

Teacher, peer and parent autonomy support in physical education and leisure-time physical activity: A trans-contextual model of motivation in four nations

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An extended trans-contextual model of motivation for health-related physical activity was tested in samples from four nations. The model proposes a motivational sequence in which perceived autonomy support from teachers in a physical education (PE) context and from peers and parents in a leisure-time physical activity context predict autonomous motivation, intentions and physical activity behaviour in a leisure-time context. A three-wave prospective correlational design was employed. High-school pupils from Britain, Estonia, Finland and Hungary completed measures of perceived autonomy support from PE teachers, autonomous motivation in both contexts, perceived autonomy support from peers and parents, attitudes, subjective norms, perceived behavioural control and intentions from the Theory of Planned Behaviour (TPB), and measures of behaviour and past behaviour in a leisure-time context. Path-analyses controlling for past behaviour supported trans-contextual model hypotheses across all samples. Effects of perceived autonomy support from peers and parents on leisure-time autonomous motivation were small and inconsistent, while effects on TPB variables were stronger. There was a unique effect of perceived autonomy support from PE teachers on leisure-time autonomous motivation. Findings support the model, which provides an explanation of the processes by which perceived autonomy support from different sources affects health-related physical activity motivation across these contexts.

Keywords: physical activity; exercise; motivation; intentions; self-determination; theoretical integration

Introduction

The rise in juvenile obesity and its associated health problems have prompted research and initiatives seeking to enhance physical activity in young people as a preventive measure (Bar-Or, 2000). Research has suggested using existing networks such as physical education (PE) to implement interventions to increase physical activity levels in young people

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(Ntoumanis, 2005; Stone, McKenzie, Welk, & Booth, 1998). While there is considerable evidence identifying the motivational factors that are positively associated with physical activity behaviour in young people (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003; Sallis, Prochaska, & Taylor, 2000), few studies have examined how motivational factors in PE are translated into physical activity participation in a leisure-time setting outside of school (Hagger & Chatzisarantis, 2007).

The present investigation aims to apply and extend the *trans-contextual model* of motivation to the study of intentional physical activity behaviour. The trans-contextual model is a multi-theory integrated model that specifies the processes by which motivation for physical activity in a PE context is transferred into a leisure-time physical activity context (Hagger & Chatzisarantis, 2007; Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005; Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003). The model draws from three prominent theories of motivation; self-determination theory (Deci & Ryan, 1985), the hierarchical model of motivation (Vallerand, 2007), and the Theory of Planned Behaviour (TPB, Ajzen, 1985). Central to the model is the hypothesis that pupils' perceived autonomy support from their PE teachers will influence self-determined or *autonomous* motivation in PE, but also in another related context, leisure time. It is further proposed that autonomous motivation compels individuals to form intentions to participate in leisure-time physical activity behaviour in the future. The hypothesis that motivation is transferred across contexts is important as it indicates that autonomous motivation in different contexts is linked and leads to intentions to engage in future health-related behaviour. Such evidence is useful for intervention design as it provides a rationale for promoting autonomous motivation in a context where a 'captive audience' exists (e.g. PE) that will have an influence on motivation in another context where access is limited (e.g. leisure time). The present study extends previous studies by incorporating perceived autonomy support from peers and parents in an extended trans-contextual model. The extended model will also be tested in independent samples from four nations to confirm the generalisability of its key hypotheses among groups with different cultural norms.

The trans-contextual model

The main hypotheses behind the trans-contextual model and the unique addition that the model makes to the understanding of motivation in physical activity will be introduced in this section. The proposed model is depicted in Figure 1. This is based on hypotheses from self-determination theory (Deci & Ryan, 1985) and the hierarchical model of motivation (Vallerand, 2007). Autonomous motivation is central to self-determination theory and reflects engaging in behaviour because it satisfies outcomes that are internal to the individual and perceived to emanate from their true sense of self. Research has shown that persistence in health behaviour is associated with autonomous forms of motivation (Hagger, Chatzisarantis, & Biddle, 2002a; Williams, 2002). Self-determination theorists also propose that autonomy-supportive behaviours displayed by significant others can influence levels of autonomous motivation (Reeve, 2002). Perceived autonomy support reflects behaviours that specifically enhance autonomous motivation such as provision of choice (Reeve, 2002) and is distinct from other sources of social support that tend to focus on support for competence/self-efficacy or relatedness (De Vries & Mudde, 1998). Research has shown that the level of perceived autonomy support given by significant others is associated with autonomous forms of motivation and behavioural persistence (Chirkov & Ryan, 2001; Williams, 2002). In accordance with this hypothesis and previous

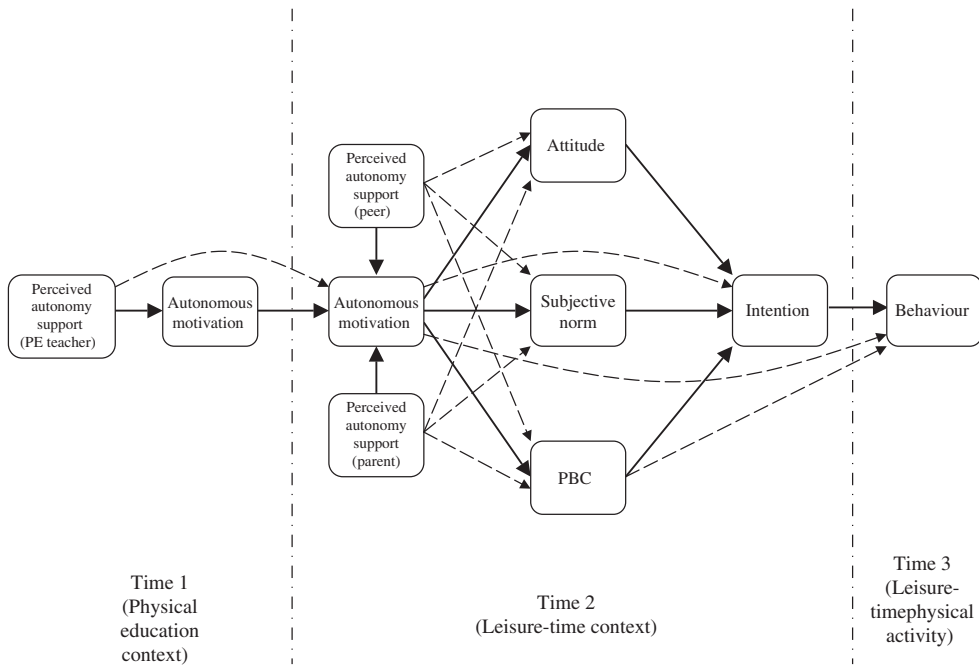


Figure 1. The extended trans-contextual model.

Notes: For clarity, the direct effects of past behaviour on all study variables and the error covariances among the attitude, subjective norm and PBC constructs and among the perceived autonomy support constructs have been omitted; solid lines illustrate the effects from the proposed motivational sequence that were tested in the model; broken lines indicate paths set to be free in order to test indirect and mediation effects.

findings from self-determination theory, the relationship between perceived autonomy support from PE teachers and autonomous motivation in PE is proposed in the trans-contextual model. Adolescents who perceive teachers to support autonomous motivation in PE are more likely to report high levels of autonomous motivation in that context (Hagger & Chatzisarantis, 2007).

