstrate autoregression over time, but the coefficients were less than 1.0. This tests the extent that the distribution of the cognitive variable at time 1, say attitude, overlaps with the distribution of that variable measured at time 2. The extent to which they do not overlap provides confirmation that change has occurred in the variable over time and the standardised coefficient reflects the extent of this instability. In addition, the attitude→PBC, PBC→attitude and intention→PBC paths exhibited modest but significant cross-lagged standardised coefficients between time 1 and time 2. None of the other cross-lagged relationships was significant. This indicates that attitudes and intentions at time 1 are sources

of information on which children base their time 2 estimates of PBC. These findings indicate that the model did not demonstrate entropicity (Hertzog and Nesselroade, 1987).

Regarding the relations between intentions, attitudes and PBC at time 2, similar predictions of intention were made compared to those at time 1. However, these relationships controlled for the influence of previous cognitions as well as recent behavioural engagement. This therefore represents the *partial* effects of these cognitions on intentions when the influence of previous attitudes, PBC and intentions are removed. Therefore, even when controlling for recent behaviour and previous cognitions, attitude at time 2 was a strong predictor of intention at time 2, but PBC had no direct effect on intention at either time point.

The lack of a PBC-intention relationship is unusual, given the correlations between these variables shown in Table 2. Re-estimating the model and fixing the attitude→intention paths to zero at both time points, restored the path coefficients between PBC and intention at both time points. This indicates that the inclusion of attitude in a simultaneous test of the influence of PBC on intention completely attenuates the PBC→intention relationship at both time points.

Finally, the children did not demonstrate a high degree of behavioural stability from previous six months behaviour (past behaviour) to five weeks prospective behaviour at time 2 (path coefficient = .37, $p < .01$). This is to be expected because behaviour across a longer period of time is likely to be influenced by a number of extraneous variables and is subject to changes in cognition that may result in concomitant behavioural change. This is corroborated by Ajzen (1985) who suggests that prediction in social cognitive models will be most successful if the interim time lag between behavioural and cognitive assessment is short.

DISCUSSION

The present study supports the use of the TPB as a framework for demonstrating the salient social cognitive influences on children's physical activity intentions and behaviour. Study 1 provides support for the construct validity of the measures used to assess the TPB variables and the predictive validity of the pattern of influence of the TPB variables and past behaviour using a structural equation modelling approach. These data were followed up by a longitudinal test of the relations between physical activity intentions, attitudes and PBC with children in Study 2. The results indicated that the model relationships exhibited a degree of stability over time, but the model was not entropic.

Predictive Validity of the TPB for Physical Activity Behaviour with Children

The results from the present investigation showed that children base their intentions to engage in physical activity behaviour largely on their attitudes and past behaviour respectively. While some previous research has suggested that subjective norms are very important in children (Godin and Shepherd, 1986b; Shepherd and Godin, 1986), other researchers have obtained similar findings to those presented in Study 1. For example, Craig *et al*. (1996) also found that attitude was the strongest predictor of intention while subjective norms had no influence.

The null contribution of subjective norms in Study 1 was not expected as it was anticipated that the additional perceived social pressures that children encounter, such as parental control, might play an important role in determining children's physical activity decisions. From a developmental perspective, it was expected that pressure from a "generalised other"

would result in subjective norms playing a more pervasive role in models of decision making than in adults. These data do not support this and the non-significance of the subjective norm variable in the model in Study 1 suggest that children make their decisions to exercise based on their attitudes and PBC.

Although contrary to the hypothesised pattern of relationships in the TPB, these results do not stand alone. Other empirical studies have demonstrated that the influences may differ across samples and behaviours. For example, Bagozzi and Kimmel (1995) and Bagozzi and Warshaw (1992) demonstrated a different order of the variables across behaviours. This is in congruence with Ajzen and Fishbein's (1980) original thoughts that the relative contributions of the predictors of intentions may vary depending on behaviour type as well as sample characteristics. Indeed, this is a strength of the theory as it enables researchers to identify behaviour and sample-specific influences on intentions and identify targets for intervention. In summary, relations between intentions, attitudes and PBC as operationalised in the present studies demonstrate that such a framework may be useful in the examination of the cognitive influences on physical activity behaviour in children.

Autoregressive and Cross-lagged Effects

The longitudinal test of children's intentions to engage in physical activity in Study 2 demonstrates the complexity of the decision-making process. The instability of children's physical activity intentions, attitudes and PBC over time suggests that the longitudinal coefficients do not perfectly model children's temporal cognition change. It demonstrates that a change in a cognition at time 1 will result in a corresponding change for that variable in the same direction and in proportion to the size of the autoregression coefficient at time 2. Further, the lack of cross-lagged effects between attitudes and intentions suggests that the effects of attitudes at time 1 on intentions at time 2 are indirect. Thus, although previous attitudes do influence physical activity intentions at a second time-point, the effects of current attitudes are far more pervasive. The decision-making process is therefore not independent of, nor solely reliant on, previous decision-making processes associated with that behaviour.

According to the model presented in Study 2, children may intend to do physical activity largely on their immediate assessment of their attitudes regarding that behaviour at that particular time. Their attitudinal assessment will largely be a function of their current positive and negative evaluation of the attributes of the behaviour, but will also be influenced by their previous attitudes. Their intentions will be a function of a direct effect of their current attitudes, an indirect influence of their attitudes towards that behaviour previously and by small direct influences from previous behaviour and intentions.

