Cross-Cultural Generalizability of the Theory of Planned Behavior Among Young People in a Physical Activity Context

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The present study tested the cross-cultural generalizability of the measurement and structural parameters of the theory of planned behavior (TPB) among youth in a physical activity context. Pupils from five cultural groups completed measures of attitudes, subjective norms, perceived behavioral control (PBC), and intentions for physical activity. Five weeks later, participants completed self-report measures of physical activity behavior. Confirmatory factor analyses and multisample structural equation models revealed well-fitting models within each sample with minimal variations in the measurement parameters across cultures. There were a few significant cross-cultural differences in the structural relations among the TPB constructs. Attitudes predicted intentions in all samples (β range = .300 to .550), whereas the effect of the subjective norms on intention was nonsignificant in all but the Hungarian sample (β = .243). Conversely, the effect of PBC on intentions was significant (β range = .302 to .573) in all but the Hungarian sample. Findings support the generalizability of the measures and pattern of effects for the TPB among young people in a physical activity context.

Key Words: intention-behavior relations, structural equation modeling, culture, measurement invariance

The benefits of regular vigorous physical activity to the health of young people has received strong empirical support from research in a number of industrialized

nations (e.g., National Centre for Social Research, 1999, and U.S. Department of Health and Human Services, 1996). However, there is evidence that young people do not engage in sufficient physical activity to gain these health benefits (e.g., Centers for Disease Control and Prevention, 2003). Such evidence has compelled psychologists to adopt models of social cognition to identify the psychological antecedents of physical activity behavior in young people and to map the processes by which these antecedents lead to action (Maddux, 1993). Prominent among these is the theory of planned behavior (TPB; Ajzen, 1985), which has shown to be an effective, parsimonious, and versatile theory in examining the antecedents of physical activity behavior in adult and younger populations alike (Hagger, Chatzisarantis, & Biddle, 2002). Importantly, there is a vast array of studies that have applied the theory to physical activity behavior and supported the major premises of the theory among young people in various nations (e.g., Craig, Goldberg, & Dietz, 1996; Hagger, Chatzisarantis, Biddle, & Orbell, 2001; Mummery, Spence, & Hudec, 2000; Van Ryn, Lytle, & Kirscht, 1996).

However, to date, no study has provided a direct comparison of the predictions of the theory across cultures. Whereas Ajzen claims that the pattern of predictions among TPB constructs should be universal and generalizable for a given behavior, he does suggest that there may be sample-specific variations in relative contributions of the key TPB variables in the prediction of intention. The present study aims to test the generalizability of the predictions of the TPB among young people from several cultural groups with differing cultural orientations in a physical activity context. Therefore, the first aim of the study is to test the cross-cultural generalizability of the measurement parameters of the TPB. The second aim is to identify cultural variations in the pattern of effects among the TPB constructs in young people's physical activity participation.

The Theory of Planned Behavior

The TPB is an important social cognitive model that aims to explain variance in intentional behavior (Ajzen, 1985). The theory hypothesizes that an individual's overtly stated intention to act is the most proximal predictor of behavior. Intention is a function of personal, social, and control perceptions regarding the target behavior. A person's attitude toward the behavior reflects her/his personal predisposition toward engaging in the target behavior. Subjective norms summarize an individual's perceptions of social influence such as beliefs that significant others want them to participate in the target behavior. The prediction of intention from attitudes and subjective norms alone constitutes the theory of reasoned action (TRA), the precursor to the TPB. Ajzen (1985) recognized that some behaviors tended to vary in the degree of volitional control an individual has over their execution. As a consequence, he modified the TRA to include perceived behavioral control (PBC), a construct that reflects the influence of personal capacities and actual constraints regarding the target behavior on intentions. Together these predictors are hypothesized to affect behavior only via the mediation of intentions and comprise the TPB.

Meta-analytic reviews support the construct and predictive validity of the proposed relations among the theory constructs across a variety of behaviors (e.g., Armitage & Conner, 2001), including physical activity (e.g., Hagger et al., 2002). Hagger et al. (2002) confirmed that attitudes and PBC tend to have strong effects on

intentions, subjective norms have weaker effects, and intentions are the sole predictor of physical activity behavior. In addition, a number of studies have investigated the pattern of influence among the TPB variables in a physical activity context with young people. The studies have indicated that the strong effects of attitudes and PBC on intentions and that intentions on physical activity behavior in adult studies follow the same pattern in adolescents (Hagger et al., 2001; Mummery et al., 2000) and children (Godin & Shephard, 1986; Van Ryn et al., 1996). This was further corroborated by meta-analytic findings in the physical activity domain, which indicated that age did not moderate the effects in the TPB (Hagger et al., 2002).

Culture and the Theory of Planned Behavior

Ajzen (1985) expected the TPB to represent universal decision-making processes toward the enactment of intentional behaviors and, as such, the pattern of influence of the key relationships in the model should be consistent across samples. Specifically, it was hypothesized that the effects of the psychological antecedents of intention, namely, attitudes, subjective norm, and PBC, would be consistent across cultures; that intention would predict behavior; and that intention would mediate the effects of attitudes, subjective norms, and PBC on behavior. Meta-analytic reviews have supported all three premises across a large sample of studies in the physical activity context (e.g., Hagger et al., 2002). Despite this support, the theory relationships have been shown to be moderated by constructs like intention stability (Sheeran & Abraham, 2003) and personality (Rhodes, Courneya, & Hayduk, 2002). This has suggested that the theory is perhaps less universal than originally proposed and that the TPB may be more of a flexible framework for identifying the processes leading to intentional behavior rather than a general model.