A second hypothesis of the trans-contextual model is that autonomous motivation in a PE context will be significantly related to autonomous motivation to participate in physical activity outside the school environment in a leisure-time context. This specific link between autonomous motivation across different contexts is derived from hypotheses from Vallerand's (2007) hierarchical model of motivation. Vallerand proposed that autonomous motivation from self-determination theory operated at three levels of generality: global, contextual and specific. Global-level motivation reflects a generalised disposition to be autonomously motivated and influences behaviour in a number of contexts. Contextual-level motivation is motivation to engage in behaviours in a given context, such as physical education or leisure-time physical activity. Motivation at the situational level refers to autonomous motivation towards specific bouts of a given behaviour. Vallerand hypothesised that motivation in a given context will be determined, in part, by global-level motivation, but also by motivation from other related contexts. The relationship between autonomous forms of motivation in PE and leisure time across contexts in the trans-contextual model is based on this hypothesis and is consistent with previous findings (Hagger & Chatzisarantis, 2007; Hagger et al., 2003, 2005).

A third hypothesis is that the influence of perceived autonomy support from PE teachers on autonomous motivation in a leisure-time context will be mediated by autonomous motivation in PE. In Figure 1, the broken line between perceived autonomy support from PE teachers and autonomous motivation in leisure time represents the direct path that should be mediated by autonomous motivation in PE. This is based on the self-determination theory hypothesis that teachers' support for autonomy will be most relevant to promoting autonomous motivation in PE (Ntoumanis, 2005). Since contextual-level motivation in one context (i.e. PE) influences motivation in a related context (e.g. leisure time), the antecedents of motivation in PE are expected to influence autonomous motivation in the other context. Again this premise has been supported in previous empirical tests of the trans-contextual model indicating that there is an indirect effect of perceived autonomy support in PE on autonomous motivation in leisure time mediated by autonomous motivation in PE (Hagger & Chatzisarantis, 2007).

A fourth hypothesis is that autonomous motivation in a leisure-time context will be related to *intentions* to engage in physical activity in the future. Specifically, it is proposed that autonomous motivation in leisure time will be related to the social cognitive variables involved in the formation of intentions to engage in physical activity behaviour in the future. The TPB posits that an individual's intention, a motivational construct, is the most proximal influence on a given behaviour and mediates the influence of three sets of belief-based perceptions on behaviour; attitudes, subjective norm and perceived behavioural control (PBC). Attitudes are a person's overall positive or negative evaluation of the target behaviour. Subjective norms summarise a person's expectation that significant others want them to engage in the target behaviour. PBC comprises a person's overall judgment whether they have the ability and resources available to engage in the target behaviour.

The trans-contextual model proposes that autonomous motivation is a distal, formative influence on attitudes and PBC from the TPB. Ajzen (1985) proposed that attitudes and PBC comprise beliefs that the behaviour will result in certain outcomes and that the behaviour is under control of the individual. However, like many social-cognitive theories, the TPB was not explicit in the reasons that these beliefs are pursued (Deci & Ryan, 1985). For example, the theory does not make the distinction between beliefs about outcomes that people *choose* to seek and are related to their true sense of self (autonomous outcomes) and beliefs about outcomes that people feel compelled to engage in out of a sense of *obligation* or duty (controlled outcomes). Some beliefs about outcomes could be interpreted as either autonomous or controlled reasons for participating in physical activity such as 'I exercise in order to lose weight'. For some people this may be autonomous because they value being healthy (autonomous), but for others losing weight may be to look good for others (controlling). Self-determination theory offers an interpretation of whether these beliefs about outcomes are interpreted as autonomous or controlling. The theory suggests that contextual-level motives to engage in behaviours for autonomous or controlling reasons predispose individuals to form beliefs that are congruent or aligned with their motives. On this basis, contextual-level autonomous motives are hypothesised in the trans-contextual model as a distal influence on attitudes and PBC. Attitudes and PBC are, in turn, proximal influences on the formation of intentions to engage in future physical activity behaviour.

For example, adolescents who cite autonomous motives to participate in physical activity (e.g. 'doing physical activity because it is fun') will tend to seek out situations and behaviours that are consistent with these motives. As a consequence, they are likely to

form beliefs about outcomes for participating in physical activity that are congruent with these autonomous motives. The motives from self-determination theory should therefore be viewed as a bias that predisposes people to forming and interpreting beliefs about outcomes for participating in physical activity as autonomous or controlling. However, measures of autonomous and controlling motives at the contextual level may demonstrate considerable overlap with behavioural and normative belief measures. This poses an empirical problem for establishing discriminant validity and testing relations among these constructs. Previous studies have tested this relationship using direct, global measures of attitudes and subjective norms rather than belief-based measures, which circumvents these measurement difficulties.

A final set of hypotheses in the trans-contextual model are derived directly from the TPB. Specifically, attitudes, subjective norms and PBC are expected to influence intentions to engage in physical activity behaviour. Intentions are proposed to be the most proximal predictor of future physical activity behaviour and mediate the effects of attitudes, subjective norms and PBC on behaviour. These hypotheses have been supported in a multitude of tests of the TPB in many contexts (Armitage & Conner, 2001) including physical activity (Boudreau & Godin, 2007; Hagger, Chatzisarantis, & Biddle, 2002b; Stiggelbout, Hopman-Rock, Crone, Lechner, & Van Mechelen, 2006).

Extending the trans-contextual model: peer and parent perceived autonomy support

A unique premise in the present study is the inclusion of autonomy support from other sources, namely, peers and parents, as influences on autonomous motivation in a leisure-time context. One of the major limitations of previous research on the trans-contextual model is that no control was included for other sources of perceived autonomy support (Hagger & Chatzisarantis, 2007). Perceived autonomy support from PE teachers is not the sole source of autonomy support for adolescents. The inclusion of perceived autonomy support from peers and parents is likely to have a proportionally greater influence on young people's decisions than those of teachers because PE teachers' influence occurs in a different, more distal, context (Baker, Little, & Brownell, 2003; Sage & Kindermann, 1999). If the effects of perceived autonomy support from PE teachers on autonomous motivation in a leisure-time context remain after controlling for perceived autonomy support from other sources, then it will yield further evidence for the unique effect of autonomy support in PE on motivation for physical activity outside of school. Finally, it was expected that the effects of perceived autonomy support from these sources on the more proximal predictors of behaviour, namely, attitudes, subjective norms and PBC, will be exerted through autonomous motivation, since self-determination theory suggests that perceived autonomy support exerts its effects through autonomous forms of motivation (Williams, 2002). These effects are depicted in Figure 1 by the broken lines from perceived autonomy support from peers and parents on attitudes, subjective norms and PBC.

