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ARTICLE

Motivational profiles in table tennis players: Relations with performance anxiety and subjective vitality

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ABSTRACT

Research has suggested the need to use a person-centred approach to examine multidimensionality of motivation. Guided by self-determination theory (Deci & Ryan, 1985), the primary aim of the present study was to examine the motivational profiles in table tennis players and their composition by gender, country, training status, and competition levels (from recreational to international). The secondary aim was to examine the differences in performance anxiety and subjective vitality across the motivational profiles. Participants were 281 table tennis players from multiple countries, mostly the U.S. and China. Hierarchical and nonhierarchical cluster analyses were conducted and showed three motivational profiles with distinct quantity and quality: "low", "controlled", and "self-determined". Chi-square tests of independence demonstrated significant differences in their cluster membership by country, formal training with a coach, and competition levels, but not gender. MANCOVA results indicated differences in performance anxiety and subjective vitality across the motivational profiles, in which the controlled profile had the greatest anxiety symptoms. These differences are attributed to the quality over quantity of motivation, which have meaningful implications for table tennis coaches and sport psychology consultants to diagnose and intervene with players in order to reduce their performance anxiety and improve their well-being.

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KEYWORDS
Self-determination theory; anxiety; subjective vitality; table tennis; cluster analysis

Introduction

Motivation is one of the most important contributors to athletic performance and psychological strength in sport (Gillet, Vallerand, & Rosnet, 2009). For instance, Chinese table tennis player Lin Ma – an Olympic gold medallist and a previous world number one ranked – once struggled with somatic anxiety due to low levels of motivation; Ma later achieved success after his head coach Guoliang Liu motivated him through optimal external pressure in training that might not have the same positive influence in other players (Larcombe, 2013). Therefore, it is imperative that coaches are able to differentiate the motivational types of various athletes and use appropriate strategies to coach them for optimal well-being and performance. Recreational athletes may possess different types of motivation than elite and world-class athletes (Fortier, Vallerand, Brière, & Provencher, 1995; Gillet & Rosnet, 2008), yet no research to date has examined the motivational differences of table tennis players across countries and competition levels. The present study, therefore, sought to explore and compare the motivational profiles of table tennis players from a variety of backgrounds. Specifically, we used a person-centred approach to examine both the quantity and quality of motivation.

Self-determination theory

Self-determination theory (SDT; Deci & Ryan, 1985, 2000) is a well-established theoretical framework for studying motivation in diverse sport settings. SDT explains human behaviour in a self-determination continuum, which consists of intrinsic motivation, extrinsic motivation (autonomous and controlled forms), and amotivation. Self-determined individuals exhibit greater engagement and functioning in a specific context, such as better athletic performance, than non-self-determined individuals. The highest end of the self-determination continuum is *intrinsic motivation*, a motivational type driven by interest or enjoyment, which exists within an individual, rather than by external pressures or rewards (Deci & Ryan, 1985). For example, autonomously and intrinsically motivated individuals participate in a sport for its enjoyment instead of an external outcome such as winning.

Individuals who are extrinsically motivated perform an activity with aims to achieve separable outcomes (Ryan & Deci, 2000). *Extrinsic motivation* is multidimensional that exists in four different types of motivational regulations: integrated, identified, introjected, and external. *Integrated regulation* is the most self-determined form of extrinsic motivation. It occurs when athletes engage in their sport for congruence with their athletic identity and core values. *Identified regulation* is the next motivational regulation in the continuum. Individuals in this form may choose to participate in a sport because they value its importance, such as playing table tennis for its health benefits. *Introjected motivation* is a less self-determined form of extrinsic motivation linked to external motives such as guilt or obligation (Deci & Ryan, 1985). Individuals might play a sport because of peer pressure, otherwise would be ashamed of disappointing their friends. *External*

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regulation is the least self-determined form of extrinsic motivation. Reasons for participation are spurred by rewards or avoidance of punishment, such as playing a sport only for receiving scholarships. Further, integrated and identified regulations are considered as autonomous extrinsic motivation (i.e., motivated to achieve outcomes consistent with their values), whereas introjected and external regulations are referred to as controlled extrinsic motivation. These extrinsic motivational types explain why people participate in sports without intrinsic motivation and why their engagement and performance may differ (Ryan & Deci, 2000).

The last motivational type at the lowest end of the whole self-determination continuum is *amotivation*. Amotivated individuals are neither intrinsically nor extrinsically motivated (Ryan & Deci, 2000). For instance, amotivated athletes may question why they play their sport and eventually drop out. Extensive literature in various domains, including sports, has shown that autonomous motivation contributes to adaptive outcomes such as coping and well-being (Alvarez, Balaguer, Castillo, & Duda, 2012; Martinent & Decret, 2015), whereas controlled motivation and amotivation are associated with maladaptive outcomes such as stress and burnout (Lonsdale, Hodge, & Rose, 2008; Martinent, Decret, Guillet-Descas, & Isoard-Gautheur, 2014).

Motivational profiles

Whilst most coaches may believe that higher motivation makes a better athlete, research in academic settings has shown quality over quantity of motivation is the most important for adaptive outcomes (Ratelle, Guay, Vallerand, Larose, & Senécal, 2007; Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009). In order to take account of both the quality and quantity of motivation, motivational profiles can be created using a person-centred approach, such as cluster analysis. A person-centred approach allows for examining the multidimensionality across all six motivational regulations to categorise individuals into groups for comparisons. Because motivational regulations can coexist at similar or different levels that contribute to different profiles and corresponding outcomes (Gillet, Berjot, Vallerand, Amoura, & Rosnet, 2012), cluster analysis is particularly helpful in identifying these homogenous clusters for research and practice (i.e., diagnostics, intervention) in sports. Most SDT studies, however, use a variable-centred approach that investigates motivational regulations as separate variables in relation to adaptive and maladaptive outcomes. This approach does not allow for simultaneous examination of motivational regulations (Vansteenkiste et al., 2009). For example, we can understand how self-determined motivation and controlled motivation relate to performance anxiety independently, but not how a combination of these motivational types in high and/or low levels may relate to anxiety differently.