One potential moderator of the effects among the TPB constructs are the cultural values that tend to be endorsed by different populations. Cultural values should be defined in this context as the social values, norms, expectations, and belief systems (e.g., religion, language, social relationships) that tend to be endorsed by individuals within a group of people. Research on many psychological constructs and processes have identified variations attributed to diversity in social value systems across cultures. Examples of such constructs are self-esteem, personality, social identity, and emotion (Bond & Smith, 1996). One central construct that is thought to underpin these differences is the relative degree of collectivism or individualism endorsed by the cultural groups being compared. People in more individualist cultures such as those from Western Europe are hypothesized to refer to themselves as independent, self-contained, and autonomous units and therefore more differentiated from others. This is in contrast to people in more collectivist cultures such as those from Eastern Europe and Asia who tend to adopt a sociocentric identity and perceive themselves as less differentiated and more interdependent and socially sensitive (Markus & Kitayama, 1991). Cross-cultural research has indicated that national groups tend to endorse either collectivism or individualism. Specifically, research in exercise psychology has indicated differences in psychological constructs like physical self-esteem in accordance with this cultural norm (e.g., Marsh, Marco, & Asçi, 2002). Findings suggest that personal beliefs such as physical self-esteem tend to be rated lower by collectivist cultures (Hagger, Biddle, Chow, Stambulova, & Kavussanu, 2003).

It is important to note that cross-cultural differences in psychological constructs are not always equivalent to cross-national differences. Many modern societies are multicultural, with numerous ethnic minority groups that may confound results when examining cross-national differences. Research examining differences in ethnic subgroups within single national groups has demonstrated such differences in psychological constructs (e.g., Walker, Courneya, & Deng, 2006). However, research into acculturation—the process by which immigrants from different cultural groups assimilate values when they come into contact with a "host" culture—suggests that people tend to adopt the cultural values of their host society to minimize conflict. This process is intensified when the consequences of deviation within their own cultural norms are minimal, and such is the case when it comes to adopting social behaviors such as physical activity (Marsh et al., 2002; Padilla & Perez, 2003). Even though generalized tendencies of the dominant cultural group may be reflected in cross-national research and acculturation processes may mitigate differences among ethnic groups, it should be recognized that there are likely to be global cross-cultural variations within national groups.

While no research has made a cross-cultural comparison of the TPB in any context, Bagozzi et al. (2001) have compared the effects of the TRA, the precursor to the TPB, across cultures in a bone marrow donation context. Bagozzi et al. compared effects in the model across groups with ostensibly different cultural influences, Chinese and American people. Adopting a rigorous a priori approach using structural equation modeling, the researchers found no cross-cultural differences in the measurement parameters of the model, supporting the use of standardized psychometric measures of the theory. However, the effects of subjective norms on intentions were generally stronger among Chinese participants and the reverse was found for attitudes. The variation in the effects was attributed to the relative importance participants placed on social influences when making decisions to donate according to their prevailing cultural norm. These findings demonstrated that TRA measures tended to be consistent across cultures whereas the relative contribution of the constructs to intentions tended to vary.

In addition, recent research has suggested that ethnicity moderates the relationships among the theory of planned behavior constructs. In the exercise domain, Blanchard et al. (2003) found that the effects of instrumental and affective forms of attitude varied among samples of African-American and Caucasian students and that there were ethnic-specific beliefs regarding exercise behavior. Recently, Walker, Courneya, and Deng (2006) demonstrated that Chinese-Canadians' gambling intentions were predominantly influenced by affective attitudes and injunctive norms, whereas British-Canadians had effects for affective and instrumental attitudes and descriptive norms. The authors concluded that the TPB had overall generalizability but exhibited variations in the pattern of predictions owing to ethnicity. The ethnic-specific findings were attributed to the cultural acceptability of the gambling behavior and the stronger role of significant others' beliefs on people from a collectivist background (Chinese-Canadian) compared with people from an individualist background (British-Canadian). These results support the notion that social influences on behavior are more likely to be stronger among people from collectivist backgrounds.

Study Hypotheses

The present study aims to extend the findings of previous research by Bagozzi et al. (2001), Blanchard et al. (2003), and Walker et al. (2006) to the TPB across a large cross-section of cultural groups and in a physical activity context among young people. The present research will make three unique contributions to the literature. First, and most importantly, it will provide a comprehensive test of the TPB within and across five national groups that represent diverse traditions in cultural norms. These include cultures with predominantly individualist (e.g., Britain, Greece) and predominantly collectivist (e.g., Hungary, Singapore) cultural orientations, and those with a blend (e.g., Estonia) of the two. Although there have been numerous tests of the TPB within many different cultures, no studies have made direct comparisons across two or more cultures simultaneously and Bond and Smith (1996) have called for more research of this nature. Second, by adopting a rigorous, hypothesis-testing approach using structural equation modeling, the present study will test whether standardized measures put forward by the TPB are generalizable across the cultural groups and whether the pattern of influence of the hypothesized relationships among the TPB constructs is consistent across these cultures. Third, the present study will provide a comprehensive test of the TPB in a leisure-time physical activity context and among young people, a population for which regular participation in physical activity yields considerable health benefits.