These are different findings to those provided by another longitudinal analysis by Armitage and Conner (1999b). These authors demonstrated that attitudes and self-efficacy predict intentions at time 2 independent of the effects of time 2 cognitions. In the present study, the time 1 cognitions do not demonstrate these independent effects, all the effects of time 1 variables occur via the mediation of the time 2 variables. Variations in study methods, the interim period between the measurement of the study variables and the type of behaviour studied may be responsible for such differences. These results do support other studies using cross-lagged panel correlations showing that the effects of attitudes on behaviour are reciprocal (Kahle and Beatty, 1987). This suggests that past behaviour and recent past behaviour lead to the formation of future attitudes towards that behaviour.

Influence of Past Behaviour

Findings from Study 1 suggest that some of the influences of the TPB on intention and behaviour are due to the presence of past behaviour, but the effects are largely additive. This was corroborated by Study 2 which demonstrated that the effects of past behaviour on children's physical activity intentions and behaviour are limited to attenuating the influence of the attitude variable on intention and accounting for slightly more explained variance in intention. The influences of past behaviour on intentions and behaviour are variant across studies. Some studies have demonstrated some very powerful attentuation effects of past behaviour on the attitude-intention, subjective norm-intention and PBC-intention relationships (Bagozzi and Kimmel, 1995; Sutton, 1994) while others have shown only moderate attenuation effects (Godin *et al*., 1991).

It is clear from this evidence that the influence of past behaviour cannot be denied and is indicative that children do account for their previous physical activity behaviour when making estimations of their prospective engagement in physical activities. This is consistent with psychological theories of cognition such as schema theory. Schema theory suggests that previous experience is a key influence on motivation towards engaging in future activities as it provides a top–down source of information on which to base future expectations (French and Richards, 1993). Therefore, on the basis of the present results, children's judgements regarding their physical activity behaviour may be tempered by their previous involvement. But since children are likely to have physical activity schemata that are less developed than adults, the influence of past behaviour may not be as great compared to adults.

Limitations of the Study

Briefly, caution must be exercised when considering the generalisability of the present results. While the present study provides strong evidence for the construct and predictive validity of the relations between intention, attitude and PBC in physical activity behaviour with children, there are some limitations. Firstly, the measure of PBC in the present studies may not have encompassed all the dimensions of this variable. In the present study, PBC was shown to have a small effect on intentions in the prospective test of the model in Study 1 and attitude swamps this effect in the longitudinal test of the intention, attitude and PBC relationships in Study 2. These findings support recent longitudinal studies that show PBC to have only small effects on intention and behaviour when compared with another control-related construct, self-efficacy (Armitage and Conner, 1999b). Future longitudinal tests of the TPB in children's physical activity will include more differentiated measures of the control construct in order to disentangle the influences of perceived control on behaviour (Armitage and Conner, 1999a).

Another limitation is the small sample size presented in Study 2. This prevented the construction of a latent variable longitudinal model. This is important as it will provide a simultaneous test of the construct validity of the model constructs and will help build a model in which the measurement error associated with the latent variables is explicitly modelled. This ensures more precise predictions as the causal relations are estimated using "error free" constructs. However, the confirmation of the construct validity of the measures used in Study 1 add confidence to the assertion of the appropriateness of the measures used in Study 1.

Finally, comment should be made on the inclusion of past behaviour–behaviour relationships in models such as the TPB. Some researchers have claimed that the inclusion of past

behaviour–behaviour relationships in the TPB has little "useful purpose" and its effects should be mediated by the intention component (Ajzen, 1991). However, many studies have reported a unique effect of past behaviour on future behaviour (e.g. Bagozzi, 1981; Godin *et al*., 1987; Sutton, 1994), a finding that has been interpreted as either the influence of an "automatic" or "habitual" performance of the behaviour or a reflection of other cognitive influences not accounted for by the TRA/TPB (Conner and Armitage, 1998). The present study has focused on the notion that past behaviour controls for the habitual effects outlined by Triandis (1977) and allows for testing the unique effects of recent behaviour on current cognitions. Further, past behaviour is also viewed as a further "source of information" (Conner and Armitage, 1998) for the time 1 and time 2 TPB cognitions and has additive rather than attenuation effect on the TPB cognitions.

CONCLUSIONS

To conclude, the present study provides evidence in support of the construct and predictive validity of children's physical activity intentions, attitudes and PBC as postulated by Ajzen (1985) in the TPB. In addition, it supports the notion that, across time, children's attitudes, intentions and PBC over their physical activity behaviour exhibit some stability, but the model is not entropic suggesting the influence of other extraneous factors. Further, past behaviour is shown to have an influence that is largely additive. Practically, this points to the fact that children perform physical activities only in part because they have performed such activities before. Rather, they engage in physical activity largely as the result of their situation-specific expectations of the behavioural engagement itself. This is consistent with the notion that children have a spontaneous nature (Sleap and Warburton, 1996) and perform activities largely for the attributes of the activity such as enjoyment and other intrinsic reasons rather than as the result of a routine (Biddle *et al*., 1998).

Overall, the findings suggest that establishing a regular pattern of physical activity amongst children might be enhanced by attitude-based intervention strategies. This is consistent with recent research that suggests that attitude-based intentions are more likely to be translated into behaviour than intentions based on subjective norms (Sheeran *et al*., 1999). It also corroborates research that has adopted attitude-based intervention strategies to enhance behaviour (Armitage and Conner, in press). Future research may focus on examining the underlying belief systems influencing children's attitudes and intentions to engage in physical activity function across time.

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