Although the use of a person-centred approach in studying motivational profiles has grown in academic settings, limited evidence exists in sport settings. To the best of our knowledge, there are only five published studies on sport motivational profiles using only SDT constructs (Gillet, Berjot, & Paty, 2009; Gillet, Vallerand, et al., 2009; Gillet et al., 2012 Martinent & Decret, 2015; Vlachopoulos, Karageorghis, & Terry, 2000). Two to four motivational profiles have been found in each study, although three profiles are the most common findings. Taken together, these studies suggest the following five types of motivational profiles in descending order of quality: (1) a self-determined profile shows high autonomous motivation and moderate-to-low controlled motivation (Gillet, Berjot, et al., 2009; Gillet, Vallerand, et al., 2009; Martinent & Decret, 2015); (2) a high motivation profile displays both high autonomous and controlled motivations (Gillet, Berjot, et al., 2009; Gillet, Vallerand, et al., 2009; Gillet et al., 2012; Vlachopoulos et al., 2000); (3) a moderate motivation profile indicates high-to-moderate autonomous motivation and moderate controlled motivation (Gillet, Berjot, et al., 2009; Gillet, Vallerand, et al., 2009; Gillet et al., 2012; Martinent & Decret, 2015; Vlachopoulos et al., 2000); (4) a low motivation profile reveals moderate-to-low autonomous motivation and low controlled motivation (Gillet, Berjot, et al., 2009; Gillet et al., 2012; Martinent & Decret, 2015; Vlachopoulos et al., 2000); and (5) a controlled profile is composed of moderate autonomous motivation and high controlled motivation (Gillet, Vallerand, et al., 2009).

Participants of these studies were recruited from a variety of age groups and sports, although most of them were elite athletes in Europe (mostly in France). Because the results of a person-centred approach are dependent on the data source, the motivational profiles could be different for athletes across countries (e.g., China, the U.S.) and competition levels (e.g., recreational, international). All of the abovementioned studies using a person-centred approach called for more research with diverse samples to replicate their findings, which provided a rationale for comparing motivational profiles across gender, countries, and table tennis background in the present study.

Sport motivation has been shown to relate to gender, training with a coach, and levels of competition. Specifically, previous studies (Clancy, Herring, MacIntyre, & Campbell, 2016; Fortier et al., 1995; Gillet & Rosnet, 2008) indicated that (1) women tended to have higher intrinsic motivation than men; (2) having a coach who emphasised training and provided informational feedback contributed to higher autonomous motivation; and (3) mixed evidence existed regarding the association between competition levels and motivation. These three findings were from research that recruited athletes from multiple sports within one study. On the other hand, the past research examining motivational profiles in sports mostly recruited athletes from only one sport within each study, including table tennis (Martinent & Decret, 2015), tennis (Gillet, Berjot, et al., 2009; Gillet, Vallerand, et al., 2009), fencing (Gillet, Vallerand, et al., 2009; Gillet et al., 2012), running (Gillet et al., 2012). These studies, deviated from those using a variable-centred approach, found no association between motivational profiles and gender (cf. Gillet et al., 2012). With regard to competition levels, Gillet and colleagues (Gillet, Berjot, et al., 2009; Gillet, Vallerand, et al., 2009, Gillet et al., 2012) found inconsistent associations between the type of motivational profile and sport performance among elite athletes. Only Vlachopoulos et al. (2000) recruited recreational sport participants across 25 sports and showed an association between motivational profiles and levels of competition, whereas the specific relationship was not provided. Because of the mixed evidence and varied motivational demands

across sports, examining any differences in the composition of motivational profiles in a diverse sample of table tennis players can provide more representative motivational patterns within the sport. Additionally, the present study investigated the motivational profiles across countries since a dearth of sport motivation studies contained non-Western samples (Clancy et al., 2016).

Motivational profiles can relate to different outcomes in sport based on their motivation quantity and quality. One would predict that higher motivation quantity and/or quality should lead to more adaptive and less maladaptive outcomes, yet inconsistent findings exist in previous studies. For instance, when compared to moderate and low motivation profiles, a high motivation profile contributed to better performance in fencing and running (Gillet, Vallerand, et al., 2009; Gillet et al., 2012), but worse performance in tennis (Gillet, Berjot, et al., 2009;). Gillet and colleagues suggested examining motivational profiles with other psychological determinants of performance, such as anxiety and burnout, to further our understanding of how the profiles relate to adaptive and maladaptive outcomes. Whilst a high motivation profile showed greater emotional and physical exhaustion than moderate and low motivation profiles among long-distance runners (Gillet et al., 2012), a moderate motivation profile displayed higher levels of reduced accomplishment, sport devaluation, and general and sport-specific stress than the self-determined and the low motivation profiles.

The inconsistency between motivational profiles and outcomes in sport settings might partly be due to the use of the Sport Motivation Scale (SMS; Brière, Vallerand, Blais, & Pelletier, 1995; Pelletier et al., 1995) in all five previous studies. There are three main drawbacks of using the SMS to classify motivational profiles: (1) the scale does not assess integrated regulation to represent all SDT constructs (Mallett, Kawabata, Newcombe, Otero-Forero, & Jackson, 2007); (2) many items are either ambiguous or wrongly classified (Pelletier, Rocchi, Vallerand, Deci, & Ryan, 2013); and (3) the external regulation items reflect the desire to be famous, rather than highly controlling rewards or avoidance of punishment, such that a high motivation profile was associated with more positive consequences than a self-determined profile (Gillet, Vallerand, et al., 2009). In light of these concerns, Gillet, Vallerand, et al. (2009) recommended using other measures, the Behavioral Regulation in Sport Questionnaire (BRSQ; Lonsdale et al., 2008) in particular, to study motivational profiles in sports. The present study, therefore, sought to address issues of inconsistent findings by being the first to use the BRSQ to assess motivational profiles, as well as by investigating two other important psychological outcomes in sports – performance anxiety and subjective vitality.

Performance anxiety and subjective vitality

Performance anxiety is a key predictor of the quality and quantity of sport participation. High levels of performance anxiety can lead to poor performance and reduced enjoyment, as well as predict less sport involvement and even sport attrition (Scanlan, Babkes, & Scanlan, 2005). Anxiety is a multidimensional construct, which includes a trait and a state component. Specifically, performance trait anxiety is viewed as a predisposition to high anxiety states under threatening situations, while performance state anxiety fluctuates based on the threat appraisal of specific situations (Spielberger, 1966). An athlete who has high performance trait anxiety is likely to experience high levels of state performance anxiety when exposed to stressful sport situations. The present study focused on trait instead of state anxiety, because trait anxiety would be expected to show more consistent and meaningful associations with the contextual (instead of situational) motivational profiles that are relatively stable and independent of specific situations (see Vallerand, 2001). Previous research also used this trait approach when examining contextual motivational constructs (e.g., Smith, Smoll, Cumming, & Grossbard, 2006).