In terms of specific hypotheses, it is expected that the measures of the TPB constructs will be appropriate within each sample and will exhibit little variation across cultures. This will provide evidence that the standard measures of the constructs are applicable within each sample and also equivalent and valid measures of the proposed constructs across cultures. It is expected that the effects among the TPB constructs may vary across cultures. Cultures that tend to endorse more collectivist cultural norms such those from Eastern Europe like Estonia and Hungary or from Asia like Singapore may more readily form their intentions to engage in physical activity on the basis of normative considerations, whereas people from individualist cultures such as those from Western European countries like Britain and Greece are hypothesized to be biased toward forming their physical activity intentions on personal evaluations such as attitudes (personal beliefs about outcomes) or PBC (personal beliefs about resources) (e.g., Bagozzi et al., 2001; Walker et al., 2006).

Method

Participants

Participants were recruited from coeducational high schools in Great Britain, Estonia, Greece, Hungary, and Singapore. British participants ($N = 699$) were recruited from two government-run high schools in southeastern England. School statistics indicated that the majority of the pupils in each school were of white European ethnicity, with less than 10% from other ethnic minority groups. Data from the National Office for Standards in Education (2004) indicated that the pupils' background matched the socioeconomic status (SES) distribution of British schools based the child's eligibility for free school meals. Data from the Estonian sample

($N = 361$) was collected in three government-run high schools. Details on the SES of the participants were given by the school director. The school draws its students from an area characterized as middle class, and the school population was adjudged to match the distribution of SES levels among town-dwelling school children in Estonia. The majority of the pupils were Estonian nationals, although a substantial minority were children of Estonian-born Russian immigrants. The Greek sample ($N = 308$) was collected from a school in the suburbs of a large city. Details on the SES of the participants were provided by the school principal. The school students are predominantly from an area characterized as middle class and the population matched the distribution of SES levels among school children in mainland Greece. The majority of the pupils were Greek nationals, with a small minority of children from Greek-born immigrants. The Hungarian sample ($N = 286$) was recruited from three government-run secondary schools. The local government register indicated that the school drew students from communities with low and middle SES. The sample from Singapore ($N = 217$) was recruited from a junior college in the Nanyang district. The majority of the participants were Chinese (78%), who tend to follow the Buddhist, Taoist, Confucian, or Christian religions. The remainder were ethnically Malay (15%), who tend to be of Muslim faith, and Indian (7%), who tend to have Hindu or Tamil religious affiliation (Singapore Ministry of Education, 2005). According to the school principal, the student body was highly representative of the national average in terms of SES level.

Design and Procedure

The study adopted a prospective design with data being collected in two waves. In the first wave, participants completed standard measures of the components of the theory of planned behavior, namely, intention, attitude, subjective norm, and PBC (see Hagger & Chatzisarantis, 2005). Five weeks later, participants' self-reported physical activity behavior was measured in the second wave of data collection. Standardized back-translation techniques were used in the development of Estonian, Greek, and Hungarian versions of the questionnaire (Brislin, 1986).

Consent for the school pupils' participation in the study was obtained from parents and the school principals prior to data collection. Before the administration of the questionnaires, 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 5-week period. They were told that participation was voluntary and they could choose to opt out if they desired. All students consented to participate in the first wave. Data was collected in quiet classroom conditions and pupils were isolated from each other so that they could not copy or discuss responses. All the questionnaires were completed anonymously to preserve confidentiality, and questionnaires across the two waves were matched using birth date and gender to preserve anonymity.

Measures

Items from the first-wave questionnaire were arranged so that no two items from a particular scale were adjacent to each other. All the items made reference to the target behavior of leisure-time physical activity, in the time frame of interest, and in the context that the behavior was to be performed. This was done so that the

measures adhered to the boundary condition of correspondence within the TPB (Ajzen, 1985). Specifically, the target behavior was defined for the pupils as "vigorous physical activities such as sports and active pastimes that raise your heart rate/pulse and make you breathe deeply for 20 minutes at a time."

Behavioral Intention.   Intentions to participate in the target behavior of leisure-time physical activity were measured via three items using 6-point Likert scales. The items were "I intend to participate in vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks" anchored by 1 (*agree very strongly*) and 6 (*disagree very strongly*); "I plan to participate in vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks" anchored by 1 (*agree very strongly*) and 6 (*disagree very strongly*); and "How often do you expect to be able to participate in vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks?" anchored by 1 (*extremely likely*) and 6 (*extremely unlikely*).

Attitudes.   Five 6-point semantic differential items were used to measure attitudes in response to the following statement: "For me, doing vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks is . . ." Three items measured affective aspects of attitude and used the following end points: *enjoyable–unenjoyable*, *pleasant–unpleasant,* and *satisfying–unsatisfying*, and two items tapped instrumental attitudes with the following end points: *useful–of no use* and *important–unimportant*. Recent evidence suggests that the affective and instrumental components capture the essence of the attitude construct and, even though they can be distinguished at the conceptual and empirical level, adequately form a global, unitary attitude construct (Hagger & Chatzisarantis, 2005).