Cross-cultural variations in the trans-contextual model

Many theories of social cognition and motivation propose that their predictions represent universal motivational and decision-making processes, and should be consistent across samples (Ajzen, 1985; Deci & Ryan, 1985). Adhering to this view, the trans-contextual model should be viewed as a general model that represents the processes that influence

the motivation, intentions and actual physical activity behaviour of all adolescents. An alternative hypothesis is the culture-centric approach (Markus & Kitayama, 1991) that proposes that the relative degree of collectivism or individualism endorsed by cultural groups will give rise to variations in the type of motivation and the social and personal influences on decision-making. Cross-cultural research is, therefore, important in order to establish whether effects in motivational models like the trans-contextual model are universal, as proposed by social-cognitive and motivational theorists (Ajzen, 1985; Chirkov & Ryan, 2001; Deci & Ryan, 1985), or are affected by individual differences in cultural orientations, as proposed by the culture-centric approach (Markus & Kitayama, 1991). The present study aims to add to existing knowledge by analysing the results in samples that either have predominantly collectivist (Estonia, Finland and Hungary) or predominantly individualist (Great Britain) cultural norms. This will provide evidence as to whether the model processes are universal and can be applied across national groups.

The present study: summary of aims and hypotheses

The aim of the present study is to test an extended trans-contextual model of motivation in independent samples from four nations. The study will make three unique contributions to the health psychology literature. First, it will evaluate the effectiveness of a model that integrates three theories of motivation into a single trans-contextual model. Second, it will extend the model to support the hypothesis that the effects of perceived autonomy support from PE teachers on autonomous motivation towards physical activity in a leisure-time context is not affected by perceived autonomy support from other significant sources, namely peers and parents. It will also provide information as to whether these referents have comparatively greater effects on physical activity motivation, given their central role in the social development of young people. Third, the study will test whether the proposed pattern of relations among the model constructs are universal in nature and not subject to variation across samples of young people from diverse cultural groups representing collectivist (Northern and Eastern European) and individualist (Western European) nations.

Specifically, the following hypotheses will be tested:

- (1) Perceived autonomy support from PE teachers will have a significant effect on autonomous motivation in a PE context.
- (2) Autonomous motivation towards physical activity in a leisure-time context will be determined by autonomous motivation in PE and perceived autonomy support from peers and parents in a leisure-time context.
- (3) Effects of peer and parental perceived autonomy support in a leisure-time context on the proximal antecedents of intentions and behaviour, namely, attitudes, subjective norms and PBC, will be indirect via leisure-time autonomous motivation.
- (4) There will be a significant indirect effect of perceived autonomy support from PE teachers on autonomous motivation in a leisure-time context, mediated by autonomous motivation in PE and independent of the effects of peer and parental perceived autonomy support in a leisure-time context.
- (5) Autonomous motivation in a leisure-time context will have a significant indirect effect on intentions to engage in physical activity in the future, mediated by attitudes and PBC.

- (6) Intentions will be the only direct predictor of physical activity behaviour and will mediate the effects of attitudes, subjective norms and PBC on behaviour.
- (7) The effects in the model will be consistent across cultures with different cultural backgrounds.
- (8) The effects in the model will be independent of the effects of past physical activity behaviour.

Method

Participants

Participants were recruited from co-educational high schools in Great Britain, Estonia, Finland and Hungary. British participants ($N=404$) were recruited from two government-run high schools in the South East of England. School statistics indicated that the majority of the pupils in each school were of white European ethnicity, with <10% from other ethnic minority groups. Data from the Estonian sample ($N=61$) were collected in three government-run high schools. Details on the socio-economic status of the participants were given by the school director. The school draws its students from an area characterised as 'middle-class' and matched the distribution of socio-economic status levels among town-dwelling school children in Estonia. Finnish participants ($N=158$) were recruited from three high schools in the region of Jyväskylä. Participants were of lower-middle class socio-economic status according to the national school registry. The Hungarian sample ($N=286$) was recruited from three government-run secondary schools. Details on ethnicity were not available, but the local government register indicated that school pupils were of a lower socio-economic status.

Research design

The study adopted a three-wave prospective design. In the first wave (time 1), participants completed self-report measures of perceived autonomy support from PE teachers and autonomous motivation in a PE context (Hagger et al., 2003). A second questionnaire containing measures of the components of the TPB (Ajzen, 1985), autonomous motivation in a leisure-time physical activity context (Mullan, Markland, & Ingledew, 1997) and perceived autonomy support from peers and parents was administered in the second wave one week later (time 2). The one-week interval between time 1 and time 2 was used to minimise the amount of error variance introduced into the data that could be attributed to the use of similar measures of autonomous motivation in PE and leisure-time contexts, as in previous research (Hagger & Chatzisarantis, 2007). Five weeks later, self-reported physical activity behaviour was measured in the third wave (time 3) using a self-report measure of physical activity based on the Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985).

Permission from school principals and parental consent was obtained prior to data collection. Pupils were told that they were participating in a survey on young people and would be asked to complete a battery of questionnaires over a series of weeks. Data were collected in quiet classroom conditions and pupils were isolated so that they could not discuss responses. Questionnaires were completed anonymously to preserve confidentiality and were matched using birth date and gender.

Measures¹

Perceived autonomy support

Three 12-item perceived autonomy support scales for exercise settings were developed with respect to three salient referent(s): PE teacher, peers and parents. These were developed from perceived autonomy support measures that have shown construct, discriminant, predictive and nomological validity with other like constructs (Hagger et al., 2003; Williams, 2002). An example item from the scale is: 'I feel that my [salient referent(s)] provide(s) me with choices, options, and opportunities to do active sports and/or vigorous exercise' with 'PE teacher', 'friends' or 'parents' as the salient referent in each of the three scales, respectively. Responses were recorded on seven-point scales ranging from 1 ('strongly disagree') to 7 ('strongly agree'). The internal reliability (Cronbach α) for the perceived autonomy support scales from PE teacher (British sample, $\alpha = 0.93$; Estonian sample, $\alpha = 0.91$; Finnish sample, $\alpha = 0.92$; Hungarian sample, $\alpha = 0.92$), peers ($\alpha = 0.94$; 0.91; 92; 0.89) and parents ($\alpha = 0.96$; 0.94; 0.96; 0.90) sources were satisfactory across samples.

