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Motivational Profiles for Physical Activity: Cluster Analysis and Links with Enjoyment

Profils motivationnels et activité physique : Analyse typologique et liens avec le plaisir

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Abstract

The primary purpose of this study was to explore self-determination theory-based motivational profiles for physical activity in a sample of Canadian adults. A secondary aim was to investigate the relationship between these motivational profiles and enjoyment of physical activity. One hundred and twenty adults with an average physical activity level falling below recommended guidelines completed the Behavioural Regulations in Exercise Questionnaire-2 in addition to the Physical Activity Enjoyment Scale. A cluster analysis confirmed three distinct clusters: self-determined, motivated, and low motivation. The clusters differed significantly from one another with respect to enjoyment, with high enjoyment scores in the self-determined and motivated clusters. The findings are interpreted in light of this investigation's contribution to the study of adult motivational patterns within the Self-Determination Theory perspective. The value of considering the magnitude of different motivational styles in understanding physical activity enjoyment is also discussed.

Résumé

Cette étude visait, dans un premier temps, à examiner les profils motivationnels basés sur la théorie de l'auto-détermination de pratique d'activité physique chez un échantillon de Canadiens adultes et, dans un deuxième temps, à explorer les liens entre les profils motivationnels et le plaisir dérivé de cette pratique d'activité physique. Cent-vingt adultes dont le taux moyen d'activité physique était inférieur au taux recommandé par les lignes directrices ont répondu au questionnaire-2 sur les règles comportementales de l'exercice (Behavioural Regulations in Exercise Questionnaire-2) et à l'échelle de plaisir dérivé de pratique d'activité physique (Physical Activity Enjoyment Scale). Une analyse typologique a confirmé l'existence de trois groupes distincts : les personnes autodéterminées, les personnes motivées et les personnes peu motivées. Sur le plan du plaisir, des différences notoires ont été observées d'un groupe à l'autre. Les personnes autodéterminées et motivées affichaient les niveaux de plaisir les plus élevés. Ces résultats sont interprétés en fonction de l'apport de la présente enquête à l'étude des structures motivationnelles des adultes, qui s'inscrit dans le sillon de la théorie de l'autodétermination. Les auteurs ont également souligné l'utilité de

tenir compte de l'ampleur de divers styles de motivation pour mieux comprendre le plaisir que les gens peuvent tirer de la pratique d'activité physique.

Introduction

Physical inactivity is one of the most significant health concerns of Western society. It has been shown to lead to a multitude of chronic diseases including diabetes mellitus, cancer, hypertension, and depression (Bryan & Katzmarzyk, 2011; Richardson, Kriska, Lantz, & Hayward, 2004). Unfortunately, there is evidence that over half of North American adults do not engage in regular physical activity (PA; Seefeldt, Malina, & Clark, 2002; WHO, 2010). The latest pedometer-based Canadian statistics reveal that only 17% of adult men and 14% of adult women achieve the recommended 150 minutes per week of moderate to vigorous PA (Colley et al., 2011). This is supplemented by results from a 2009 national survey showing that 51% of Canadian adults are inactive. This same survey also released data indicating a decline from 53% to 46% in the last 16 years in the rate of Canadian adults who exercised at least 12 times per month (King, Mainous III, Carnemolla, & Everett, 2009). Given these mediocre statistics in adults, research focusing on the determinants of PA in this large portion of the population has proliferated.

A multitude of influences on PA engagement have been identified, including several psychological, theory-based factors (Trost, Owen, Bauman, Sallis, & Brown, 2002). Among them, one of the most recognized psychological correlates of PA in the empirical literature is motivation (Pan et al., 2009; Weiss & Ferrer-Caja, 2002). Sherwood and Jeffery (2000) indeed argued that it is essential to understand why (i.e., motive) individuals engage in PA, as opposed to other things, in their leisure time. One motivational perspective that is highly recommended for understanding this complex behaviour is Deci and Ryan's (1985) Self-Determination Theory (SDT; Biddle & Nigg, 2000; Fortier, Williams, Sweet, & Patrick, 2009; Landry & Solmon, 2002). Notably, this theory is well-regarded in the literature as it assumes that an individual's own sense of volition underlies his or her capacity to make healthy lifestyle decisions and changes, such as engaging in regular PA.

Self-determination Theory (SDT)

SDT postulates that there is a continuum of motivation that has been ordered along the degree to which a behaviour is internalized within the self (or is self-determined; Ryan & Connell, 1989). This continuum is comprised of the following types of regulations, in order of self-determination: intrinsic motivation, four types of extrinsic regulation (integrated, identified, introjected, and external) and amotivation. Specifically, *amotivation* represents lacking the intention to act while *external* regulation involves being motivated according to external demands (i.e., to obtain a reward or to avoid punishment; Ryan & Deci, 2002). Next along the continuum lies *introjection* a slight internalization of the behaviour but with little acceptance of it as one's own (i.e., from guilt or shame). Of the more self-determined styles, *identified* regulation arises when an individual personally values the behaviour in question, followed by *integrated* motivation whereby the behaviour is consistent with one's sense of self and personal goals (Ryan & Deci, 2002). Lastly, *intrinsic* motivation entails performing an activity for its own sake due to the inherent satisfaction gained from it (Ryan & Deci, 2002). In sum, being motivated in a self-determined or autonomous fashion is characterized by greater choice and valuation of the behaviour whereas being non-self-determined is defined by pressure from internal or external demands/constraints (Ryan and Deci, 2007).