Subjective Norms.   Two items formed the subjective norms scale: "Most people who are important to me would want me to do vigorous physical activities for at least 20 minutes at a time at least three times per week in the next five weeks" and "People who are important to me would *approve* of me doing vigorous physical activities for at least 20 minutes at a time at least three times per week in the next five weeks." Responses were measured on 6-point Likert scales anchored by 1 (*disagree*) and 6 (*agree*). Previous studies have indicated that these two items define a single subjective norms construct (e.g., Hagger & Chatzisarantis, 2005).

Perceived Behavioral Control.   Perceived behavioral control was assessed via three items using 6-point Likert scales: "For me doing vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks would be . . ." with scale end points 1 (*very difficult*) and 6 (*very easy*); "How much personal control do you think you have in doing vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks?" with scale end points 1 (*complete control*) and 6 (*no control at all*); and "How much do you feel doing vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks is beyond your control?" with scale end points 1 (*not at all*) and 6 (*very much so*).

Behavior.   Self-reported physical activity behavior at the second time point was assessed on two items from the Leisure-Time Exercise Questionnaire (LTEQ, Godin & Shephard, 1985) using 6-point Likert scales. The statement for the first behavior item was, "In the course of the past five weeks, how often have you participated

in vigorous physical activities for 20 minutes at a time?" with scale points labeled *everyday*, *most days*, *on about half of the days*, *a few times but less than half*, *a few times,* and *almost never*. The second item read, "I engaged in vigorous physical activity for 20 minutes at a time with the following regularity . . ." with the following scale labels: *everyday*, *most days*, *some days*, *occasionally*, *very seldom,* and *never*. Independent evaluations of the LTEQ have found it an easy to administer self-report measures with satisfactory validity and reliability statistics (e.g., Sallis, Buono, Roby, Micale, & Nelson, 1993).

Results

Participants

Attrition across the two waves of data collection that was due to absences and inaccessibility resulted in final sample sizes of 432 participants in the British sample (boys = 198, girls = 234; *M* age = 13.96, *SD* = 1.51), 268 participants in the Estonian sample (boys = 117, girls = 151; *M* age = 15.04, *SD* = .91), 150 participants in the Greek sample (boys = 65, girls = 85; *M* age = 4.35, *SD* = .80), 235 participants in the Hungarian sample (boys = 114, girls = 121; *M* age = 14.01, *SD* = .99), and 133 participants in the Singaporean sample (boys = 66, girls = 67; *M* age = 13.32, *SD* = .47). A chi-square test indicated that there was no significant difference in the female-to-male ratio and participants' ages by gender within the samples. However, a univariate *F*-test revealed significant differences in age across the national groups, $F(4, 1,213) = 64.589$, $p < .01$, $\eta^2 = .176$), with the Estonian participants significantly older than participants in all the other national groups; participants in the Singaporean sample significantly younger than participants from all other groups; British participants significantly younger than participants in the Estonian, Hungarian, and Singaporean samples; and no differences in the ages of the Greek and Hungarians samples.

Single-Sample Confirmatory Factor Analyses and Structural Equation Models

A systematic approach to the construction of the models in the present study was adopted using the factor analytic–structural equation modeling (FASEM) method advocated by Bentler (1995). In the first step of the analysis, a confirmatory factor analysis (CFA) model was estimated for each sample. This model tested the adequacy of the study measures in representing their associated hypothesized constructs using latent (unobserved) variables indicated by the questionnaire items pertaining to each construct. In addition, intercorrelations among the latent variables provided evidence for the discriminant validity of the constructs. Pending the adequacy of the CFA model, a structural equation model was estimated for each sample. This model stipulated a priori the hypothesized structural paths among the latent constructs in accordance with the predictions of the TPB (see Figure 1). Specifically, intention was set to be the only predictor of physical activity behavior, while intention was set to be predicted by attitudes, subjective norms, and PBC. Finally, the attitude, subjective norms, and PBC constructs were all intercorrelated to account for the common redundancies in the exogenous predictors of intentions in the TPB.
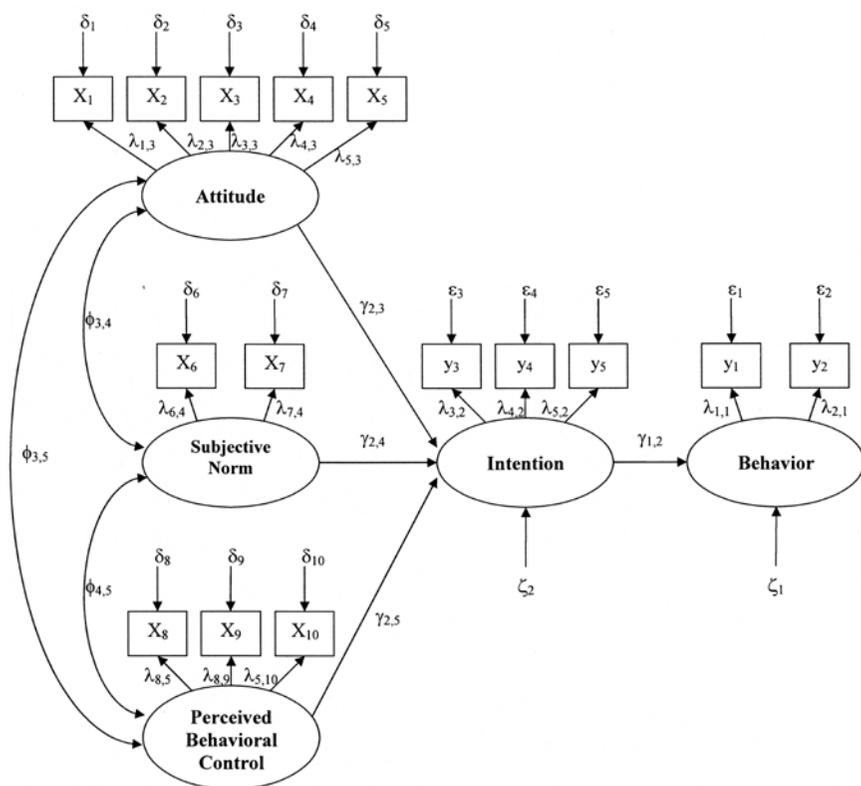
Figure 1 — Structural equation model of the theory of planned behavior.