Autonomous motivation in PE

A modified version of Ryan and Connell's (1989) perceived locus of causality scale was used to measure autonomous motivation in PE. The scale measures four types of motivation, each varying in the degree of autonomy on a continuum ranging from high to low autonomy, known as the perceived locus of causality (PLOC). The types of motivation are: *intrinsic motivation* (e.g. 'I participate in PE because it is fun'), the prototypical form of autonomous motivation representing behavioural engagement for no external contingency or reinforcement; *identified regulation* (e.g. 'I participate in PE because I value PE'), a highly autonomous form of motivation representing motivation to engage in a behaviour because it services goals that are intrinsic and salient to the self; *introjected regulation* (e.g. 'because I will feel ashamed if I do not do PE'), a less autonomous form of motivation reflecting behavioural engagement due to perceived internal pressures like avoiding shame or guilt or gaining contingent self-worth or pride; and *external regulation* (e.g. 'I participate in PE because important others want me to do PE'), the prototypical form of extrinsic motivation, and therefore, the least autonomous, reflecting engaging in behaviours due to external reinforcement such as obtaining a reward or avoiding punishment. Four items tapped each motivation type, and responses were made on four-point scales ranging from 1 ('not true at all') to 4 ('very true'). The internal reliabilities for these scales were typically satisfactory across the four national samples for the intrinsic motivation (British sample, $\alpha = 0.91$; Estonian sample, $\alpha = 0.91$; Finnish sample, $\alpha = 0.87$; Hungarian sample, $\alpha = 0.85$), identified regulation ($\alpha = 0.80$; 0.74; 0.82; 0.69), introjected regulation ($\alpha = 0.80$; 0.68; 0.78; 0.61) and external regulation scales ($\alpha = 0.69$; 0.54; 0.55; 0.59).

Autonomous motivation in leisure time

Mullan, Markland and Ingledew's (1997) Behavioural Regulations in Exercise Questionnaire was used to measure autonomous motivation in a leisure-time context. Participants were asked 'Why do you participate in active sports and/or vigorous physical activities in your spare time?' followed by four reasons from each motivation style from the PLOC. Items measuring intrinsic motivation (e.g. 'I exercise because it is fun'), identified regulation (e.g. 'I exercise because it is important to make the effort'), introjected

regulation (e.g. 'I exercise because I will feel guilty if I do not') and external regulation (e.g. 'I exercise because others say I should') were assessed on seven-point scales ranging from 1 ('not true at all') to 7 ('very true'). Reliabilities were satisfactory across samples for intrinsic motivation (British sample, $\alpha = 0.80$; Estonian sample, $\alpha = 0.87$; Finnish sample, $\alpha = 0.93$; Hungarian sample, $\alpha = 0.79$), identified regulation ($\alpha = 0.81; 0.79; 0.80; 0.70$), introjected regulation ($\alpha = 0.85; 0.81; 0.88; 0.65$) and external regulation ($\alpha = 0.82; 0.76; 0.83; 0.58$).

Intentions. The measure of intentions comprised three items (e.g. 'I intend to do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks...') rated on seven-point scales anchored by 1 ('strongly agree') to 7 ('strongly disagree'). Internal consistency statistics for this scale were satisfactory across the samples ($\alpha = 0.95; 0.92; 0.94; 0.81$).

Attitudes. Attitudes were measured using five seven-point semantic differential scales with the bipolar adjectives: *bad-good*, *harmful-beneficial*, *not enjoyable-enjoyable*, *useful-useless* and *boring-interesting* in response to the common stem: 'Participating in active sports and/or vigorous physical activities during my leisure time in the next 5 weeks is...'. These items achieved satisfactory internal consistency in all samples ($\alpha = 0.89; 0.85; 0.91; 0.87$).

Subjective norms. Subjective norms were measured by four items (e.g. 'People important to me think that I should do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks') on seven-point scales with 1 ('strongly disagree') to 7 ('strongly agree') endpoints. The internal reliability of this scale was satisfactory for all samples ($\alpha = 0.83; 0.83; 0.88; 0.75$).

Perceived behavioural control. Three items comprised the measure of PBC (e.g. 'I feel incomplete control over whether I do active sports and/or vigorous physical activities in my leisure time in the next 5 weeks') measured on seven-point scales ranging from 1 ('no control') to 7 ('complete control'). The internal consistency of this scale was adequate for this scale across the samples ($\alpha = 0.80; 0.81; 0.88; 0.71$).

Physical activity behaviour. Self-reported leisure-time physical activity behaviour was measured at time 3 using an adapted version of Godin and Shepherd's (1985) Leisure-Time Exercise Questionnaire. Participants rated their five-week behavioural frequency on two items (e.g. 'In the course of the past 2 weeks, how often have you participated in vigorous physical activities for 20 min at a time?') using six-point Likert scales with scale endpoints *never* (1) and *everyday* (6). A definition of vigorous physical activity was given: 'Vigorous physical activities are activities which make your heart beat faster, make you breathe faster and leave you hot and sweaty'. The inter-item correlations for these measures were adequate across the samples ($r = 0.77; 0.68; 0.67; 0.67$).

Past behaviour. Past physical activity behaviour was assessed at time 1 using a single item: 'In the course of the past 6 months, how often, on average, have you participated in vigorous physical activities for 20 min at a time?' Responses were made on six-point

Likert scales with scale endpoints *not at all* (1) and *most days per week* (6). This measure has been used in many previous studies to estimate past behavioural frequency (Hagger et al., 2003, 2005).

Translation procedures

Language-specific questionnaires for use with the Estonian, Finnish and Hungarian samples were developed using standardised back-translation procedures by three independent bilingual translators (Brislin, 1986). The back-translation procedure was repeated iteratively until the original and back-translated English versions of the questionnaires were virtually identical.

Results

Participants

Attrition across the three occasions of data collection due to absences and inaccessibility resulted in final sample size of 210 participants in the British sample (boys = 94, girls = 116; M age = 13.19, SD = 1.12), 268 participants in the Estonian sample (boys = 117, girls = 151; M age = 15.04, SD = 0.91), 127 participants in the Finnish sample (boys = 55, girls = 72; M age = 14.30, SD = 0.49) and 235 participants in the Hungarian sample (boys = 114, girls = 121; M age = 14.02, SD = 0.99). Independent samples t -test and chi-square analysis revealed no significant differences in age and psychological constructs between participants recruited at time 1 and those that remained in the study at time 3. Chi-square tests indicated no significant differences in gender distribution and age by gender within the samples. However, a univariate F -test revealed significant age differences across the national groups ($F_{3836} = 155.01$, $p < 0.01$, $\eta^2 = 0.36$), with the British participants significantly younger than participants in the other samples; the Estonian participants were significantly older than participants in the other samples and the Hungarian participants also significantly younger than the Finnish participants.

Data analysis

Data were initially analysed by confirmatory factor analysis (CFA) with latent variables to test for the construct and discriminant validity of the study measures, and main hypotheses were tested using path analysis with composite variables. All models were estimated using a robust maximum likelihood estimation method with the EQS programme (Bentler, 2004). Goodness-of-fit of the proposed models with the data was evaluated using multiple recommended indexes of good fit: the Comparative Fit Index (CFI), the Non-Normed Fit Index (NNFI) and the Standardized Root Mean Squared Residuals (SRMSR). Cut-off values of 0.90 or above for the CFI and NNFI indicated acceptable models, although values greater than 0.95 were preferable. Values of 0.08 or less for the SRMSR were deemed satisfactory for well-fitting models (Hu & Bentler, 1999). Modification indexes (MI) were used to flag fixed parameters in the model that would make a significant change in the goodness-of-fit chi-square value if freed and the likelihood-ratio test based on the goodness-of-fit chi-square was used to identify misspecifications in the constrained models from the invariance analyses relative to the baseline model.