In addition to the trait and state components, anxiety can further be discriminated between somatic and cognitive components (Smith et al., 2006). Somatic anxiety refers to physiological, affective elements of an experience, such as the feelings of nervousness and tension, whilst cognitive anxiety concerns with negative thoughts of a situation and potential consequences. Conceptualizing performance anxiety as it relates to sports, Smith et al. (2006) further separated cognitive anxiety into worry and concentration disruption. Examining this multidimensionality yields both theoretical and practice significance. Theoretically, differentiating the anxiety components provides more accurate information about the antecedents (e.g., motivation) and consequences (e.g., performance) of corresponding anxiety components (Grossbard, Smith, Smoll, & Cumming, 2009). Practically, coaches and sport psychology consultants can identify the anxiety components (i.e., trait/state, somatic/cognitive) and intervene with athletes by implementing appropriate strategies, such as using positive self-talk to alleviate worry symptoms, in order to enhance sport performance. Whereas a growing body of literature supports an inverse relationship between performance anxiety and the quality of motivational profiles in academic settings (Ratelle et al., 2007; Vansteenkiste et al., 2009), little research has studied the association between performance anxiety and sport motivation (Horn, Bloom, Berglund, & Packard, 2011; van de Pol, Kavussanu, & Kompier, 2015). Investigating the role of motivational profiles would further our understanding of which types of athletes might be more vulnerable to certain anxiety symptoms.

In contrast to performance anxiety as a negative psychological construct, subjective vitality is a positive feeling of having self-generated energy that reflects physical and psychological well-being (Ryan & Frederick, 1997). This well-being stems from the eudemonic perspective that is concerned with values and engagements, rather than the hedonic perspective that focuses on achieving happiness. Subjective vitality, therefore, is positively associated with autonomous motivation and negatively associated with controlled motivation (Nix, Ryan, Manly, & Deci, 1999). Due to the physiological and psychosocial demands of sport participation, subjective vitality can be considered as a central indicator of contextual well-being among athletes (Lundqvist, 2011). Therefore, motivational profiles in table tennis players may be related to their subjective vitality, which is in turn associated with their general well-being and health (Lundqvist, 2011). Understanding how subjective vitality relates to different motivational profiles can help coaches and sport psychology consultants target athletes' individual needs for positive well-being across various levels and types of motivation. Examining performance anxiety and subjective

vitality simultaneously in the present study would also provide complementary findings on the motivational patterns of both adaptive and maladaptive outcomes.

Aims and hypotheses

The primary aim of the present study was to explore the characteristics of motivational profiles in table tennis players and their comparisons by gender, country, training status (with a coach vs. no coach), and competition levels (from recreational to international). The secondary aim was to examine any differences in performance anxiety and subjective vitality across motivational profiles.

Based on the SDT assumptions and our literature review of motivational profiles, we hypothesised that:

(1) Compared to the motivational profiles with poorer quality (lower autonomous motivation, higher controlled motivation and amotivation), those with the better quality (higher autonomous motivation, lower controlled motivation and amotivation) would consist of larger ratios of players who had a coach than those who did not.
(2) The motivational profiles with better quality would have less somatic anxiety, worry, and concentration disruption, as well as greater subjective vitality, than the motivational profiles with poorer quality.
(3) Somatic anxiety, worry, concentration disruption, and subjective vitality would be significantly different across the motivational profiles, in which the quality of motivation contributed to most of these differences.

Method

Participants

Participants were 323 table tennis players (269 men, 54 women) from 35 countries in all continents except Antarctica as shown in Table 1. Their age ranged from 18 to 91 years (mean = 39.68, *SD* = 17.62). The majority of the participants were from the U.S. (51.2%), followed by China (25.1%) and other countries (23.7%; <4% each), whereas a larger proportion of female participants were from China (47.7%) as compared to the U.S. (18.2%) and other countries (34.1%). With regard to the table tennis background, participants had been playing table tennis for 1–78 years (mean = 16.76, *SD* = 14.90); 61.3% had trained with a coach and 38.7% had not. Both current and previous players were eligible to participate in the present study in order to increase the variability in the motivational profiles. They reported currently playing 0–48 hours (mean = 5.76) of table tennis per week. The highest competition level of participants varies across recreational (26.0%), intercollegiate (11.5%), local (15.5%), state/provincial/regional (14.5%), national (21.1%), and international (11.5%). Most participants who did not have formal training (46.8%) were recreational players.

Procedures

Formal approval of the present study was obtained from the university's institutional review committee prior to data collection. The president and/or coaches of various table tennis clubs and tournament directors were informed about the study purpose for participant recruitment. After obtaining their permission, data collection was conducted via an online survey in one of the two ways: (1) the table tennis club presidents and coaches disseminated the information to their club members through email for them to complete the survey at any place individually (89.7%); (2) the first author attended the local, regional, and national tournaments (e.g., U.S. Open) to collect data from participants in person with an electronic device (10.3%). There were no significant differences in the study variables except for age ($p < .05$; mean = 40.56 and 33.07) between the email and face-to-face recruitment methods. The survey took approximately 20 minutes to complete.

Demographics and table tennis background

Participants provided demographic information including age, gender, and country of origin. They also answered questions regarding their table tennis background, including the number of years of playing (and formal training with a coach), number of hours playing table tennis per week, and highest competition level.

Sport motivation

Participants' sport motivation for table tennis was measured with the 24-item Behavioural Regulation in Sport Questionnaire (BRSQ; Lonsdale et al., 2008), beginning with the stem "I participate in my sport (table tennis)…". There are four items in each subscale assessing one of the six motivational regulations: (1) intrinsic motivation (e.g., "Because I enjoy it"); (2) integrated regulation (e.g., "Because it's a part of who I am"); (3) identified regulation (e.g., "Because it teaches me self-discipline"); (4) introjected regulation (e.g., "Because I would feel guilty if I quit"); (5) external regulation (e.g., "Because I feel pressure from other people to play"); and (6) amotivation (e.g., "But the reasons are not clear to me anymore"). Responses are on a 7-point scale ranging from 1 (*not at all true*) to 7 (*very true*). The factorial validity and test–retest reliability of the scale have been supported in previous studies among sport participants across different countries and age groups (Lonsdale et al., 2008; Viladrich et al., 2013).