Consistently, high levels of self-determination have been found to positively influence people's actions and desired outcomes (Ryan & Deci, 2002), particularly in the PA domain

(Wilson, Mack, & Grattan, 2008). Notably, studies have demonstrated that self-determined motivation can lead to greater adherence and maintenance of PA (e.g. Davey, Fitzpatrick, Garland, & Kilgour, 2009; Fortier & Kowal, 2007; Fortier, Sweet, O'Sullivan, & Williams, 2007). Often, these relationships have been established by assessing and analyzing a single self-determination score, the Relative Autonomy Index (RAI), that is calculated by weighting and summing scores for the different regulation. Despite the simplicity and theoretical consistency of this global approach, there is merit in understanding the role of *each* predictor along the motivation continuum (Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008; Wilson & Rodgers, 2004). Indeed, researchers have also made insightful links between the behavioural regulations and PA-related outcomes of the cognitive, behavioural, and affective varieties, for instance between identified regulation and the stages of change and between introjection and social physique anxiety (Daley & Duda, 2006; Edmunds, Ntoumanis, & Duda, 2008; Thøgersen-Ntoumani & Ntoumanis, 2006).

Motivational Profiles

Regarding the conceptualization of SDT, Vallerand and Fortier (1998) have suggested that motivation is multidimensional in nature and that SDT constructs should not solely be looked at in isolation. Several authors have advanced parallel views that the motivational regulations are not mutually exclusive (Covington & Müeller, 2001; Fairchild, Horst, Finney, & Barron, 2005; Lepper & Henderlong, 2000). Similarly, Vallerand (1997) remarked that individuals can exhibit multiple types of motivation for a single behaviour and that these can merge to create different motivational profiles. Not surprisingly, he suggested that researchers investigate such profiles and how they relate to positive behavioural and affective outcomes. The profiling of individuals' PA motivation embraces a person-centered research approach, as recently recommended by Pintrich (2003) and Ratelle and colleagues (Ratelle, Guay, Vallerand, Larose, & Senécal, 2007).

Consequently, researchers have begun studying SDT-based motivational profiles using techniques such as cluster analysis. Cluster analysis is particularly advantageous for creating profiles, as people's assignment into such clusters reflects distinct combinations of scores on the motivational constructs, which "is likely to yield more diagnostic information relative to [people's] scores on the separate motivational dimensions" (Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009, p. 673). For instance, in the education realm studies have shown that students can present diverse profiles of motivation related to academic achievement (Boiché et al., 2008) and adjustment (Ratelle et al., 2007). In sports settings, researchers have found evidence of self-determined and non-self-determined profiles and have linked them to outcomes such as objective performance (Gillet, Vallerand, & Rosnet, 2009), sport satisfaction, and affect (Vlachopoulos, Karageorghis, & Terry, 2000). Cluster analysis studies have also linked self-determined profiles to better physical self-worth (Biddle & Wang, 2003) and greater sport effort (Vlachopoulos et al., 2000).

SDT-based profile studies that have analyzed the regulations separately, as well as those specific to the PA realm, are limited, and the latter have focused mainly on youth (e.g., Ullrich-French & Cox, 2009; Wang & Biddle, 2001). Yet, these studies consistently demonstrate similar, multiple-cluster (often three to five) solutions and provide evidence that identifying individuals as high or low in PA motivation is insufficient, thus affording great merit to the profiling approach. Investigations with *adults* in the PA context remain scarce despite trends towards low PA in this cohort. One particular study saw the rise of four different profiles in Japanese adult PA participants (Matsumoto & Takenaka, 2004). Perhaps not surprisingly, the authors were able to link the more self-determined profiles to the maintenance stage of behaviour change, although cautious interpretation is required as over half of the participants in this study were already active (Matsumoto & Takenaka, 2004). It

remains unknown whether similar profiles would hold up in a North American population and in a sample of less active individuals.

Recently in France, Stephan, Boiché, and Le Scanff (2010) saw the emergence of a high combined motivation cluster as well as high- and moderate-introjection cluster, the former being associated with greater PA levels. However, the profiles were created with a sample of active older women and are difficult to generalize to the general North American adult population. Thus, the primary objective of this study was to employ cluster analysis to create PA motivational profiles using SDT's regulations in a representative sample of otherwise healthy Canadian adults but who fail to meet recommended levels of PA. Although this purpose remained rather exploratory, from previous studies it was conjectured that three to four profiles would emerge, with a greater proportion of participants in less self-determined clusters given predominantly low levels of PA in the present sample (at time of assessment).

