Passion and engagement in sport: A look at athletes and coaches using a quadripartite approach

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Abstract

Athletes and coaches often feel a great deal of passion for sport. But are these highly passionate individuals also highly engaged in sport? Based on the theoretical underpinnings and empirical findings from the dualistic model of passion (Vallerand, 2015), it is unclear if the highest levels of sport engagement are associated with high levels of passion, or with specific combinations of high/low levels of harmonious and obsessive passion. We examined this issue in samples of athletes (*N* = 403) and coaches (*N* = 208). Participants completed online questionnaires assessing dimensions of sport passion (i.e., harmonious and obsessive passion) and engagement (i.e., confidence, vigor, dedication, enthusiasm). In both samples, we found that the highest levels of engagement were associated with high harmonious passion. This means that those who are passionate toward sport are not necessarily engaged in sport; engagement is found when passion involves high harmonious passion.

Keywords: athlete engagement questionnaire; dualistic model of passion; harmonious passion; obsessive passion; passion scale

Research on sport passion has relied extensively on the dualistic model of passion (Vallerand, 2015; Vallerand & Verner-Filion, 2020). This model distinguishes between two passion dimensions: *harmonious passion* (HP), involving a balanced, flexible engagement in an activity that one loves, and *obsessive passion* (OP), involving a rigid, all-consuming engagement in an activity that one loves. Recently, research has started to focus on the idea that both passion dimensions can coexist within people to different degrees (Vallerand, 2015), and that sport outcomes may be predicted by different within-person combinations of HP and OP. For instance, the quadripartite approach to passion (Schellenberg et al., 2019) focusses on four prototypical passion subtypes: pure HP (high HP combined with low OP), pure OP (low HP combined with high OP), mixed passion (high HP combined with high OP), and non-passion (low HP combined with low OP). Research among recreational and elite athletes (Schellenberg et al., 2021, 2023) has found that the most adaptive outcomes are often associated with high HP, especially in combination with low OP (i.e., pure HP). This conclusion has been drawn from research with various sport outcomes including self-reported performance, group cohesion, positive affect, and sportspersonship (Schellenberg et al., 2021, 2023).

But this general conclusion may be different with one key sport outcome: engagement. Engagement has been studied primarily with athletes and is defined as an optimal and long-lasting sport experience involving four dimensions: *confidence* (i.e., belief in one's ability to achieve goals in sport), *vigor* (i.e., physical, mental, and emotional liveliness), *dedication* (i.e., desire to devote time/energy toward goal pursuit), and *enthusiasm* (i.e., feeling excitement and enjoyment; Lonsdale et al., 2007). Athlete engagement is clearly adaptive and has been associated with other positive outcomes such as greater flow and lower burnout (DeFreese & Smith, 2013; Hodge et al., 2009).

However, it is unclear how sport engagement is associated with different combinations of HP and OP. On one hand, both HP and OP involve intensely pursuing an activity and devoting a great deal of time and energy toward it (Vallerand, 2015). Thus, you would think that those with the highest levels of engagement in sport are those with high levels of both HP and OP. Indeed, research with students has shown that levels of academic engagement (conceptualized as involving a sense of vigor, dedication, and absorption; Schaufeli et al., 2002) are highest among students with high HP and high OP (Bélanger & Ratelle, 2021; Stoeber et al., 2011). But on the other hand, OP can prevent people from fully partaking in an activity because it involves feelings of conflict and defensiveness (Vallerand, 2015). In contrast, HP allows people to engage in an activity with a sense of control, balance, and security. There is even evidence that having high HP can compensate for the costs that come with high OP (Schellenberg et al., 2021). This means that, in line with the hypotheses of the quadripartite approach and findings with other adaptive outcomes in sport (Schellenberg et al., 2021, 2023), those with high HP may report the highest levels of sport engagement, particularly when combined with low OP. Therefore, it is currently not known if the highest levels of sport engagement are associated with high HP (i.e., either pure HP or mixed passion), high HP combined with high OP (i.e., only mixed passion), or high HP combined with low OP (i.e., only pure HP). The purpose of this research was to address this question.