Data were analyzed using the EQS v. 6.0 structural equation modeling program. The comparative fit index (CFI), the non-normed fit index (NNFI), and the root mean square error of approximation (RMSEA) were utilized as means for evaluating model fit. A cut-off value greater than .90 for the CFI and NNFI, and a cut-off value less than or equal to .08 for the RMSEA were considered adequate for model fit, although values approaching .95 for the former two fit indexes are considered preferable (Hu & Bentler, 1999). In addition to overall model fit, model solution estimates (e.g., factor loadings and reliability estimates), factor correlations, and composite reliability coefficients (ρ_c) were examined to permit a broader evaluation of the adequacy of the estimated models.

Goodness-of-fit statistics for the single-sample CFA models are given in Table 1. In all cases, the hypothesized models approached or exceeded the more stringent cut-off value for a well-fitting model (Hu & Bentler, 1999), suggesting that the hypothesized model adequately accounted for the covariance matrices of the data from all five samples. In addition, standardized factor loadings for the latent factor on each of its indicators were all positive and significant as expected, exceeding the recommended minimum of .50 (Ford, MacCallum, & Tait, 1986).[1]

Table 1   Goodness-of-Fit Statistics for Single-Sample Confirmatory Factor Analytic and Structural Equation Models of the Theory of Planned Behavior in a Physical Activity Context for Each Culture

Sample	Model	Goodness-of-fit statistics				
		SB-χ^2	*df*	CFI	NNFI	RMSEA
British	CFA	212.316**	78	.955	.939	.063
	SEM	214.429**	81	.955	.942	.062
Estonian	CFA	125.463**	78	.974	.966	.048
	SEM	129.079**	81	.974	.966	.047
Greek	CFA	87.054	78	.987	.983	.029
	SEM	86.879	81	.992	.989	.023
Hungarian	CFA	100.663*	78	.979	.972	.035
	SEM	102.999	81	.980	.973	.034
Singaporean	CFA	75.323	78	1.000	1.000	.001
	SEM	96.020	81	.982	.977	.037

Note. CFA = confirmatory factor analysis; SEM = structural equation model; SB-χ^2 = Sattora-Bentler scaled chi-square; *df* = model degrees of freedom; CFI = comparative fit index; NNFI = non-normed fit index; and RMSEA = root-mean squared error of approximation.

*p < .05, **p < .01.

However, there were three exceptions: one item for the PBC factor in the British and Singaporean samples and one item each for the intention and subjective norm factors in the Greek sample exhibited low factor loadings. The low sample-specific factor loadings for the easy–difficult item for the PBC is not surprising given the considerable debate over the role of the easy–difficult item as a measure of control in the TPB (e.g., Hagger & Chatzisarantis, 2005). Furthermore, there is controversy surrounding standard measures of subjective norm, which have yet to be resolved, and this measure has exhibited low reliability in other studies (e.g., Hagger et al., 2002). It is therefore unsurprising that sample-specific misspecifications for these constructs were found.

Factor correlations and composite reliability coefficients for the CFA models of the TPB constructs in each sample can be found in Table 2. All factor correlations were significantly different from unity, providing evidence to support the discriminant validity of the TPB constructs in each sample (Bagozzi & Kimmel, 1995). Composite reliability coefficients were largely satisfactory, exceeding the recommended .70 minimum. Exceptions were the reliability coefficients for the intention and subjective norm constructs in the CFA for the Greek sample and the PBC construct in the analysis for the British sample. This is not surprising given the misspecified factor loadings, on which the reliabilities are based, for each of these factors.

Given the adequacy of the CFA models, structural equation models specifying structural relations between the constructs in accordance with the hypotheses of

Table 2   Factor Correlations for the Latent Factors from the Confirmatory Factor Analysis of the Theory of Planned Behavior in Each Sample

Factor	ρ_c	1	2	3	4	5
1. Behavior	.815					
British	.837	—				
Estonian	.833					
Greek	.834					
Hungarian	.749					
Singaporean						
2. Intention	.927	.738**				
British	.922	.713**	—			
Estonian	.672	.482**				
Greek	.812	.455**				
Hungarian	.959	.765**				
Singaporean						
3. Attitude	.895	.508**	.717**			
British	.843	.583**	.696**	—		
Estonian	.909	.387**	.726**			
Greek	.869	.277**	.438**			
Hungarian	.906	.569**	.570**			
Singaporean						
4. Subjective norms	.637	.391**	.608**	.634**		
British	.710	.511**	.677**	.671**	—	
Estonian	.513	.374**	.825**	.694**		
Greek	.632	.134	.221**	.255**		
Hungarian	.694	.622**	.620**	.546**		
Singaporean						
5. PBC	.420	.190**	.286**	.341**	.575**	
British	.810	.294**	.415**	.444**	.750**	—
Estonian	.751	.241*	.508**	.442**	.518**	
Greek	.715	.167	.401**	.515**	.622**	
Hungarian	.636	−.077	−.177	−.152	−.085	
Singaporean						