Enjoyment

Positive emotional states that accompany PA are found to predict long-term PA engagement (Williams et al., 2008) and are noted to positively influence well-being and quality of life (Biddle & Mutrie, 2008). However, PA studies using SDT's motivational regulations have focused abundantly on behavioural outcomes (e.g., Fortier, Sweet, et al., 2007). Although research linking the regulations to emotional consequences are fewer, existing studies demonstrate that PA motivation that is more self-determined can lead to beneficial emotional outcomes, including positive affect (Lutz, Lochbaum, & Turnbow, 2003) and greater task enjoyment (Murcia, de San Roman, Galindo, Alonso, & Gonzalez-Cutre, 2008). Enjoyment of PA in turn can lead to a multitude of psychological and behavioural benefits (Raedeke, 2007; Wankel, 1993). Notably, enjoyment has been identified as an important mediator in PA interventions (Dishman et al., 2004) and as a catalyst for PA maintenance (Ingledew, Markland, & Medley, 1998). Moreover, given the moderate effect size for the relationship between affective judgements toward PA (i.e., enjoyment) and the rate of engaging in this behaviour, experts recommend that it is quite reasonable to isolate this outcome and examine it in its own right (Rhodes, Fiala, & Connor, 2009).

A few cluster analysis studies have recognized the value of studying enjoyment. Notably, Vlachopoulos et al. (2000) linked enjoyment to a self-determined profile in young adult sport participants, while others (Ntoumanis, 2002; Ullrich-French & Cox, 2009) report similar findings in youth. However, to our knowledge there are no such explorations with adults in a PA context. That being said, Vlachopoulos and Karageorghis (2005) have indicated an additive link between the motivational regulations in predicting PA enjoyment in adults. They found that when there is a combination of intrinsic motivation and self-determined but external styles, higher levels of enjoyment tend to arise. However, these authors employed interactional regression analyses, which are less flexible or accommodating of combinations of several continuous variables and their complex interplay with given outcomes (Ratelle et al. 2007). An examination of PA enjoyment as it relates to distinct patterns of the regulations across motivational subgroups as ascertained through cluster analysis would extend this line of inquiry. Thus, the secondary purpose of the current study was to examine how PA enjoyment in adults would differ as a function of the profiles identified. In light of presented evidence, greater PA enjoyment was hypothesized in profiles demonstrating higher levels of self-determined motivation.

Method

Study Design and Procedure

Data for the present study was obtained from the Physical Activity Counseling (PAC) randomized controlled trial (Fortier, Hogg, et al., 2007). The purpose of this novel trial was to test the effectiveness of integrating a PA counsellor in a primary medical care setting. Detailed descriptions of the intervention, participant eligibility criteria and recruitment, as well as key findings from the trial, can be found elsewhere (i.e., Fortier, Hogg, et al., 2007; Fortier, Sweet, et al., 2007). In short, patients between the ages of 18 and 69 years were recruited for the PAC trial from one primary care practice in Ottawa, Ontario. To be eligible, participants needed to report: less than 150 minutes of PA/week and no unstable/ uncontrollable diseases. They also had to have received a prescription for PA from their health care provider and have an interest in meeting with a PA counsellor. Stratification by age and gender during randomization for the PAC trial (based on demographics from the clinic) helped ensure a representative sample from this location (Fortier, Hogg, et al., 2007). The institutional review board of the University of Ottawa approved this research and all participants provided written informed consent to partake in all aspects of the PAC trial.

While psychosocial variables were evaluated at several time points during the trial, only participants' baseline data were employed in the current study. Using this initial time-point is consistent with the objective of the current study geared towards a sample of adults who, on average, do not meet recommended levels of PA and it also prevented intervention effects from contaminating the data. Specifically, this study employed data from participants' first assessment session at the research/health clinic prior to formal randomization. Therefore, examining treatment group differences on the variables in this study was unwarranted; the groups were pooled for all analyses.

Participants

The sample for this study corresponded to the total one hundred and twenty (N = 120) who took part in the full PAC trial (see section above). The majority of the sample was female (69.2%) and Caucasian (67.7%). Participants ranged in age from 20 to 67 years (M = 47.3, SD = 11.14) and they demonstrated a moderately high level of education (M = 14.75 years). The average BMI for the sample was high (M = 30.74, SD = 7.86). The mean baseline level of PA (18.14 MET/week, SD = 15.53, range = 0-67), as calculated using the Godin Leisure Time Exercise Questionnaire (Godin & Shephard, 1985), fell below Canadian recommendations of 150 minutes of moderate/vigorous PA per week and below Godin's (2001) cut-off score of 24 METS/week to achieve health benefits (Tremblay et al. 2011; G. Godin, personal communication, November 24, 2005; Godin, 2011).