The Current Research

We examined associations between HP, OP, and sport engagement in two samples: recreational athletes and coaches. Although most research on sport engagement has been conducted with athletes, we reasoned that it was also important to understand the factors that predict engagement among coaches (e.g., Balk et al., 2019). We obtained institutional ethics approval prior to data collection from the University of Manitoba (Protocol #HE2021-0210, "Wellness in Sport Study"). Anonymous data and Mplus files for each sample are available on the Open Science Framework at https://osf.io/kphbr. Accompanying this Short Communication is a Supplementary File that provides more specific details on (a) the quadripartite approach, (b) power analyses, (c) quality control criteria with each sample, (d) the measurement models with the athlete sample, and (e) descriptive statistics and correlations.

Method

Participants and Procedure

Our preference was to analyze the data from both samples using structural equation modeling. To do so, based on a power analysis using the pwrSEM app (Wang & Rhemtulla, 2021), we needed at least 400 participants in each sample to achieve desired power (.80) to test each regression coefficient. We recruited a sufficient sample of athletes (N = 403), but not of coaches (N = 208). However, using G*Power (Faul et al., 2009), we determined that the sample size of coaches was sufficient to conduct the analyses using observed scores (with adjustments made to account for measurement error).

We recruited athletes from Prolific Academic; any user who indicated that they played a sport was eligible to participate. An additional 11 athletes were excluded because they did not pass our quality control criteria. Athletes (270 men, 130 women, 1 non-binary, 2 did not report a gender) ranged from 18 to 65 years old (M = 26.31 years, SD = 7.55 years), and most identified having a White/European (59.31%) or Black (18.61%) ethnic/cultural background. On average, participants spent 7 hours (SD = 7.15 hours) per week playing their sport and, when asked to rate how competitive their sport was on a scale from 1 (*not at all*) to 5 (*extremely*), reported that their sport was moderately competitive (*M* = 3.74, *SD* = 1.08). Each athlete received £1.47 for agreeing to participate.

We invited coaches to complete our survey by (a) posting advertisements on social media, and (b) emailing coaches of university-level teams throughout Canada directly. An additional eight coaches were excluded because they did not pass our quality control criteria, and an additional 30 responses were excluded because we suspected they were from bots. Coaches (148 men, 55 women, 5 did not report a gender) ranged from 19 to 78 years old (*M* = 43.05 years, *SD* = 12.88 years), and most identified having a White/European (75.96%) ethnic/cultural background. On average, participants spent 22.63 hours (*SD* = 18.04 hours) per week coaching their sport and, using the same scale used in the athlete sample, reported coaching at a competitive level (*M* = 4.33, *SD* = 0.88). Each coach was entered into a draw to win a gift card.

All interested athletes and coaches clicked a link which redirected them to an online survey. Participants completed the survey after providing informed consent. The survey items were the same for both samples but were modified to be relevant for either athletes or coaches.

Measures

Harmonious and Obsessive Passion. Levels of HP and OP were assessed with the Passion Scale (PS; Marsh et al., 2013; Vallerand, 2015). The PS assesses HP and OP with 6 items each, using a scale from 1 (*not agree at all*) to 7 (*totally agree*). Items were modified to apply to either athletes (e.g., HP item: “My sport is in harmony with the other activities in my life”), or coaches (e.g., OP item: “I have almost an obsessive feeling for coaching”).

Sport Engagement. We assessed sport engagement in both samples using the Athlete Engagement Questionnaire (AEQ; Lonsdale et al., 2007). The AEQ assesses four dimensions of engagement (confidence, vigor, dedication, enthusiasm) with four items each, using a scale from

1 (*almost never*) to 5 (*almost always*). With the sample of coaches, the items were modified to be related to coaching (e.g., vigor item: “I feel energized when I coach”).[1]

Data Analysis

In both samples, we tested the association between dimensions of passion and engagement by (a) simultaneously regressing all four engagement scales on both HP and OP, and (b) testing differences between the four prototypical passion subtypes using simple slopes and calculating Cohen’s *d*. Note that main effects models were analyzed because there were no significant HP × OP interactive effects. With the sample of athletes, we first tested the factor structure of the PS and AEQ individually, and a measurement model that included latent factors representing each dimension of passion and engagement (i.e., scale items loading onto six latent factors). With the sample of coaches, we modeled each variable as a single indicator latent factor with loadings fixed to 1.0 and unique variances fixed to the following formula: (1-reliability) *variance (Williams & Boyle, 2008). Reliability values were estimated using Cronbach’s alpha. All analyses were conducted with Mplus using robust maximum likelihood (MLR) estimation.