Invariance and discriminant validity of study measures

A series of multi-sample CFA models tested whether the measurement parameters (factor loadings) of the psychological constructs in the study were invariant across the national samples. The CFA models for autonomous motivation in PE and leisure time, perceived autonomy support from all three sources, and the TPB constructs were conducted separately as there were too many parameters to estimate an omnibus model. Prior to the analyses, the PLOC was reduced to a single index of autonomous motivation by calculating a relative autonomy index as recommended by Vallerand (2007)². Invariance analyses, constraining the factor pattern and factor loadings to be invariant across the samples, resulted in no substantial decrease in the fit of the models. This satisfies the minimum criterion for measurement invariance (Byrne, Shavelson, & Muthén, 1989) and the construct validity of study measures across samples³. Discriminant validity of the TPB measures of attitude, subjective norm and PBC from the autonomous motivation and perceived autonomy support constructs from self-determination theory was tested via a series of two-step, multi-sample CFA models (Mulaik & Millsap, 2000). In the first step, a discriminant-validity CFA model was estimated, for which items from the constructs of interest indicated separate latent factors that were freely correlated. In the second step, a congeneric CFA model was estimated in which a single latent factor was indicated by items from both constructs. The discriminant-validity models were expected to exhibit inferior fit compared with the congeneric models. In all cases, the discriminant-validity models exhibited superior fit with the data compared to the congeneric models across all four samples supporting the discriminant validity of the autonomous motivation constructs in the PE and leisure-time contexts from the TPB constructs⁴.

Path analyses

Composite variables for path analyses

Non-latent composite variables were used in a path analysis to test the main study hypotheses. Descriptive statistics and correlations for the composite variables are given in Table 1.

Single-sample analyses

The hypothesised relationships among the trans-contextual model constructs were tested by path analyses (Figure 1). In addition to estimating the hypothesised relationships, we controlled for the effect of previous involvement and decision-making by including past behaviour as an independent predictor of all model variables as in previous tests of the model (Hagger et al., 2003). The hypothesised model exhibited good fit with the data for the British ($\chi^2 = 21.48$, $df = 18$, $p = 0.26$; CFI = 1.00; NNFI = 0.98; SRMSR = 0.04), Estonian ($\chi^2 = 53.78$, $df = 18$, $p < 0.01$; CFI = 0.97; NNFI = 0.96; SRMSR = 0.05), Finnish ($\chi^2 = 25.52$, $df = 18$, $p = 0.11$; CFI = 0.98; NNFI = 0.95; SRMSR = 0.05) and Hungarian samples ($\chi^2 = 29.21$, $df = 72$, $p = 0.05$; CFI = 0.98; NNFI = 0.96; SRMSR = 0.04). These results support the replicability of the trans-contextual model in each sample.

Bootstrapping the models

A 'bootstrap' re-sampling analysis was conducted for the path analysis models in each sample to confirm that the satisfactory goodness-of-fit statistics for the models

Table 1. Descriptive statistics and intercorrelations among the extended trans-contextual model components.

Factor	M	SD	1	2	3	4	5	6	7	8	9	10
1 PAS (PE Teacher)												
British	4.33	1.02										
Estonian	4.23	1.09	–									
Finnish	4.89	0.91										
Hungarian	4.07	1.18										
2 Autonomous motivation (PE)												
British	1.51	2.53	0.36**									
Estonian	1.33	2.33	0.49**	–								
Finnish	2.66	1.60	0.39**									
Hungarian	1.78	2.35	0.40**									
3 PAS (Peer)												
British	4.32	1.17	0.31**	0.31**								
Estonian	4.71	1.09	0.33**	0.36**	–							
Finnish	4.85	1.05	0.27**	0.33**								
Hungarian	4.23	1.31	0.26**	0.22**								
4 PAS (Parent)												
British	4.55	1.22	0.21**	0.30**	0.70**							
Estonian	4.97	1.13	0.34**	0.37**	0.72**							
Finnish	5.07	1.29	0.27**	0.33**	0.67**							
Hungarian	4.62	1.39	0.21**	0.21**	0.63**	–						
5 Autonomous motivation (LT)												
British	5.62	5.69	0.25**	0.56**	0.48**	0.49**						
Estonian	5.14	4.72	0.20**	0.47**	0.38**	0.36**	–					
Finnish	8.26	4.74	0.15*	0.55**	0.38**	0.23**						
Hungarian	6.19	5.27	0.18**	0.29**	0.38**	0.37**						

could be replicated in samples based on the original. Two-thousand samples were drawn randomly from the original datasets, with replacement, equal in size to the original sample. All 2000 replications resulted in a successful fit of the specified model and CFI values that exceeded cut-off values (Hu & Bentler, 1999) with narrow 95% confidence intervals that were negatively skewed towards the upper end. The bootstrap analyses provided further support for the adequacy of the model in each national sample⁵.

Relationships in the model

Standardised path coefficients for the free parameters in the path analyses from each sample are given in Table 2. Overall, the model accounted for 70.2, 58.6, 65.0 and 44.8% of the variance in leisure-time physical activity intentions and 53.2, 49.6, 52.4 and 22.7% of the variance in physical activity behaviour in the British, Estonian, Finnish and Hungarian samples, respectively.

Hypothesis 1

Perceived autonomy support from PE teachers had a significant direct effect on autonomous motivation in PE in all samples (British $\beta=0.25$, $p < 0.01$; Estonian $\beta=0.43$, $p < 0.01$; Finnish $\beta=0.36$, $p < 0.01$; Hungarian $\beta=0.39$, $p < 0.01$) as hypothesised.

Hypothesis 2

In accordance with the hypothesis, there was a significant direct effect of autonomous motivation in PE on autonomous motivation in a leisure-time context in all samples (British $\beta=0.38$, $p < 0.01$; Estonian $\beta=0.38$, $p < 0.01$; Finnish $\beta=0.48$, $p < 0.01$; Hungarian $\beta=0.18$, $p < 0.01$). Perceived autonomy support from peers and parents was also hypothesised to have direct effects on autonomous motivation in a leisure-time context. However, results indicated that not all of the samples exhibited significant effects of these autonomy-support variables on autonomous motivation. Perceived autonomy support from peers had a significant direct effect on autonomous motivation in the Estonian ($\beta=0.17$, $p < 0.01$), Finnish ($\beta=0.24$, $p < 0.01$) and Hungarian ($\beta=0.16$, $p < 0.01$) samples. The direct effect of perceived autonomy support from parents on autonomous motivation was significant in the British ($\beta=0.20$, $p < 0.01$) and Hungarian ($\beta=0.20$, $p < 0.01$) samples only (Table 2).