Measures

Behavioural Regulation in Exercise Questionnaire-2. The BREQ-2 (Markland & Tobin, 2004) was used to measure the different exercise regulations postulated by SDT. This 19-item scale is partitioned into 5 subscales, each assessing respondents' behavioural regulations for exercise: amotivation, external regulation, introjected regulation, identified regulation, and intrinsic motivation. Sample items for the stem "Why do you engage in exercise?" include: "I feel guilty when I don't exercise" (introjected), and "I find exercise a pleasurable activity" (intrinsic). Participants responded to each item on a 5-point Likert scale from not true for me (0) to very true for me (4).

The reliability, validity, and factor structure of the BREQ-2 in adult is well established (Peddle, Plotnikoff, Wild, Au, & Courneya, 2008; Wilson & Rodgers, 2004). In the current study, internal consistency for the subscales ranged from .63 for identified regulation to .90

for intrinsic regulation. The Cronbach's alpha for amotivation was very low (.31). Although this low value is consistent with previous research (e.g., Mullan, Markland, & Ingledew, 1997) and may be accounted for by participants' willingness to partake in a PA trial (Markland & Tobin, 2004), this subscale was omitted from further analyses. Although motivational profiles were created using scores on the four regulations, the RAI was computed in order to interpret and validate the cluster solution. The RAI was calculated using the weightings from the original BREQ since amotivation items were removed (Mullan et al., 1997). This was done by multiplying the score for each subscale by their weighting (external [-2], introjected [-1], identified [+1], intrinsic [+2]) and obtaining a sum of the weighted scores (Ryan & Connell, 1989).

Physical Activity Enjoyment Scale (PACES). A modified version of the PACES, as used by Motl and colleagues (2001), was employed to measure PA enjoyment. Items such as "I enjoy it and it gives me energy" followed the stem "Usually when I participate in PA". Participants answered each item by responding on a 5-point Likert scale from disagree a lot (1) to agree a lot (5). Average enjoyment scores were computed across all items. Reliability and validity for the original scale (Fox, Rejeski, & Gauvin, 2000) has been corroborated for the Motl et al. version (Dishman et al., 2005). The reliability of the modified version was confirmed in the current study ($\alpha = .91$).

Data Analyses

All analyses were carried out using PASW Statistics 18.0.1. Data was inspected and cleaned according to procedures outlined in Tabachnick and Fidell (2007). Since cluster analysis is particularly sensitive to outliers, preliminary analyses were conducted to identify extreme cases. Descriptive statistics for the full sample were calculated (Table 1). Cluster analysis (Aldenderfer & Blashfield, 1984) was employed to isolate theoretically meaningful motivation subgroups of adults based on regulation scores using the BREQ-2. Cluster analysis takes a heterogeneous set of individuals and groups them according to their similarity across specified variables simultaneously, leaving a smaller number of mutually exclusive and exhaustive clusters (Everitt, Landau, & Leese, 2001; Hair & Black, 2000). The hierarchical agglomerative method was employed first to discover natural clusters in the data. In order to maximize within-cluster homogeneity and to evade the formation of long chains of cases, Ward's method using the squared Euclidian distance measure was applied (Aldenderfer & Blashfield, 1984). The number of clusters was determined using the agglomeration schedule coefficient and the dendogram. Specifically, a fairly large increase in the coefficient between sets of cluster fusions is indicative that clusters with dissimilar subjects are being combined (Hair, Anderson, Tatham, & Black, 1998). Clusters were interpreted according to mean scores on each regulation.

A k-means cluster analysis ensued using the initial cluster centers. This later procedure imposes a structure on the data by specifying the expected number of clusters. This performs a confirmatory analysis that affords greater confidence in the clusters that have surfaced (Aldenderfer & Blashfield, 1984; Morusis, 2010). Further validation of cluster stability was carried out by performing three additional k-means cluster analyses on 75%, 50%, and 25% randomly selected subsamples of the original 120 participants (Sicilia, Moreno, & Rojas, 2008). Consistency of the clusters is informed by similar cluster sizes and patterns of regulations to the original hierarchical solution.

The composition of the final cluster solution was examined according to age and gender using an ANOVA and a chi-squared test of independence respectively. A MANOVA and one ANOVA with post hoc tests using Tukey's HSD with a Bonferroni adjustment were conducted to demonstrate meaningful variability between clusters on the regulations and on the RAI, thus validating the cluster solution (Everitt et al., 2001; Purpose 1). A similar

ANOVA was used to test for differences between the clusters on enjoyment (Purpose 2). Results of G*Power (Erdfelder, Faul, & Buchner, 1996) tests for ANOVAs with 3 to 5 groups (unknown cluster solution) revealed that the given sample size (N = 120) was satisfactory to detect a large effect difference between clusters on the enjoyment variable. The more flexible cluster analysis appears to have no widely accepted rules for determining the minimum required sample size, other than a loose standard of 2^m (m = number of clustering variables) advised by some experts (Formann, 1984; Mooi & Sarstedt, 2011).