Note. For British sample, $N = 432$; Estonian sample, $N = 268$; Greek sample, $N = 150$; Hungarian sample, $N = 235$; Singaporean sample, $N = 133$; PBC = Perceived behavioral control.

p < .05. **p* < .01.

the TPB in a physical activity context were estimated (Figure 1). Goodness-of-fit statistics for this model were acceptable for each sample (see Table 1). Standardized parameter estimates for the structural relations among the latent constructs in the model in each sample are given in Table 3. Attitudes and PBC were significant predictors of intention in each sample, with the exception of the Hungarian sample in which attitude and subjective norms alone were the significant predictors. Intentions were the sole predictor of behavior with no significant direct effects of the other TPB constructs. This supports the hypothesis that intention completely mediates the effects of the exogenous TPB constructs on behavior.[2]

Table 3   Standardized Parameter Estimates Among Latent Factors (λ) Exogenous Factor Correlations (ϕ) and Explained Variance (R^2) in Intention and Behavior Factors for the Structural Equation Model of the Theory of Planned Behavior for Each Sample

Parameter	Sample				
	British	Estonian	Greek	Hungarian	Singaporean
Structural parameters (λ)					
Attitude → Intention	.550**[abc]	.431**[abc]	.300*[bcde]	.321**[ade]	.321**[ade]
Subjective norm → Intention	−.078[b]	−.162[b]	.078[b]	.243*[acde]	−.063[b]
PBC → Intention	.302**[b]	.511**[b]	.573**[b]	−.010[acde]	.451**[b]
Intention → Behavior	.738**	.718**	.485**	.458**	.769**
Exogenous factor correlations (ϕ)					
Attitude ↔ Subjective norm	.341**	.449**	.442**	.517**	−.174
Attitude ↔ PBC	.639**	.673**	.694**	.257**	.543**
Subjective norm ↔ PBC	.577**	.751**	.519**	.625**	−.046
Variance explained (R^2)					
Intention	.555	.583	.730	.238	.477
Behavior	.545	.516	.235	.209	.591

Note. PBC = perceived behavioral control

[a]Significantly different from the Greek sample; [b]significantly different from the Hungarian sample; [c]significantly different from the Singaporean sample; [d]significantly different from the Estonian sample; and [e]significantly different from the British sample.

*p < .05, **p < .01.

Multisample Analyses

Given that the structural equation models were replicable in each individual sample, we conducted a series multisample structural equation model to identify any variation in the measurement parameters and pattern of structural relationships among the TPB constructs in the proposed model across the five samples.[3] We followed

the invariance routine suggested by Byrne, Shavelson, and Muthén (1989), in which measurement parameters are initially constrained to be equivalent across samples, namely, the factor loadings, factor variances, and factor correlations followed by the structural parameters representing the hypothesized relationships among the TPB constructs. Goodness-of-fit indices for each model in the invariance routine and comparisons among these models are given in Table 4.

Table 4   Goodness-of-Fit Statistics and Model Comparisons for Multisample Structural Equation Models

Model	Invariance tests	SB-χ^2	df	CFI	NNFI	RMSEA
1	Baseline	613.984**	405	.971	.963	.021
2	λ's invariant	735.082**	445	.960	.953	.023
3	λ's and ζ's/ξ's invariant	856.894**	465	.946	.939	.026
4	λ's, ζ's/ξ's and φ's invariant	917.869**	477	.939	.933	.028
5	λ's, ζ's/ξ's, φ's and γ's invariant	963.208**	493	.935	.931	.028

Comparison	ΔSB-χ^2	Δdf	ΔCFI	ΔNNFI
Model 1 vs. Model 2	121.098**	40	−.011	.010
Model 1 vs. Model 3	242.910**	60	−.025	−.024
Model 1 vs. Model 4	303.885**	72	−.032	−.030
Model 1 vs. Model 5	349.224**	88	−.036	−.032
Model 2 vs. Model 3	121.812**	20	.014	.014
Model 2 vs. Model 4	182.787**	32	.021	.020
Model 2 vs. Model 5	228.126**	48	.025	.022
Model 3 vs. Model 4	60.975**	17	.007	.006
Model 3 vs. Model 5	106.314**	28	.011	.008
Model 4 vs. Model 5	45.339**	16	.004	.002

Note. SB-χ^2 = Sattora-Bentler scaled chi-square; *df* = model degrees of freedom; CFI = comparative fit index; NNFI = non-normed fit index; RMSEA = root-mean squared error of approximation.

*p < .05, **p < .01.

An initial baseline model was estimated to test whether the pattern of items and factors was feasible across the samples. This model demonstrated good fit with the data according to the multiple criteria adopted (Table 4, Model 1). We subsequently estimated a nested model that constrained the factor loadings to be invariant across the five samples. Invariance of the factor loadings is considered the minimum acceptable criterion for measurement invariance (Byrne et al., 1989). The analysis resulted in a model that exhibited good fit with the data (Table 4, Model 2). While the chi-square difference between the baseline Model 1 and the

factor loadings–invariant Model 2 was significant (see Table 4), the incremental fit indices indicated that such a change reflected differences that were largely unsubstantial, as indicated by a change of .01 or less in the fit indexes (Cheung & Rensfold, 2002).