Hypothesis 3

Contrary to the hypothesis, autonomous motivation did not mediate the effects of the perceived autonomy-support variables on the proximal predictors of intentions and behaviour. Instead, there were a number of significant direct effects. Most prominent were the direct effects of perceived autonomy support from parents on attitudes in the British ($\beta=0.29$, $p < 0.01$), Estonian ($\beta=0.40$, $p < 0.01$) and Finnish ($\beta=0.26$, $p < 0.01$) samples and on subjective norms in all samples (British $\beta=0.36$, $p < 0.01$; Estonian $\beta=0.53$, $p < 0.01$; Finnish $\beta=0.69$, $p < 0.05$; Hungarian $\beta=0.48$, $p < 0.01$).

Table 2. Standardised parameter estimates and univariate comparisons from the path analyses of the extended trans-contextual model for each national sample.

Relationship	Sample			
	British	Estonian	Finnish	Hungarian
PAS (PE teacher)→Autonomous motivation (PE)	0.25**	0.43**	0.36**	0.39**
PAS (PE teacher)→Autonomous motivation (LT)	-0.03	-0.11	-0.09	0.02
Autonomous motivation (PE)→Autonomous motivation (LT)	0.38**bc	0.38**bc	0.48**acd	0.18**abd
PAS (Peer)→Autonomous motivation (LT)	0.11	0.17**	0.24**	0.16**
PAS (Peer)→Attitude	0.05 ^{bc}	-0.02 ^{bc}	0.22**ad	0.21**ad
PAS (Peer)→Subjective norm	0.08	0.13	-0.08	0.05
PAS (Peer)→PBC	0.09	0.01	0.23**	0.06
PAS (Parent)→Autonomous motivation (LT)	0.20**	0.08	-0.13	0.20**
PAS (Parent)→Attitude	0.29**c	0.40**c	0.26**c	0.04 ^{abd}
PAS (Parent)→Subjective norm	0.36**abc	0.53**cd	0.69**cd	0.48**abd
PAS (Parent)→PBC	0.21**	0.51**	0.14	0.17**
Autonomous motivation (LT)→Attitude	0.17**abc	0.24**a	0.34**a	0.25**a
Autonomous motivation (LT)→Subjective norm	0.12 ^a	-0.15**bcd	-0.05 ^a	0.09 ^a
Autonomous motivation (LT)→PBC	0.31**ac	0.02 ^{bcd}	0.30**ac	0.19**abd
Autonomous motivation (LT)→Intention	0.17**	0.06	0.07	0.21**
Autonomous motivation (LT)→Behaviour	0.04	0.09	0.07	0.01
Attitude→Intention	0.14**a	0.25**bcd	0.16**a	0.12**a
Subjective norm→Intention	0.21**	0.06	0.09	0.17**
PBC→Intention	0.01 ^{ab}	0.23**cd	0.18**cd	-0.05 ^{ab}
Intention→Behaviour	0.34**b	0.32**b	0.55**acd	0.21**b
PBC→Behaviour	0.08	0.02	-0.01	0.04
Past behaviour→PAS (PE teacher)	0.31**	0.27**	0.09	0.02
Past behaviour→Autonomous motivation (PE)	0.34**	0.21**	0.27**	0.17**
Past behaviour→Autonomous motivation (LT)	0.21**	0.18**	0.23**	0.17**
Past behaviour→PAS (Peer)	0.49**	0.38**	0.37**	0.31**
Past behaviour→PAS (Parent)	0.42**	0.39**	0.27**	0.23**
Past behaviour→Attitude	0.36**	0.23**	0.04	0.13*
Past behaviour→Subjective norm	0.24**	0.09	0.01	0.06
Past behaviour→PBC	0.10	0.23**	-0.08	0.02
Past behaviour→Intention	0.50**	0.38**	0.59**	0.44**
Past behaviour→Behaviour	0.37**	0.40**	0.18**	0.31**
R ² Intention	0.702	0.586	0.650	0.448
R ² Behaviour	0.532	0.496	0.524	0.227

Notes: PAS = Perceived autonomy support; PE = Physical education context; LT = Leisure-time context; PBC = Perceived behavioural control.

^aSignificantly different from Estonian sample; ^bSignificantly different from Finnish sample;

^cSignificantly different from Hungarian sample; ^dSignificantly different from British sample.

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

Hypothesis 4

We also hypothesised that perceived autonomy support in a PE context would have an indirect effect on autonomous motivation in leisure time mediated by autonomous motivation in a PE context. In the path analysis, there was no direct effect of perceived autonomy support from PE teachers on autonomous motivation in leisure time in any of the samples (Table 2). However, there was a significant indirect effect of perceived autonomy support from PE teachers on autonomous motivation in a leisure-time context in each sample supporting the hypothesis (British $\beta = 0.10$, $p < 0.01$; Estonian $\beta = 0.17$,

$p < 0.01$; Finnish $\beta = 0.18$, $p < 0.01$; Hungarian $\beta = 0.07$, $p < 0.05$)⁶. This effect was independent of the direct effects of perceived autonomy support from peers and parents on leisure-time autonomous motivation, supporting the hypothesis that the effect of perceived autonomy support from PE teachers was independent of effects from perceived autonomy support from other sources.

Hypothesis 5

Autonomous motivation in leisure time was hypothesised to have a significant indirect effect on intentions mediated by attitudes and PBC. In the path analysis, there was a significant direct effect of autonomous motivation on attitudes in all samples (British $\beta = 0.17$, $p < 0.01$; Estonian $\beta = 0.24$, $p < 0.01$; Finnish $\beta = 0.34$, $p < 0.01$; Hungarian $\beta = 0.25$, $p < 0.01$). There were also significant direct effects of autonomous motivation on subjective norms in the Estonian ($\beta = -0.15$, $p < 0.01$) sample and on PBC in British ($\beta = 0.31$, $p < 0.01$), Finnish ($\beta = 0.30$, $p < 0.01$) and Hungarian ($\beta = 0.19$, $p < 0.01$) samples. There were, however, significant direct effects of autonomous motivation on intention in the British ($\beta = 0.17$, $p < 0.01$) and Hungarian ($\beta = 0.21$, $p < 0.01$) samples. This indicated that any mediation of the effect of autonomous motivation on intentions in these samples would be partial. Attitudes also had a significant direct effect on intention in all samples (British $\beta = 0.14$, $p < 0.01$; Estonian $\beta = 0.25$, $p < 0.01$; Finnish $\beta = 0.16$, $p < 0.05$; Hungarian $\beta = 0.12$, $p < 0.05$) and the attitude–intention relationship in the Estonian sample was significantly higher relative to the other samples. Subjective norms had a significant direct effect on intentions in the British ($\beta = 0.21$, $p < 0.01$) and Hungarian ($\beta = 0.17$, $p < 0.05$) samples while PBC had a significant direct effect on intentions in the Estonian ($\beta = 0.23$, $p < 0.01$) and Finnish ($\beta = 0.18$, $p < 0.01$) samples. The total effect of autonomous motivation on intentions (British $\beta = 0.21$, $p < 0.05$; Estonian $\beta = 0.12$, $p < 0.01$; Finnish $\beta = 0.18$, $p < 0.01$; Hungarian $\beta = 0.26$, $p < 0.01$) was therefore, direct and indirect (British $\beta = 0.05$, $p < 0.05$; Estonian $\beta = 0.05$, $p < 0.05$; Finnish $\beta = 0.11$, $p < 0.01$; Hungarian $\beta = 0.05$, $p < 0.05$) via the proximal predictors of intention, namely attitudes, subjective norms and PBC. Therefore, Hypothesis 5 was fully supported in the Estonian and Finnish samples and partially supported in the British and Hungarian samples due to the significant direct effect of autonomous motivation in leisure time on intentions in these samples.