Results

Purpose 1: Cluster Analysis

Since all regulations were assessed on a 5-point scale, thus contributing equally to cluster formation, standardization of the variables was not warranted. No outliers were identified as no cases had distances from the mean greater than three times the standard deviations. Moreover, multicollinearity did not pose a problem as none of the Pearson Correlation Coefficients between the regulations were higher than .90 (Hair et al., 1998). The pattern of bivariate correlations between the regulations was comparable to previous studies (Milne, Wallman, Guilfoyle, Gordon, & Courneya, 2008) and not inconsistent with the simplex pattern forwarded by SDT (Ryan & Connell, 1989). As previously mentioned, the low internal consistency of the amotivation subscale warranted that these scores be withheld from all clusters analyses and subsequent statistical tests linking enjoyment. See Table 1 for the correlation matrix.

Table 1

Descriptive Statistics and Correlation Matrix of Full Sample (N = 120).

Variable	M	SD	α	2	3	4	5	6	7
1.Amotivation[a]	0.12	0.27	.31	.13	-.12	-.28**	-.28**	-.48**	-.39**
2.External	0.35	0.55	.75	-	.12	-.06	-.09	-.38**	-.14
3.Introjected	1.19	0.81	.76	-	-	.33**	.20*	.04	.23*
4.Identified	2.83	0.64	.63	-	-	-	.57**	.69**	.58**
5.Intrinsic	2.83	0.98	.90	-	-	-	-	.89**	.74**
6.RAI	11.89	4.29	NA	-	-	-	-	-	.75**
7.Enjoyment	4.19(1.33)	0.59(.21)	.91	-	-	-	-	-	-

Note. Means and standard deviations for transformed enjoyment data appear in brackets. Correlations values were calculated using transformed data with reflected sign. [a]Scores omitted from further analyses given low alpha value.
*p < .05; ** p < .01.

The initial cluster analysis showed one drastic increase of the agglomeration schedule, thus revealing that only one solution matched the data. Specifically, and compared to the three previous changes in the agglomeration schedule (17.4%, 19.1%, 18.1%), a large increase was evident when three clusters merged to two (28.7%). Thus, the three-cluster solution was deemed suitable given that large increases imply the merging of dissimilar clusters (Wang & Biddle, 2001). The proportion of males and females was consistent across profiles, χ^2 (2, n = 120) = 0.072, p = .97, Cramer's V = .024. Moreover, the motivational profiles did not differ significantly from one another in terms of age, F (2, 117) = 0.97, p = .38.

The first cluster, labeled the *self-determined* cluster, comprised 30.8% (n = 37) of participants. These individuals displayed the highest intrinsic motivation scores, with moderate scores on identified and low scores on both external and introjected regulations. They also showed the highest RAI values. The second and largest cluster (47.5%, n = 57) was labeled the *motivated* cluster as individuals in this subgroup showed moderate scores on identified and intrinsic regulations and on the RAI. However, these participants also displayed the highest level of introjected regulation and the second highest scores for external regulation. In cluster three, the *low motivation* cluster (21.7%, n = 26), participants showed very low levels of intrinsic motivation and low levels of identified regulation. Scores on external regulation for this cluster were the highest among all clusters. Given the low RAI value for this cluster (M = 6.03), the participants exhibiting this profile were indeed the least self-determined and least motivated overall. The profiles are displayed in Figure 1.