Subsequent nested models in which the factor variances (variances of exogenous factors) and disturbances (variances of endogenous factors) (Table 4, Model 3) and factor correlations between the exogenous predictors of intention, namely, the attitude, subjective norm, and PBC factors (Table 4, Model 4), revealed substantial decrements in the fit indexes relative to the baseline model (see Table 4). Lagrange multiplier (LM) tests were used to identify parameters responsible for model misspecification. The tests revealed that the factor variances and disturbances were mainly responsible for decrements in model fit and only the subjective norms–PBC correlation across the British and Estonian samples was significantly different.

Finally, a model in which the structural paths were set to be equivalent across samples was estimated and revealed a decrement in goodness-of-fit indexes from baseline (Table 4, Model 5), but little change relative to the previous two models in the routine (see Table 4) and there were few structural parameters that varied significantly across the samples. Modification indexes revealed that only three structural parameters were responsible for the misspecification: the attitude → intention, subjective norm → intention, and PBC → intention paths. As the British sample was used as a reference sample in the first multisample analysis, the analysis was repeated with each national group as the reference sample to check the location of the differences.

Results confirmed that the standardized parameter estimate for the attitude → intention path was significantly lower in the Greek (Cohen's $d = .401$), Hungarian ($d = .143$), and Singaporean ($d = .208$) samples relative to the British sample. The Greek ($d = .375$), Hungarian ($d = .232$), and Singaporean ($d = .167$) samples also exhibited significantly lower values compared to the Estonian sample for this effect. However, most of the differences were small with the exception of those for the Greek sample, which exhibited medium effect sizes. Further, the strength of this effect among the Greek participants was also significantly lower relative to this effect for their Hungarian ($d = .143$) and Singaporean ($d = .208$) counterparts. In addition, the coefficient for the subjective norm → intention path was significantly higher in the Hungarian sample relative to the British ($d = .191$), Estonian ($d = .206$), Greek ($d = .182$), and Singaporean ($d = .191$) samples. Finally, the strength of the PBC → intention path was significantly lower in the Hungarian sample relative to the British ($d = .155$), Estonian ($d = .281$), Greek ($d = .143$), and Singaporean ($d = .286$) samples.

Discussion

The aim of the present study was to test the cross-cultural generalizability of the theory of planned behavior across five national samples from different cultural backgrounds in a leisure-time physical activity context and in young people. It was expected that the measurement aspects of the proposed TPB model would exhibit minimal variation across samples, but that there would be some variation in hypothesized effects of the attitude and subjective norm constructs on intentions to engage in physical activity across contexts according to the prevailing cultural

orientation of the samples, individualist or collectivist. Specifically, it was expected that cultures with a largely collectivist cultural orientation would exhibit a stronger effect of subjective norms on intentions to engage in physical activity whereas those from cultures traditionally viewed as individualist would form intentions predominantly on the basis of attitudes and PBC.

The present study found few variations in the measurement aspects of the proposed model. Although there were some variations, these were largely unsubstantial and did not compromise model fit in cross-cultural comparisons, supporting the hypothesis of invariance. The variant parameters could be partly explained by inherent inadequacies in the standardized measures, which have been acknowledged previously by other researchers. There was, however, some variation in the relative contributions of the attitude and subjective norm constructs to physical activity intentions across the samples. Importantly, the attitude constructs tended to be stronger in the British and Estonian samples whereas the subjective norm constructs had a greater contribution in the Hungarian sample and a null influence in all other samples. The effect of PBC was also significantly lower in the Hungarian sample relative to the other samples. Finally, the intention-behavior relationships exhibited invariance across the samples, suggesting that whereas there is variation in the relative contribution of the constructs that lead to the formation of intentions across cultures, there is no variation in relative contribution of intentions to behavior.

In terms of measurement, the present study provides additional support for the generalizability of the standardized measures of the TPB constructs used here. This finding is congruent with those provided by Bagozzi et al. (2001), whose results supported the invariance of the attitude and subjective norm measures in the theory of reasoned action among Chinese and American bone marrow donors. The present results extend this finding to the TPB, a physical activity context, and a diverse set of national samples with varied cultural backgrounds. A number of issues raised by the invariance of the measures across cultures are worth noting. It seems that the translation procedures were successful in producing valid and reliable measures of the TPB components in these cultures. Given that "gold standard" back-translation techniques were used to produce language specific-versions of the questionnaires, the present study suggests that researchers can easily produce valid and reliable TPB measures for use with young people in a physical activity context.

One caveat here is that the reliabilities and factor loadings of some subjective norm and PBC items were unsatisfactory and is indicative of some measurement inadequacies. Such inadequacies may occur at the conceptual level, and research has suggested that subjective norms and PBC reflect global representations of multidimensional constructs, which include descriptive and injunctive norms and perceived controllability and self-efficacy, respectively (e.g., Hagger & Chatzisarantis, 2005; Rhodes & Courneya, 2003). However, because these constructs appear to be adequately represented in the single-sample CFA models within most of the cultural samples represented here, the possibility of variance attributed to the meaning of particular items to participants from specific cultures cannot be ruled out. Future research adopting TPB measures based on the belief-based components of the attitude, subjective norms, and PBC components may identify more precisely the source of such cross-cultural variations.