Hypothesis 6

Behavioural intentions were the sole predictor of leisure-time physical activity behaviour in all samples as hypothesised (British $\beta = 0.34$, $p < 0.01$; Estonian $\beta = 0.32$, $p < 0.01$; Finnish $\beta = 0.55$, $p < 0.01$; Hungarian $\beta = 0.21$, $p < 0.01$). There were no other direct predictors of physical activity behaviour, as expected, and intentions completely mediated the effects of attitudes, subjective norms and PBC on physical activity behaviour in all samples.

Hypothesis 7

We hypothesised that the effects in the trans-contextual model would be consistent across the four samples. Multi-sample path analyses were conducted to test for the invariance of the relationships in the proposed model across samples. An initial baseline model was estimated to test the congruency of the pattern of the model relationships across samples.

This model demonstrated good fit with the data according to the multiple criteria adopted ($\chi^2=126.30$, $df=72$, $p < 0.01$; CFI=0.98; NNFI=0.95; SRMSR=0.05). We subsequently estimated a model that constrained the free parameters from the theoretical model to be invariant across the four samples. The invariance analysis resulted in a model with adequate overall fit ($\chi^2=247.55$, $df=135$, $p < 0.01$; CFI=0.96; NNFI=0.94; SRMSR=0.07) but exhibited substantial misspecification relative to the baseline model as indicated by the likelihood-ratio test ($\Delta\chi^2=121.25$, $\Delta df=63$, $p < 0.01$). The Lagrange Multiplier (LM) test was used to identify the constraints that contributed to this misspecification. A series of modified models were estimated in which parameters from the LM-tests that contributed most to model misspecification were freed in an iterative fashion until no misspecified constraints remained. The final model after all these parameters had been released exhibited optimal fit ($\chi^2=174.05$, $df=120$, $p < 0.01$; CFI=0.98; NNFI=0.97; SRMSR=0.06) and did not differ significantly from baseline model ($\Delta\chi^2=47.75$, $\Delta df=48$, $p=0.48$).

Parameters significantly different in the invariance analyses are flagged in Table 2. Many of the invariant parameters represented instances where the magnitude of the effect differed, rather than whether the effect was significant or not. In such cases, the *pattern* of effects remains consistent. For example, although the direct effect of autonomous motivation in PE on autonomous motivation in leisure time was significantly higher in the Finnish sample than the other samples, and significantly lower in the Hungarian sample relative to the other samples, the path was significant in all cases suggesting a robust effect across samples with a consistent pattern. This was true for the majority of the hypothesised effects in the model. Notable variations were the direct effects of perceived autonomy support from peers on attitudes and the direct effects of subjective norms and PBC on intentions. Therefore, the hypothesis cannot be unequivocally accepted because of these minor variations, but the invariance of the overall pattern of effects provides partial support for Hypothesis 7.

Hypothesis 8

It was hypothesised that the pattern of effects in the proposed model would be independent of past behaviour. Past behaviour was found to be a significant predictor of virtually all model variables in the four samples (Table 2). The inclusion of past behaviour accounted for a statistically greater proportion of the explained variance in intention (British $\Delta R^2=0.16$, $p < 0.01$; Estonian $\Delta R^2=0.11$, $p < 0.01$; Finnish $\Delta R^2=0.15$, $p < 0.01$; Hungarian $\Delta R^2=0.17$, $p < 0.01$) and behaviour (British $\Delta R^2=0.07$, $p < 0.01$; Estonian $\Delta R^2=0.13$, $p < 0.01$; Finnish $\Delta R^2=0.16$, $p < 0.01$; Hungarian $\Delta R^2=0.07$, $p < 0.01$) in all samples. Although introducing past behaviour attenuated the magnitude of the hypothesised relationships in the model (Table 2), it did not substantially alter the pattern of the effects.

Discussion

The present study tested an extended trans-contextual model that aimed to explain the processes underlying motivation towards leisure-time health-related physical activity behaviour in two motivational contexts and in samples from four culturally-diverse nations.

The within-context effect of perceived autonomy support on autonomous motivation, as found in the PE context in all samples in the present study (Hypothesis 1), is consistent with previous research with the trans-contextual model (Hagger & Chatzisarantis, 2007;

Shen, McCaughtry, & Martin, 2007) and tests of self-determination theory in other contexts (Williams, 2002; Wilson & Rodgers, 2004). Most important, however, was support found for the effect of autonomous motivation across contexts. Autonomous motivation in a leisure-time context was significantly related to autonomous motivation in PE in all samples as expected (Hypothesis 2). This provides further evidence for the fundamental premise of the trans-contextual model and supports Vallerand's (2007) contention that motivation at the contextual level is transferable across contexts, particularly in closely-related contexts.

Interestingly, perceived autonomy support from other sources had significant effects on leisure-time autonomous motivation (Hypothesis 2), but the effects were weak and inconsistent across samples. Perceived autonomy support from peers had weak effects on leisure-time autonomous motivation in the Estonian, Finnish and Hungarian samples. Perceived autonomy support from parents influenced autonomous motivation only in the British and Hungarian samples. Furthermore, contrary to our hypothesis (Hypothesis 3), perceived autonomy support from parents also influenced attitudes directly in all but the Hungarian sample and PBC in all but the Finnish sample. This resulted in significant indirect effects of perceived autonomy support from parents on intentions, indicating that this autonomy support variable had the most pervasive effect on decision-making. This is an important new finding because it not only suggests that other sources of autonomy support are motivationally relevant, but that they can act independent of leisure-time autonomous motivation. A reason why these autonomy support constructs have effects that are independent of autonomous motivation may be that perceived autonomy support from significant others is more closely associated with relatedness motives than autonomous motives (Edmunds, Ntoumanis, & Duda, 2007). This may be because perceived autonomy support from significant others may capture reasons for engaging in physical activity that satisfy needs for relatedness not autonomy. In terms of cultural variations, it seems that perceived autonomy support from parents tends to affect intentions via the mediation of attitudes and autonomous motives with no variations attributable to cultural differences.

A major original contribution of the present study is that the indirect effect of perceived autonomy support from PE teachers on leisure-time autonomous motivation is independent of the effects of perceived autonomy support from peers and parents (Hypothesis 4). This effect was consistent across all samples with no cultural variations. This corroborates an original hypothesis of the trans-contextual model that perceived autonomy support from PE teachers will have a pervasive effect on motivation within the PE context, but also on autonomous motivation outside of school (Hagger et al., 2003). This implies that the transfer of motivation from one context (PE) to another (leisure time) is the mechanism by which perceived autonomy support in PE influences autonomous motivation in a leisure-time context. This finding is important for PE curricula and the promotion of physical activity as it implies that teachers may utilise the PE context to convey autonomy-supportive messages about physical activity that will promote autonomous motivation towards physical activity outside of school.