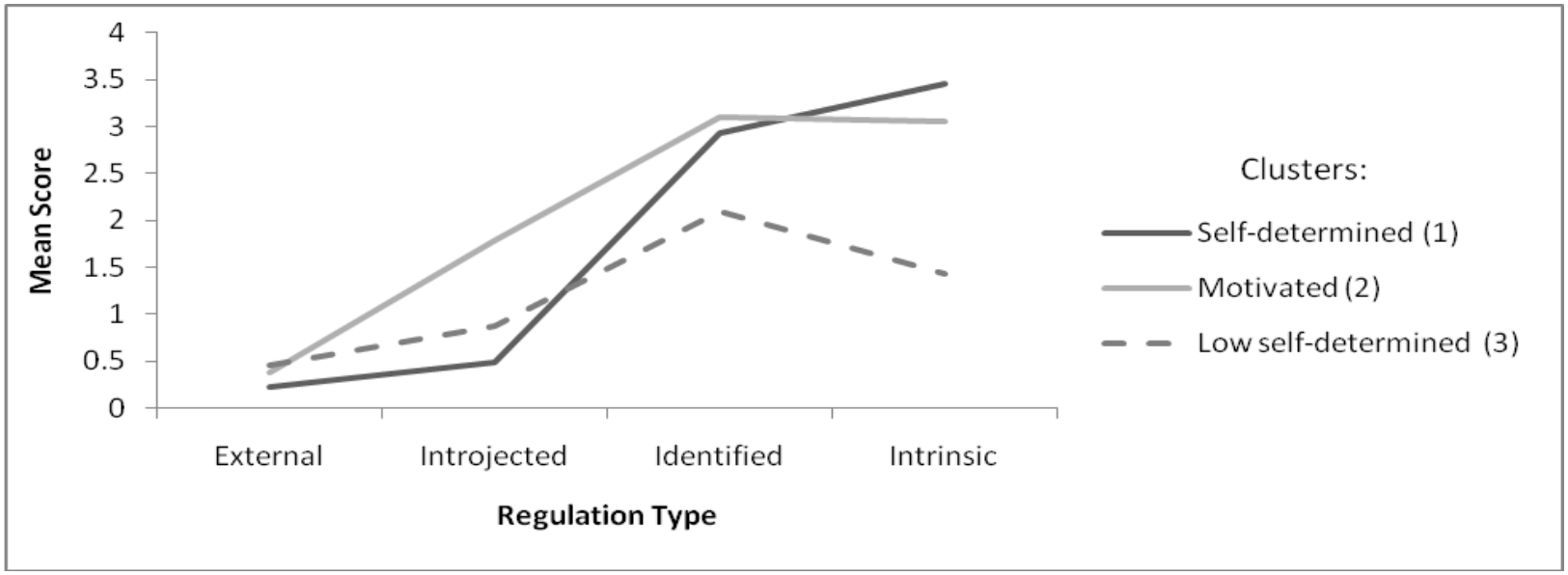

Figure 1. Cluster Profiles Based on Motivational Regulations of Sedentary Canadian Adults (N = 120).

Preliminary MANOVA assumption testing indicated no serious violations of linearity or the presence of outliers. Since Box's M test was non-significant (p = .05), the Wilk's lambda statistic was evaluated and revealed an overall difference between the three clusters on the behavioural regulations, F (8, 228) = 44.57, p < .001; Wilk's Lambda = .15, η_p^2 = 0.61. Follow up analyses with Bonferroni adjustments indicated significant differences between the clusters on the intrinsic, identified, and introjected regulations (p < .001) but not on external regulation (p = .22; see Table 2 for descriptive values by cluster membership, F ratios, and pairwise comparisons). An ANOVA revealed that the three clusters also differed significantly on the RAI, F (2, 117) = 81.59, p < .001; η_p^2 = 0.58. As expected, the *self-determined* cluster was significantly higher on the RAI than both the *motivated* (mean difference = 2.48, p < .001) and the *low motivation* (mean difference = 8.98, p < .001) clusters. Also, the *motivated* cluster scored significantly higher on the RAI than the low motivation cluster (mean difference = 6.50 p < .001). These results provide evidence that the three-cluster solution was theoretically sound.

Table 2

Univariate F, Effect Size, and Profile Means and Standard Deviations for Regulations, RAI, and Enjoyment.

			Cluster					
			I. Self-determined (n = 37)		II. Motivated (n = 57)		III. Low motivation (n = 26)	
Variable	*F* (2, 117)	η_p^2	*M*	SD	*M*	SD	*M*	SD
1. External	1.54	.03.	.22	.44	.38	.65	.45	.42
2. Introjected	65.03*	.53	.49†	.47	1.79‡	.63	.88§	.52
3. Identified	36.61*	.39	2.93†	.50	3.10†	.45	2.10‡	.61
4. Intrinsic	84.36*	.59	3.45†	.62	3.06‡	.64	1.44§	.63
5. RAI	81.59*	.58	15.01†	2.72	12.54‡	2.78	6.03§	2.93
6. Enjoyment	35.63*	.38	4.45†	.37	4.35†	.44	3.48‡	.60

Note. Means and standard deviations for enjoyment are based on untransformed data. *All F values are significant at $p <$. 001; A distinct symbol in a given row indicates a difference between this cluster and the others based on pairwise comparisons of estimated marginal means ($p < .05$). Three distinct symbols in one row indicate that all three clusters differ from one another on the given variable (no symbols, no differences).

A three-cluster, k-means cluster analysis was repeated using the initial cluster centers. The percentages of participants in each cluster that were correctly allocated to the same respective clusters with the k-means analysis were 96%, 75%, and 85% for the low motivation, the motivated, and the self-determined clusters respectively. These percentages are adequate, and although minor disparities in terms of cluster sizes were evident, the regulations and RAI scores for each cluster were similar across the two procedures. Similar percentages and profiling were also evident when a k-means analysis was repeated using *random* initial seed points. Finally, separate k-means analyses on 75%, 50% and 25% subsamples further confirmed the consistency of the three-cluster solution, in terms of size and motivational profiling.

Purpose 2: Enjoyment

As the PA enjoyment data revealed a non-normal distribution,[1] a square root transformation was performed on this variable. All other assumptions for ANOVA were met. Results indicated a significant difference overall between the clusters on enjoyment, F (2, 117) = 35.63, $p < .001$; $\eta_p^2 = .38$. This medium sized effect of cluster membership on enjoyment levels was also evident after controlling for age, gender, and amount of PA ($p < .001$). As expected, the *low motivation* cluster ($M = 3.48$) was significantly lower on enjoyment than the *motivated* cluster ($p < .001$, $g = 1.74$) and the *self-determined* cluster ($p < .001$, $g = 2.02$). In addition, participants within the *self-determined* cluster scored higher on enjoyment than those in the *motivated* cluster, however this effect was rather small and did not reach significance (mean difference = 0.11, $p = .281$, $g = .25$). See Table 2 for all comparisons.