Performance anxiety

Participants' performance trait anxiety in table tennis was measured with the 15-item Sport Anxiety Scale-2 (SAS-2; Smith et al., 2006), beginning with the stem "Before or while I compete in my sport (table tennis)…". There are five items in each subscale assessing one of the three anxiety components: (1) somatic anxiety (e.g., "My body feels tense"); (2) worry (e.g., "I worry that I will not play my best"); and (3) concentration disruption ("I cannot think clearly during the game"). Responses are on a 4-point scale defined by 1 (*not at all*), 2 (*a little bit*), 3 (*pretty much*), and 4 (*very much*). The factorial and construct validity of the scale have been supported with

Table 1. Origin of study participants in the original sample and the final sample without outliers.

Continent and country	Original *n*	Final *n*
North America	**175**	**157**
United States	165	149
Canada	6	4
Dominican Republic, Jamaica, Mexico, Panama[a]	4	4
Asia	**113**	**93**
China	81	65
India	13	12
Taiwan[b]	10	9
Malaysia	2	1
Iran, Japan, Nepal, the Philippines, Saudi Arabia, Sri Lanka, Vietnam[a]	7	6
Europe	**22**	**19**
United Kingdom	9	9
Malta	3	2
Ukraine	2	2
Bosnia and Herzegovina, Croatia, France, Italy, Russia, Slovenia, Spain, Turkey[a]	8	6
South America	**8**	**7**
Colombia	4	3
Brazil, Ecuador, Peru, Venezuela[a]	4	4
Africa	**2**	**2**
Nigeria, South Africa[a]	2	2
Australia and Oceania	**2**	**2**
Australia	2	2
Unspecified	**1**	**1**
Total *N*	323	281

Note: Continents and the associated numbers are **bolded**.
[a]There was one participant from each of the listed countries in the original sample.
[b]Although Taiwan is not a country in itself, it is considered as an entity analysed separately from China as it has a different sports system and table tennis association.

both child and adult sport participants (Smith et al., 2006). The total scores for each of these three subscales were computed for data analyses.

Subjective vitality

Participants' subjective vitality in table tennis was assessed with the 5-item modified version of the Subjective Vitality Scale (SVS; Ryan & Frederick, 1997), beginning with the stem "When I play table tennis…". This scale measures the extent of physical and psychological energy to which participants feel in table tennis. An example item is "I feel alive and vital". Responses are on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The validity and reliability of the scale have been supported with the general population (Bostic, Rubio, & Hood, 2000; Ryan & Frederick, 1997) and in the sport domain (Reinboth & Duda, 2006; Reinboth, Duda, & Ntoumanis, 2004) across age groups. The mean scores for the scale items were computed for data analyses.

Data analyses

Prior to the data analyses, all data were checked for missing values, invalid patterns, outliers, and normality. Descriptive statistics, alpha coefficients, and correlation coefficients were then computed for the study variables. The strength of the correlations were categorised as weak, moderate, and strong (r = .10, .30, and .50), respectively (Cohen, 1992). There were less than 5% of data missing at random (partial missing data in 15 cases) so no data were imputed (Tabachnick & Fidell, 2007).

Cluster analyses were then conducted to categorise the motivational profiles among the participants. All motivational types were first transformed to standardised z scores. Missing data and outliers ($z \pm 3$) were deleted to avoid influencing the results of cluster analyses. Using the two-step procedure recommended by Hair, Anderson, Tatham, and Black (1998), a hierarchical cluster analysis was performed as a preliminary step to examine the possible cluster solutions, which were then validated using non-hierarchical (k-means) procedures. For the hierarchical cluster analysis, the Ward's method with a squared Euclidean distance was employed to reduce the within-cluster differences (Aldenderfer & Blashfield, 1984). Both the agglomeration schedule and dendrogram (graphical method) were used to decide the number of clusters. Using the mean scores of the clustering variables from the hierarchical cluster analysis, k-means analysis was conducted to produce the same number of clusters for comparison in their mean scores and size.

To determine the type of motivational profile in each cluster, z scores were used to classify each motivational type as "high" ($z > .50$), "moderate" ($-.50 < z < .50$), and "low" ($z < -.50$) values (Hodge & Petlichkoff, 2000). In addition to presenting high-to-low scores in each motivational type across clusters, z-scores were used to create two more scores to represent the quantity and quality of motivation in each cluster. A quantity score was calculated by adding the z-scores of intrinsic motivation and integrated, identified, introjected and external regulations (Vansteenkiste et al., 2009). Amotivation was not included in the equation because amotivation is essentially an absence of self-determination and intention (Deci & Ryan, 2000). A quality score was computed by adding the z-scores using the following weights based on relative

autonomy index (Grolnick & Ryan, 1987): intrinsic motivation (+2), integrated and identified regulations (+1), introjected and external regulations (–1), and amotivation (–2). For each cluster, the quantity score was categorised as "high" (>1.0), "moderate" (–1.0 to 1.0), and "low" (<–1.0) values, and the quality score was categorised as "good" (>2.0), "fair" (–2.0 to 2.0), and "poor" (<–2.0) values (see Vansteenkiste et al., 2009).

To interpret the characteristics of each cluster, three separate multivariate analyses of variance (MANOVAs) were performed across motivational regulations, external variables (anxiety and vitality), and demographic factors (age, playing hours/week, years of playing). In addition, a series of chi-square test of independence were conducted to compare the cluster membership by gender, country (the U.S., China, and other), formal training with a coach (yes or no), and competition level. To further examine the potential differences in performance anxiety and subjective vitality among the motivational profiles, a multivariate analysis of covariance (MANCOVA) was conducted with age, number of playing hours per week, and years of playing as covariates, because there were significant correlations between these variables and anxiety components or vitality in the present study as well as previous research (e.g., Smith et al., 2006). The covariates, however, would be eliminated if they violated any of the two assumptions – independence of the covariate and the grouping variable (i.e., motivational profile) or homogeneity of regression slopes (Huberty & Petoskey, 2000). Partial eta-squared (η_p^2) values of .01, .06, and .14 indicated small, medium, and large effect sizes, respectively, in the multivariate analyses. To determine which specific clusters differed in the study variables from the multivariate analyses, follow-up univariate analyses and Least Significant Difference (LSD) post-hoc tests were performed. Bonferroni-adjusted significant levels of $P = .05$/dependent variables (i.e., .01, 0125 .0167 for the motivational regulations, the external variables, and the demographic factors, respectively) were used to reduce chances of committing Type I errors.