Focussing on the effects of autonomous motivation on intentions in the TPB, results indicated that the effects of autonomous motivation on intentions were mediated (partially or completely) by the TPB variables (Hypothesis 5). This supports Ajzen's (1985) proposition that distal influences on intentions would be mediated by the proximal predictors of intention; namely, attitudes, subjective norms and PBC. However, there were direct influences of autonomous motivation on intentions in the British and Hungarian samples. One possible reason for this is that the direct measures of attitudes, subjective

norms and PBC did not encompass all of the autonomous and controlling reasons for participating in exercise behaviour. An alternative explanation is that individuals may form intentions to act independent of the proximal antecedents of intentions from the TPB. Recent research suggests that this may reflect more spontaneous formation of intentions independent of beliefs about outcomes (Hagger, Chatzisarantis, & Harris, 2006).

In terms of hypotheses from the TPB, attitudes had strong and consistent effects on intention in all samples as expected (Hypothesis 6). There were some interesting cultural variations in the effects of subjective norms and PBC. Subjective norms were related to intentions in the British and Hungarian samples only and the effect of PBC on intentions was significant in the Estonian and Finnish samples only. It seems that competence-related perceptions may be more relevant to Estonian and Finnish children while social norms are more important to British and Hungarian children when forming physical activity intentions. Alternatively, it may be that such sample-specific variations often found in social-cognitive research cannot be attributed to cultural norms (e.g. Bagozzi, Lee, & Van Loo, 2001).

Overall, the pattern of effects in this extended trans-contextual model was consistent across cultural samples, as expected (Hypothesis 7). Although there were some culture-specific variations in relationships, such as the previously mentioned effects of peer and parent perceived autonomy support and subjective norms, there were relatively few relative to the overall pattern of effects. The *pattern* of effects refers to the significance of the proposed relationships regardless of variations in effect size. On this basis, the effects of perceived autonomy support from PE teachers on autonomous motivation in PE, autonomous motivation in PE on autonomous motivation in leisure time, autonomous motivation in leisure time on attitudes and intention on behaviour were significant across the samples. This provides support for the motivational sequence proposed in the trans-contextual model and indicates that these relationships are consistent across national groups from different cultural backgrounds. Importantly, it corroborates other tests of the trans-contextual model (Barkoukis & Hagger, (in press); Hagger et al., 2003; Shen et al., 2007) and a recent meta-analysis (Hagger & Chatzisarantis, 2007). Finally, model effects were unique and remained after controlling for the effects of past behaviour (Hypothesis 8).

These findings have two important implications for applied practise. First, PE teachers should present physical activities in an autonomous fashion as this is likely to promote autonomous motivation in that context, but also in leisure-time outside of school (Hagger & Chatzisarantis, 2007; Hagger et al., 2003). Examples of such strategies are providing choice, giving a rationale for activities and acknowledging conflict, providing informational feedback, fostering personally-relevant goals and empowering students in lessons are all autonomy-supportive strategies that teachers can adopt to foster autonomous motivation. Second, significant others in a leisure-time context, particularly parents, have a small but significant influence on young people's intentions to engage in physical activity in leisure time (Chirkov & Ryan, 2001). Parents should, therefore, present physical activities in an autonomy-supportive style to foster intentions to engage in future physical activity (Ntoumanis, 2005).

Limitations and directions for future research

This study is not without its limitations and these should be acknowledged. First, the network of relationships among constructs in this extended trans-contextual model

was tested using path analyses using manifest rather than latent variables. While the path-analytic approach controls for error in prediction, it does not control for error in measurement as would a full latent-variable approach, but the latter analysis was precluded due to small sample sizes. However, we used measures that have been previously validated using a latent-variable approach (e.g. Hagger et al., 2003, 2005) to support the construct and discriminant validity of the model constructs (Mulaik & Millsap, 2000). Second, although average age of the school pupils was significantly different across samples, research has suggested that model relationships are consistent across school grade (Hagger et al., 2002a, 2003, 2005; Hagger & Chatzisarantis, 2007) and age had no effect on model of the relationships in any of the samples⁷. Third, behaviour and past behaviour were measured by self-report. Although the concurrent validity of such measures with more 'objective' measures such as heart-rate monitoring has been supported (Godin & Shephard, 1985), these measures may be subject to response bias and estimation error. Fourth, the PLOC measure used to tap motives can be subject to criticism because they could potentially overlap with measures of behavioural beliefs or normative beliefs in the TPB. For example, identified regulated motives such as doing physical activity 'because I enjoy it' may be akin to behavioural beliefs and external regulated motives such as 'because others want me to' may overlap with normative beliefs. Future research is needed to analyse whether these constructs are indeed conceptually different and to resolve the technical problem of measurement by refining the measures to make this distinction empirically. This could be established experimentally by getting people to classify their salient or accessible beliefs about physical activity as autonomous or controlling using methods proposed by Trafimow and Fishbein (1995). Finally, the present data are correlated, and future studies may attempt to replicate these findings experimentally to more effectively infer the causal direction of the proposed effects. This may be achieved by manipulating the autonomy support of PE teachers and testing the effects on within-context and trans-contextual autonomous motivation.

Notes

1. All questionnaire items are available from the first author on request.
2. In order to produce a single measure of autonomous motivation, a relative autonomy index was calculated from the perceived locus of causality constructs using the procedures outlined by Vallerand (2007). Weights were assigned to each intrinsic motivation (+2), identified regulation (+1), introjected regulation (−1) and extrinsic regulation (−2) items from the perceived locus of causality measures for PE and leisure time. Each weighted item was then aggregated to form four indicators of two latent relative autonomy index constructs, one in each context.
3. Full results of the multi-sample confirmatory factor analyses including fit indexes of nested invariance models are available from the first author on request.
4. Full results of the congeneric and discriminant-validity multi-sample confirmatory factor analyses including fit indexes are available from the first author on request.
5. Full results of the bootstrap analyses are available from the first author on request.
6. In all analyses testing for significant indirect effects the following criteria proposed by Baron and Kenny (1986) were met: (1) significant correlations between the dependent variable and the independent (predictor) variable(s); (2) significant correlations between the mediator and the independent variable(s); (3) a significant unique effect of the mediator on the dependent variable when it is included alongside the independent variable(s) in a multivariate test of these relationships; and (4) the significant effect of independent variable on the dependent is attenuated or extinguished when the mediator is included as an independent predictor of the dependent variable.
7. Age effects in the trans-contextual model were tested by (1) examining the bivariate correlations between age and the psychological constructs in the model for each sample and (2) by

statistically controlling for age in the path analyses of the trans-contextual model in each sample (in much the same way as we controlled for past behaviour). In both cases there were no effects and we concluded that the proposed relationships in the trans-contextual model were unaffected by variations in age.

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