Discussion

The primary objective of this study was to uncover motivational profiles for PA in a sample of Canadian adults whose average PA levels fell below recommended levels. This research could be important in light of evidence that a significant proportion of North American adults are insufficiently active (Bryan & Katzmarzyk, 2009; Sapkota, Bowles, Ham, & Kohl, 2005) and that motivation is an influential determinant of PA (Buckworth, Lee, Regan, Schneider, & DiClemente, 2007). To our knowledge, the present study is one of few to profile *adult* motivation patterns for PA within a North American context. From the results of our cluster analyses using SDT's behavioural regulations, three clusters emerged: The *self-determined*, *the motivated*, and *the low motivation*.

This cluster solution, in terms of size and profiling, holds some resemblance to the four-cluster result found by Matsumoto and Takenaka (2004) in a sample of Japanese adults, with some areas of disagreement. For instance, in addition to the absence of an "amotivated cluster" (items removed), our "self-determined" cluster was not the largest. We speculate that one contributor to this discrepancy could be the higher overall levels of PA reported in the Japanese study, since, consistent with SDT, greater and continued engagement in PA should be tied to higher levels of self-determined motivation (Thøgersen-Ntoumani & Ntoumanis, 2006). The current study does make a valid contribution to the SDT literature by identifying three specific patterns/arrangements of the motivational regulations in a PA context and this in a low-activity sample of Canadian adults. Although gaining in popularity, motivational profiles have been under examined in this line of inquiry.

Our investigation agrees with past studies that saw the emergence of *motivated* or *moderate* clusters, such as the High Combined profiled identified by Stephen et al. (2010), in which individuals modestly endorsed several motives, including introjection. This

corroborates a multidimensional conceptualization of motivation. This also means that PA researchers and practitioners should not underestimate the breadth of potential motivational sources of this behaviour, even when working with groups of individuals who fail to achieve high rates PA, such as the PAC participants who on average did not meet recommended levels. This said, some authors do feel that exhibiting the moderate profile specifically might not be entirely adaptive. Matsumoto and Takenaka (2004) found that adults fitting this profile scored low on the maintenance stage of PA change. They argued that adults fitting the moderate profile do exercise to some degree although they will likely not become regular exercisers. It is curious then that on the contrary, Stephen et al. (2010) found high levels of PA in this profile in an older population. Undoubtedly more research is needed to reconcile such discrepancies, especially considering that a similar cluster in our study (i.e. *motivated*) comprised a fair proportion (57%) of adults who may be in jeopardy of maintenance issues in the future.

The above finding also denotes the value in considering individuals' scores on *each* of the regulations, as per the current cluster analysis. This substantiates that individuals can, to differing degrees, present several motivation styles for engaging in- and enjoying- a particular behaviour, and this lends support for the additive influence of the regulations (Vallerand & Fortier, 1998; Vallerand, 1997). Profiling based solely on the regulations and SDT-based variables are scarce (Ullrich-French & Cox, 2009) as many studies have incorporated other theories or constructs (e.g., achievement goal theory; Sicilia et al., 2008; Wang & Biddle, 2001) in conjunction with *global* self-determination scores (i.e., RAI). Although useful in reducing the motivational components, the RAI is not informative of the unique contribution of each type of motivation to one's behaviour or emotional experience (Ratelle et al., 2007). In the current study for instance, the noteworthy levels of introjection demonstrated in the *motivated* cluster could have been easily overlooked had the focus been solely on cluster-based RAI values.

The second purpose of this study was to examine how the clusters differed with regards to enjoyment. Studying enjoyment in PA research is timely as there has been a heavy emphasis to date on instrumental (behavioural/physical) rather than affective outcomes (Williams, Anderson, & Winett, 2005) and as enjoyment is recognized to facilitate well-being as well as future PA (Raedeke, 2007; Williams et al., 2008). In line with our hypothesis, the *self-determined* and *motivated* clusters demonstrated the highest levels of enjoyment. Through the use of cluster analysis, these findings supplement research by Vlachopoulos and Karageorghis (2005) who found an additive identified-intrinsic relationship in predicting enjoyment. But as will become evident, drawing on this innovative profiling method also gave rise to particularly curious findings worthy of further attention.

As expected, the most noticeably different (and significantly lower) levels of enjoyment were observed in the *low motivation* cluster. Given the positive relationship between enjoyment of PA and rates of engagement and maintenance (e.g. Davey et al., 2009), targeting enjoyment of being active, through amusing and preferred activities, might be a valuable intervention avenue for this subgroup. Future studies will need to explore the malleability of the regulations within profiles, and more specifically, how targeting the self-determined motives within vulnerable profiles might augment PA enjoyment and vice versa.