Results

Descriptive statistics and correlations

After screening the data, 15 and 27 participants were deleted due to missing data and outliers, respectively, so the final sample consisted of 281 participants. Table 2 shows the distribution of demographic factors across table tennis background in the final sample. While a greater proportion of women than men had formal training with a coach and higher competition levels (i.e., international and national), a greater proportion of participants from the U.S. and other countries had higher competition levels than those from China. The outliers mostly had poorer motivational profiles (mean = 5.66 [intrinsic], 4.27 [integrated], 4.61 [identified], 3.91 [introjected], 3.57 [external], and 3.43 [amotivation]) and/or higher anxiety levels than the final sample (mean = 12.86 [somatic], 13.00 [worry], 10.86 [concentration]). Deleting the outliers enhanced normal distribution of the data with reduced skewness and kurtosis.

The means, standard deviations, alpha coefficients, skewness, kurtosis, and bivariate relationships among the study variables are displayed in Table 3. The scale scores of the study measures demonstrated good internal consistency (αs > .70; Nunally, 1978) and normal distribution (skewness and kurtosis between –2 and +2) in the present study. Only the number of playing hours per week had highly positive skewness and kurtosis, which may be due to uneven distribution of competition levels with mostly recreational players. Participants generally perceived high levels of autonomous motivation and low levels of controlled motivation and amotivation. Consistent with SDT, the correlation analyses revealed (1) moderate-to-strong positive associations among autonomous forms of motivation (intrinsic, integrated, and identified), among controlled forms of motivation (introjected and external) and amotivation, and among different anxiety components; (2) weak positive associations between all three anxiety components and, controlled forms of motivation and amotivation; (3) moderate-to-strong positive associations between subjective vitality and autonomous forms of motivation and weak negative associations between subjective vitality and, external regulation and amotivation. Deviating from SDT, there were no significant associations between the anxiety components and autonomous forms of motivation, except between intrinsic motivation and, worry and concentration disruption. With regard to the demographics and table tennis participation: (1) age was positively related to intrinsic motivation and negatively related to integrated, introjected, and external regulations,

Table 2. Distribution of gender and countries across competition levels and training background ($N = 281$).

		Training with a coach		Highest competition level					
		Yes ($n = 172$)	No ($n = 109$)	International ($n = 34$)	National ($n = 55$)	State/Provincial/ Regional ($n = 44$)	Local ($n = 43$)	Collegiate ($n = 33$)	Recreational ($n = 72$)
Gender	Men ($n = 237$)	136	101	23	44	41	37	29	63
	Women ($n = 44$)	36	8	11	11	3	6	4	9
Country	United States ($n = 149$)	83	66	12	33	25	20	23	36
	China ($n = 65$)	41	24	7	8	5	14	7	24
	Other ($n = 67$)	48	19	15	14	14	9	3	12

Table 3. Descriptive statistics and correlations among study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Intrinsic motivation	(.88)												
2. Integrated regulation	.29***	(.89)											
3. Identified regulation	.42***	.69***	(.75)										
4. Introjected regulation	−.19**	.34***	.19**	(.85)									
5. External regulation	−.38***	.10	−.02	.67***	(.84)								
6. Amotivation	−.50***	.03	−.15*	.56***	.66***	(.90)							
7. Somatic anxiety	−.07	.09	.08	.20***	.16**	.15*	(.74)						
8. Worry	−.13*	.07	.01	.27***	.17**	.19**	.63***	(.88)					
9. Concentration disruption	−.21***	−.03	−.04	.24***	.27***	.20**	.56***	.51***	(.79)				
10. Subjective vitality	.44***	.42***	.51***	−.04	−.15**	−.28***	.06	−.04	−.09	(.87)			
11. Age	.21***	−.13*	.07	−.24***	−.23***	−.23***	−.19**	−.29***	−.34***	.05	–		
12. Playing hours/week	.22***	.22***	.27***	.09	−.02	−.01	.06	.07	−.03	.13*	.05	–	
13. Years of playing	.06	−.04	.06	−.18**	−.17**	−.15*	−.09	−.17**	−.29***	.07	.58***	−.05	–
Mean	6.40	4.91	5.26	2.45	1.92	1.95	7.76	9.33	7.80	5.31	39.79	5.74	16.65
Standard deviation	0.81	1.50	1.16	1.42	1.14	1.19	2.36	3.41	2.53	1.08	17.68	5.04	15.29
Range	1–7	1–7	1–7	1–7	1–7	1–7	5–20	5–20	5–20	1–7	18–91	0–48	0–78
Skewness	−1.32	−0.48	−0.24	0.84	1.23	1.25	1.04	0.83	0.69	−0.34	0.59	3.01	1.35
Kurtosis	0.81	−0.35	−0.65	−0.25	0.87	0.69	0.83	0.40	−0.29	−0.26	−0.85	18.34	1.27

Note: Alpha coefficients are presented in brackets on the diagonal. *$P < .05$, **$P < .01$, ***$P < .001$.

Table 4. Descriptive statistics and mean comparisons across the three motivational profiles.