The most prominent finding from the present study is the relatively consistent pattern of influence among the TPB constructs across the five cultural groups in

the prediction of physical activity intention and behavior. Attitudes and PBC had a prominent role in predicting intentions, intentions predicted self-reported physical activity behavior, and intention mediated the impact of attitudes and PBC on behavior as suggested by Ajzen (1985). This suggests that the TPB does reflect a useful means to describe the processes that lead to intentional physical activity behavior among young people across cultures, which has been noted in ethnicity research using the TPB (e.g., Walker et al., 2006). It also suggests that the target psychological variables for interventions to increase physical activity participation among young people do not vary greatly across national groups. Therefore, interventions based on the TPB are likely to be effective in young people regardless of cultural background, as suggested by previous researchers (e.g., Chatzisarantis & Hagger, 2005).

Importantly, the few variations found in these effects in the multisample tests of invariance across the cultural groups were in magnitude rather than in pattern of effect and the effect sizes tended to be small. The hypothesis that social considerations (e.g., subjective norms) would be more prominent in the prediction of intentions for youth in collectivist cultures and personal considerations (e.g., attitudes and PBC) for youth in individualist cultures had to be rejected. However, there was a variation that was in keeping with this prediction for the influence of subjective norms and PBC on intention for the Hungarian sample relative to the other four groups. Subjective norms displayed a moderate, significant influence on intentions in this sample, whereas PBC had no significant effect. One possible explanation for this variation is difference in cultural orientation. Cross-cultural research suggests that collectivist societies like those from Eastern Europe (e.g., Hungary) tend to apportion greater weight to social considerations (e.g., subjective norms) when making decisions to act. This is relative to members of individualist cultures (e.g., Britain, Greece), whose decisions may be more oriented about personal considerations like attitudes. Therefore it is not surprising that intentions to participate in physical activity among young people from the Hungarian culture with an ostensibly more collectivist cultural orientation were influenced more by social pressures rather than personal influences. This is congruent with research in ethnicity using the TPB (Blanchard et al., 2003; Walker et al., 2006) For example, Walker et al. (2006) found greater effects for injunctive norms (identical to subjective norms in the present study) on intentions to participate in gambling among Chinese-Canadians compared with British-Canadians. The more-collectivist orientation for the Chinese-Canadians was put forward as an explanation for these variations.

Limitations and Future Research

The present study makes a unique contribution to the literature by evaluating the generalizability of the measures and effects among the TPB constructs in a physical activity context in young people. Strengths of the study include the adoption of a prospective design, a rigorous a priori hypothesis-testing approach, standardized measures of the study constructs, state-of-the-art back-translation techniques, and five samples of young people from schools that generally match the SES of pupils in each culture. However, a random-stratified sampling technique was not adopted, which may impose limits on the generalizability of the results. Even though all efforts were made to recruit participants that were representative of young people

from each culture, the possibility that the sample may not be entirely representative cannot be ruled out. A further limitation is the use of self-report measures of physical activity behavior. Although the measure used compares favorably to more comprehensive measures (Jacobs, Ainsworth, Hartman, & Leon, 1993) and the use of structural equation modeling controls for measurement error, it must be acknowledged that this is no substitute for more objective measures, particularly because the correction for attenuation tends to artificially inflate structural parameters. In addition, although a prospective design was adopted, the present data are cross-sectional in nature, which imposes limits on inferences of causality. Future research may examine variations in effects among TPB constructs across different cultures at the beliefs level.

Acknowledgments

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Notes

1. Standardized factor loadings for the single-sample CFA models from each sample are available from the first author on request.

2. To confirm the mediation of the effects of attitudes, subjective norms, and PBC on behavior by intention, we adopted the criteria put forward by Baron and Kenny (1986) for the structural equation model in each sample. The factor correlations given in Table 2 confirmed that the independent variables (e.g., attitudes, subjective norms, and PBC) and the dependent variable (physical activity behavior) were significantly correlated and that the independents were correlated with the mediator (intention). This satisfied initial criteria for mediation. To confirm mediation, we specified two alternative models. The first tested whether the direct effects of the independent factors (attitude, subjective norms, and PBC) on the dependent variable (behavior) were significant. The second confirmed whether direct effects of the attitude, subjective norm, and PBC constructs on behavior were significant when the intention → behavior path was dropped. Finally, we ensured that the indirect effects of the attitude, subjective norms, and PBC on behavior through intentions from the final structural equation models were significant.

3. For completion, we also tested the invariance of the mean scores of the latent constructs across the samples. In this multisample model, the intercepts or reproduced means of the observed items on the latent factors and the means of the latent factors in the analysis were set to be invariant. The analysis yielded a model that did not exhibit satisfactory goodness of fit ($\chi^2 = 1{,}697.935$; $df = 545$; CFI = .929; NNFI = .916; RMSEA = .042) with the LM flagging 10 latent means that were significantly different across the samples. Children in the Singapore sample had lower levels on the intention, attitude, subjective norm, PBC, and physical activity behavior constructs compared to the British, Estonian, and Greek samples, who exhibited few differences. Interestingly, the Hungarian participants rated their PBC higher and their attitude lower than all other samples.