That being said, such efforts might be called into question by noticing that scores for enjoyment are still arguably high in the *low motivation* cluster, despite being comparatively lower than the other two. Discussed as weaknesses in a subsequent paragraph, possible self-report biases and/or ceiling effects on this variable may require attention in future explorations. Indeed, high baseline levels of enjoyment across this particular sample might reflect a bias of general enthusiasm among participants about the idea of beginning to make changes to their sedentary behaviour. It would be interesting for future research to examine

how enjoyment levels, even if initially high, may be subject to change as individuals make modifications to their PA engagement throughout an intervention. It might also be worthwhile in future studies to consider additional SDT-based variables (e.g., need satisfaction) that might supplement the regulations in contributing to clusters that best explain PA enjoyment.

Another interesting finding that runs contrary to theoretical expectation is that the *motivated* cluster displayed the highest introjection levels, despite a relatively elevated RAI and an enjoyment rating comparable to the *self-determined* cluster. Introjection, a more extrinsic regulation, involves a slight internalization of behaviour but with little acceptance as one's own since motivation arises from feelings of guilt or shame. Theoretically, introjection is expected to lead to negative consequences in the PA domain. However, consistent with previous findings (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003; Edmunds et al., 2008; Markland, 2009; Thøgersen-Ntoumani & Ntoumanis, 2006), this might not always be the case. In studying motivational profiles specifically, Boiché and colleagues (2008) linked introjection to physical education performance. Moreover, Ntoumanis (2002) found that those with a 'self-determined profile' displayed moderate introjection levels and high levels of affective outcomes including enjoyment and satisfaction. Yet to remain fair and coherent with SDT, this did not occur for the *self-determined* cluster in the present investigation.

Reasoning by Ntoumanis (2002) may be relevant in this regard. Namely, due to pressure from doctors or family members, adults may partially internalise the value of participating in PA and do so, in part, to avoid feeling guilty. Thus, it appears that non-self-determined forces are not fruitless for motivating physically strenuous behaviors that might hold limited *immediate* intrinsic appeal to many adults. Wilson and Rodgers (2004) similarly argued that in PA contexts it is important to consider the *quality* of extrinsic motivation. As ours and past studies indicate, the behavioural regulation should be looked at concurrently with one another. Notably, findings in the current study suggest that differing levels of more self-determined motives might still lead to enjoyment of PA despite simultaneous feelings of guilt or shame. Still, future studies will need to examine the longitudinal effects of introjection in particular on behavioural and affective outcomes (Thøgersen-Ntoumani & Ntoumanis, 2006) and within different profiles given concerns about this regulation for facilitating *long-term* changes (Matusomoto & Takenaka, 2004). Researchers might consider experience sampling methods (Barrett & Barrett, 2001) in order to examine the complexity of the regulations-enjoyment link over time.

In addition to the many theoretical implications that have been discussed, the findings have practical implications from a diagnostic perspective (see Vansteenkiste et al., 2009). Indeed, "diagnosing" certain individuals as being higher or lower in certain motivational styles could lead to better tailoring of PA interventions for particular groups that are less active. For instance, this could be achieved by using SDT-based strategies (e.g., less structure) that target decrements in the levels of certain regulations while highlighting others. It may be that motivational profiles are malleable and that similarities and differences between groups of profiles may serve as building blocks for interventions that will maximize PA enjoyment.

Several limitations, including a small sample size, possible ceiling effects (enjoyment) and a cross-sectional design warrant that our conclusions be interpreted with caution and be addressed in future studies. Also, despite arguments raised earlier in attempting to explain the low alpha for items tapping amotivation, these items demonstrated poor reliability and were removed from further analyses. The exclusion of amotivation items from cluster formation should be acknowledged as a weakness. This is especially true given that levels of amotivation may be particularly relevant to assess in less active individuals (Daley & Duda, 2006; Markland & Tobin, 2004) and that, theoretically, amotivation is expected to reversely predict any possible enjoyment to be gained from a particular behaviour such as PA (Deci & Ryan, 2000). Improvements toward sensitive and internally consistent items that capture very

low or absent motivation are needed in order to capture this form of regulation in future motivational profiling in similar populations. Finally, additional studies are needed to understand the mechanism by which motivational profiles exert different influences on outcomes such as enjoyment and how this plays out longitudinally. Although Vlachopolous and colleagues (2000) propose a protective effect from high levels of self-determination on non-self determined forces, our findings suggest that rigorous testing of this and other premises (Ullrich-French & Cox, 2009) is required.

Conclusion

Overall, our findings are generally consistent with previous studies in terms of the clusters identified and the patterns of motivation within them. Our results offer theoretical and practical implications regarding the relative contribution of each regulation style in explaining PA motivation in a sample of Canadian adults not meeting current PA guidelines. Specifically, practitioners and researchers might gain from examining how moderate levels of each regulation are related to the affective PA experience (i.e., enjoyment). Moreover, PA counsellors can draw from the similarities and differences between profiles in order to provide more individually tailored interventions that highlight and target several motivational regulations at a given time. Also, findings for our second purpose highlight how differing magnitudes of each regulation, especially introjection, can be differentially associated with PA enjoyment. This addresses a shortage of research on how motivation is linked to enjoyable PA experiences (Vlachopoulos & Karageorghis, 2005).

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