	Cluster 1 "Low" (n = 92)		Cluster 2 "Controlled" (n = 81)		Cluster 3 "Self-determined" (n = 108)				
	mean	*SD*	mean	*SD*	mean	*SD*	*F*	*P*	η_p^2
Intrinsic motivation	6.36	0.85	5.82	0.85	6.86	0.29	53.09	<.001	.28
Integrated regulation	3.43	1.19	5.12	0.85	6.02	0.98	163.79	<.001	.54
Identified regulation	4.20	0.84	5.09	0.76	6.29	0.67	195.22	<.001	.58
Introjected regulation	1.45	0.58	3.89	1.14	2.23	1.24	122.48	<.001	.47
External regulation	1.30_a	0.51	3.26	1.09	1.45_a	0.61	178.03	<.001	.56
Amotivation	1.49_a	0.78	3.26	1.13	1.35_a	0.62	137.49	<.001	.50
Somatic anxiety	7.13_a	2.34	8.46_b	2.45	7.78_{ab}	2.17	37.91	.001	.05
Worry	8.55_a	3.16	10.65	3.59	9.00_a	3.22	104.59	<.001	.06
Concentration	7.51_a	2.68	8.73	2.54	7.36_a	2.20	49.26	<.001	.06
Subjective vitality	4.87_a	1.07	4.99_a	0.95	5.94	0.86	34.45	<.001	.21
Age	43.24_a	18.39	32.77	15.23	42.11_a	17.42	10.64	<.001	.07
Playing hours/week	4.31_a	3.57	6.02_{ab}	4.92	6.74_b	5.88	5.94	.003	.04
Years of playing	18.57_a	17.47	12.61_a	10.50	18.01_a	15.88	3.61	.028	.03
Quantity score	−3.21		1.45		1.63				
Quality score	0.00		−5.83		4.33				

Note: SD = Standard deviation; concentration = concentration disruption. Means with the same subscripts indicate no differences based on the Tukey's post-hoc tests using Bonferroni-adjusted significant levels.

amotivation, and all anxiety components; (2) number of playing hours per week was positively related to autonomous forms of motivation and subjective vitality; and (3) number of years playing table tennis was negatively related to controlled forms of motivation, amotivation, worry, and concentration disruption.

Cluster analysis

The agglomeration schedule from the hierarchical cluster analysis demonstrated a large increase in the clustering coefficient from four- to three-cluster solution, and from three- to two-cluster solution. Inspection of the dendrogram indicated a three-cluster solution, thus concluding three clusters of motivational profiles. Using the cluster means from the hierarchical cluster analysis as seed points, *k*-means procedures produced three new clusters that possessed similar cluster means and sizes. Chi-square test of independence showed substantial agreement (Cohen's kappa = .75, $P < .001$) between the hierarchical and non-hierarchical cluster analyses in classifying the participants into each of the three clusters. The cluster solution revealed three types of motivational profiles (Figure 1), namely (1) Cluster 1: "low motivation" (32.8%), (2) Cluster 2: "controlled" (28.8%), and (3) Cluster 3: "self-determined" (38.4%). These profiles demonstrated relatively positive profiles in the majority of the table tennis players who had higher autonomous motivation as well as lower controlled motivation and amotivation.

Table 4 presents the means and standard deviations of the study variables, as well as the quantity and quality scores, for each motivational profile. The quantity and quality of the motivational profiles are considered as follows: (1) Cluster 1: low quantity and fair quality; (2) Cluster 2: high quantity and poor quality; and (3) Cluster 3: high quantity and good quality. The clusters were ranked for further analyses that compared the contribution of motivation quantity and quality: (1) Quantity: Cluster 3 > 2 > 1; and (2) Quality: Cluster 3 > 1 > 2. Results of the three MANOVAs showed that the three motivational profiles varied across motivational regulations, Wilk's $\lambda = .11$, $F(12, 546)$, $P < .001$, $\eta_p^2 = .67$, external variables, Wilk's $\lambda = .72$, $F(8, 550)$, $P < .001$, $\eta_p^2 = .15$, and

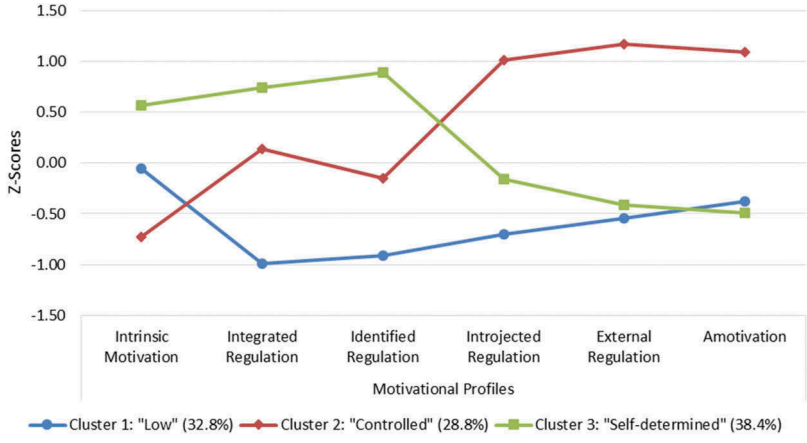

Figure 1. Three–cluster motivational profiles based on the *k*–means procedure.

demographic factors, Wilk's λ = .89, $F(6, 542)$, P < .001, η_p^2 = .06. Follow-up univariate analyses and Tukey's post-hoc tests revealed significant differences in all of the variables between two or among all three profiles, except for years of playing (see Table 4). These differences support the distinction of the three profiles with different characteristics.

Comparisons of cluster membership

Chi-square test of independence indicated significant differences in cluster membership by country, χ^2 (4) = 25.68, P < .001, formal training with a coach, χ^2 (2) = 11.06, P = .004, and competition levels, χ^2 (10) = 20.79, P = .02, but not gender, χ^2 (2) = 1.47, P = .49. Upon examination of the cluster membership, the comparisons of the profile characteristics were as follows:

(1) Country: Cluster 1 contained the largest ratio of players from the U.S. and smallest ratio of players from other countries (64.1% vs. 14.1%); Cluster 2 contained the largest ratio of players from China and the smallest ratio of players from the U.S. (38.3% vs. 39.5%); Cluster 3 contained the largest ratio of players from other countries and the smallest ratio of players from China (33.3% vs. 13.0%).
(2) Formal training with a coach: Cluster 3 contained the largest ratio of players who had a coach to those who did not (70.4% vs. 29.6%), followed by Cluster 2 (64.2% vs. 35.8%), whilst Cluster 1 contained the smallest ratio of players who had a coach to those who did not (47.8% vs. 52.2%).
(3) Competition level: The main differences of cluster membership lie in the ratios of international- and national-levels to recreational-level players. Cluster 3 contained the largest ratio of international and national to recreational levels (16.7% and 24.1% vs. 15.7%), followed by Cluster 2 (12.3% and 21.0% vs. 25.9%), whilst Cluster 1 contained the smallest ratio of international and national to recreational levels (6.5% and 13.0% vs. 37.0%).

Performance anxiety and subjective vitality across motivational profiles

Age and playing hours were eliminated as covariates, because both of them were significantly associated with and not independent of the motivational profiles (see Table 2). Therefore, only years of playing was entered as a covariate in the final MANCOVA. Results indicated that years of playing was a significant covariate, Wilk's λ = .91, $F(4, 272)$, P < .001, η_p^2 = .09, and the motivational profiles contributed to a significant and large multivariate effect on performance anxiety and subjective vitality, Wilk's λ = .73, $F(8, 544)$, P < .001, η_p^2 = .15. The multivariate model explained approximately 5.1%, 8.2%, 12.1%, and 21.9% of the variance in somatic anxiety, worry, concentration disruption, and subjective vitality, respectively. Follow-up univariate analyses and LSD post-hoc tests[1] revealed significant effects for all anxiety components with small effect sizes and vitality with a large effect size: (1) somatic anxiety was significantly greater in Cluster 2 than Cluster 1 (P < .001, η_p^2 = .04); (2) worry was significantly greater in Cluster 2 than Cluster 1 and Cluster 3 (Ps < .0125, η_p^2 = .05); (3) concentration disruption was significantly greater in Cluster 2 than Cluster 1 and Cluster 3 (Ps < .0125, η_p^2 = .04); and (4) subjective vitality was significantly greater in Cluster 3 than Cluster 1 and Cluster 2 (Ps < .001, η_p^2 = .21). The specific estimated marginal means of the variables from the MANCOVA results are shown in Figure 2.

Discussion

The present study examined the motivational profiles in a sample of 281 table tennis players, and their relations with

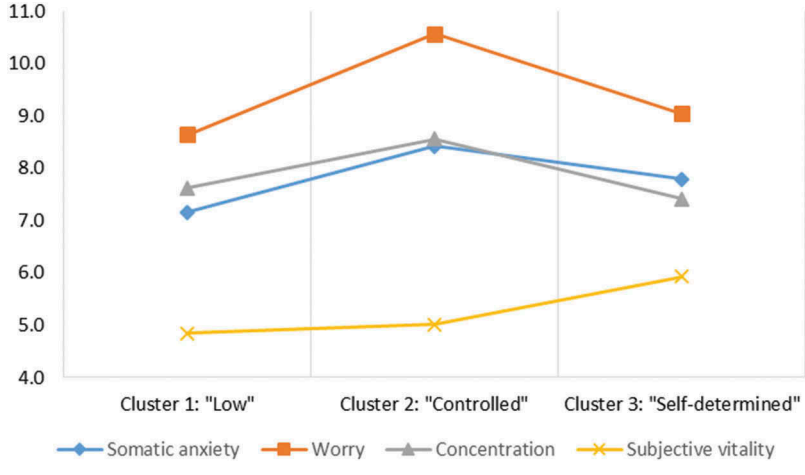

Figure 2. MANCOVA's estimated marginal means of performance anxiety and subjective vitality across motivational profiles with years of playing (mean = 16.65) as a covariate.

[1]LSD was used in place of Tukey's post hoc tests for two reasons (Keselman et al., 1998): (1) Tukey's is not an option in ANCOVA or MANCOVA analyses with covariates performed in SPSS; and (2) the analyses were controlled for by the covariates and Bonferroni-adjusted significance levels were used to reduce Type I errors.

performance anxiety and subjective vitality. The results corresponding to each hypothesis are discussed below.

Characteristics and composition of motivational profiles

Cluster analyses revealed three distinct motivational profiles in this sample that were similar to the three profiles found in elite young table tennis players (Martinent & Decret, 2015), including "self-determined" and "low" profiles. The self-determined profile was characterised by high autonomous motivation, moderate controlled motivation, and low amotivation; the low profile was characterised by low autonomous and controlled extrinsic motivations, as well as moderate intrinsic motivation and amotivation. Yet, instead of a "moderate" profile (Martinent & Decret, 2015), the current sample consisted of a "controlled" profile, characterised by low intrinsic motivation, moderate autonomous extrinsic motivation, and high controlled motivation and amotivation. It is worth noting that the controlled profile still had higher autonomous motivation scores and lower controlled motivation scores than the scale midpoint (4). The absolute motivation scores of the controlled profile in this sample were indeed similar to Martinent and Decret's (2015) moderate profile, although their relative motivation scores were considered "controlled" when compared to other participants in this sample, which consisted of many recreational players with very high intrinsic motivation instead of all competitive players. This sampling strategy might also have contributed to a truly self-determined profile (high autonomous–low controlled) that did not exist in the five studies on motivational profiles in sports (Gillet, Berjot, et al., 2009; Gillet, Vallerand, et al., 2009; Gillet et al., 2012; Martinent & Decret, 2015; Vlachopoulos et al., 2000).

The first hypothesis is supported. Consistent with previous research (Clancy et al., 2016), among the three profiles, the self-determined profile consisted of the largest ratios of players who had a coach and who played at the national and international level; the low profile consisted of the largest ratios of players who never had a coach and who played recreationally. This finding may be partially explained by the premise of SDT that individuals who exhibit higher self-determination tend to have higher commitment and performance in any performance domain (Deci & Ryan, 2000). Additionally, the composition of motivational profiles differed by country. An interesting and unexpected finding emerged is that the players from China had the largest ratio of controlled profile and the smallest ratio of self-determined profile, whereas the players from the U.S. had the largest ratio of low profile and the smallest ratio of controlled profile. These differences can be attributed to different reward systems in table tennis between the U.S. and China.

Not much incentive is offered to play table tennis in the U.S. due to a larger emphasis on team sports such as American football, basketball, and baseball, so most table tennis players would neither view playing table tennis as their important values nor pursue external rewards for motivation. In contrast, table tennis is one of the most competitive and popular sports in China, so people are more likely to be drawn to play table tennis due to external incentives, including award money and social status. This finding is in line with research on competition and intrinsic motivation that demonstrates the pressure to win, especially when attached to monetary reward, reduces the positive effect of winning and overall intrinsic motivation and intensifies the negative effect of losing in sport settings (Ryan & Deci, 2017). Additionally, having mostly lower-level (recreational and local) players in the Chinese subsample could potentially explain why the controlled profile consisted of a larger proportion of players from China as compared to other countries (Clancy et al., 2016). Consistent with previous studies, no gender differences were found in the composition of motivational profiles (Gillet, Berjot, et al., 2009; Gillet, Vallerand, et al., 2009; Gillet et al., 2012; Martinent & Decret, 2015; Vlachopoulos et al., 2000).

Performance anxiety and subjective vitality

The second hypothesis is supported. The controlled profile had greater somatic anxiety, worry, and concentration disruption than the self-determined and the low profiles. In particular, the differentiations of worry and concentration disruption were the most prominent, which implied that motivational profile might better predict cognitive than somatic anxiety. This interpretation makes practical sense because players in the controlled profile would think more about external rewards or negative consequence related to their competition, which would trigger negative thoughts and a loss of focus (Horn et al., 2011). On the other hand, the self-determined and the low profiles had similar levels of all three anxiety components, which might be due to the fact that the low-motivation players would not have a strong desire or pressure to perform well in competitions and thus experience weaker emotions. The discrimination of subjective vitality across motivational profiles revealed that the self-determined profile perceived table tennis as an autonomous activity, rather than a controlled activity that might be perceived by the controlled and the low profiles, which fostered feelings of energy and well-being from playing the sport (Nix et al., 1999).

Our results are consistent with the SDT tenets and academic motivation research that show the quality of motivation is more important than the quantity of motivation for adaptive outcomes (Vansteenkiste et al., 2009), thus supporting the third hypothesis. The importance of motivation quality over quantity is evidenced by the quality and quantity scores, such that the low profile (low quantity, fair quality) had lower somatic anxiety, worry, and concentration disruption than the controlled profile (high quantity, poor quality), although their subjective vitality was comparable. In theory, this finding provided further evidence that the amount of motivation is not the higher the better. In practice, sport psychology consultants may help coaches create an empowering motivational climate that supports basic psychological needs to foster a self-determined profile among players, rather than a disempowering climate that thwarts basic psychological needs to result in a controlled profile. If sport psychology consultants assess and understand players' motivational profiles, they can

assist coaches in developing individualised strategies to create optimal motivational climates for each player. More importantly, these individualised strategies need to match with the specific culture and sports system in order to facilitate self-determination effectively. For instance, an optimal motivational climate may be created through different coaching strategies in individualist cultures than in collectivist cultures (Si, Duan, Li, Zhang, & Su, 2015).

The findings of this study suggest that although a self-determined profile is the most adaptive motivational profile, in reality many players who want to achieve their goal may possess other types of motivational profiles, which require adaptions in coaching strategies to create an empowering climate and foster self-determination. Whilst players who are more self-determined or compete at a higher level may be immune to negative effects of extrinsic rewards, those who belong to the controlled profile are vulnerable to performance anxiety due to extrinsic rewards and critical feedback from coaches (Ryan & Deci, 2017). Thus, this study provide new insights into the quality and quantity of motivational profiles for coaching interventions based on these profiles. Further research is warranted to examine the effectiveness of matching motivational profiles with intervention strategies accordingly.

Limitations and future directions

There are several limitations related to the study design that need to be addressed in the present study. First, a cross-sectional research design was employed with the use of self-report measures, hence no causal relationships can be drawn from the findings. More longitudinal and experimental studies are needed to determine the effects of motivational profile on anxiety and vitality, and vice versa. Due to our participant recruitment through club presidents and coaches, most players who volunteered to participate were likely the ones with high interest and value in table tennis. In other words, players who have high controlled motivation, amotivation, and anxiety would be less likely to participate in the present study. Therefore, the exceptionally high mean score of intrinsic motivation in the present study may not have represented all players' motivation.

It is important to note that results from a person-centred approach is sample-specific. Future studies are therefore needed to sample players who may have dropped out of table tennis in order to examine any differences in their motivational profiles. Although our sample consisted of both current and former players, their distinction was not made in data collection. Moreover, because of gender imbalance and multiple competition levels in the present study, future research should recruit more women and players of certain competition levels for better representation and comparisons of motivational profiles in table tennis players. Further investigations of the potential interactions between competition levels and countries related to motivational profiles would also yield meaningful implications. For instance, a U.S. national player may have a similar skill level and motivational profile to a provincial-level player in China due to differences in the competition levels across countries.

Regarding the assessment of the study variables, contextual motivation and trait anxiety were used. Our recruitment of some participants at the competition venues might have affected their general responses to a certain extent by taking situational motivation and state anxiety into account. Future studies might examine motivational profiles based on situational motivation to compare and contrast the profiles with those based on contextual motivation. Furthermore, assessment of performance anxiety could include directional interpretation and frequency to provide a more comprehensive understanding of the adaptive and maladaptive natures of perceived anxiety (Jones, 1995).

Conclusions

To our knowledge, this is the first study that investigates sport motivational profiles by including integrated regulation and examines performance anxiety and subjective vitality across these profiles. Our results suggest that motivational profiles differed by country, training with a coach, and competition levels, but not by gender. The motivational profiles were also associated with performance anxiety and subjective vitality in that the quality of motivation plays a main role. This finding provides practical information for coaches and sport psychology consultants to diagnose and intervene with table tennis players who may experience motivational and performance issues. After assessing players' motivational profiles across various time points of a season (Martinent & Decret, 2015), they can be assigned to intervention programs specifically tailored to improve their motivation. More specifically, each motivational profile represents a distinct starting point for a person to progress through internalisation toward the adaptive self-determined profile. Because these profiles do not necessarily signify a linear relationship with performance outcomes, continuous assessment of player profiles and adaptions in coaching strategies become crucial for creating optimal motivational climates.

Alongside various motivational strategies that guide players through practice and competitions when extrinsic rewards are inevitable, coaches should generally provide table tennis players with frequent informational feedback as well as opportunities to be involved in decision-making concerning practice schedules, tournament selection, and training partners (Horn et al., 2011). In addition, coaches can help their players set achievable self-referenced goals in order for them to feel more competent and autonomous in table tennis. These strategies can in turn reduce performance anxiety and enhance subjective vitality. To examine the effectiveness of different interventions for improving specific types of motivational profile, further intervention studies using a person-centred approach are warranted.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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