Results

Results of the structural models are displayed in Table 1, passion subtype comparisons are displayed in Tables 2 (athlete sample) and 3 (coach sample), and plots of predicted engagement scores for each passion subtype are displayed in Figure 1. We identified outliers from the analyses with athletes ($n = 1$) and coaches ($n = 3$) by inspecting log-likelihood distance influence measures (Cook & Weisberg, 1982) and removed them from the analyses.

[1] We conducted a confirmatory factor analysis to test the four-factor structure of the AEQ that we adapted for coaching. Acceptable model fit was obtained after the inclusion of two sets of correlated residuals between two items from the enthusiasm scale and two items from the confidence scale: MLR χ^2 (96) = 235.259, $p < .001$, RMSEA = .084 90% CI [.071, .098], CFI = .925, TLI = .906.

With the sample of athletes, HP was positively associated with all dimensions of engagement, whereas OP was negatively associated with vigor and enthusiasm, but not associated with confidence and dedication. When we compared predicted values for each passion subtype, pure HP was associated with the highest levels of vigor and enthusiasm, whereas both pure HP and mixed passion were associated with the highest levels of confidence and dedication.

With the sample of coaches, HP was positively associated with all dimensions of engagement, whereas OP was positively associated with dedication, but not associated with any other engagement dimension. When predicted values for each passion subtype were compared, mixed passion was associated with the highest levels of dedication, whereas both pure HP and mixed passion were associated with the highest levels of confidence, vigor, and enthusiasm.

Discussion

Our goal in this research was to examine whether the highest levels of sport engagement are found when HP is high (mixed passion or pure HP), when both HP and OP are high (mixed passion), or when HP is high and OP is low (pure HP). With both athletes and coaches, we found that all dimensions of engagement were positively associated with HP (i.e., both pure HP and mixed passion). In two cases (with vigor and enthusiasm among athletes) engagement was even higher when high HP was combined with low OP (i.e., pure HP), and in one case (with dedication among coaches) the highest levels of engagement were found when high HP was combined with high OP (i.e., mixed passion). This latter finding supports those that have been obtained with students in the academic domain (e.g., Bélanger & Ratelle, 2021; Stoeber et al., 2021). But in general, the main takeaway from this research is that it is most important to have high levels of HP in order to experience the greatest levels of engagement in sport.

But what about those with the lowest levels of engagement? Unsurprisingly, low levels of both HP and OP (i.e., non-passion) were associated with low levels of all dimensions of engagement in both samples. However, with the exception of dedication among coaches, the levels of engagement that were associated with non-passion were either not significantly different from or, in two cases (with vigor and enthusiasm among athletes), significantly *greater* than those associated with pure OP. Athletes with pure OP pursue sport with all the hallmarks of OP (sense of conflict, defensiveness, lack of activity control) and without any of the hallmarks of HP (sense of balance, personal volition). This may prevent athletes with pure OP from being able to be fully engaged in sport and, interestingly, result in levels of engagement that are no different from or are even lower than athletes who do not consider themselves to be passionate about their sport. This finding underscores the broad message from research on the dualistic model of passion in sport (Vallerand & Verner-Filion, 2020): when predicting sport outcomes, the quality of passion (i.e., HP and OP) matters.

This research is limited by its use of a cross-sectional design and reliance on self-report assessments. We also chose to assess engagement in coaches using a version of the AEQ that we modified for coaches. Although others have opted to assess coach engagement using scales designed for the workplace (Balk et al., 2019), we chose to modify the AEQ because it had been developed specifically for the sport domain. However, this approach assumes that engagement among coaches maps on to the same four dimensions of engagement among athletes, which may not be the case. More research is needed on coach engagement, and on the link between passion and engagement using different study designs (longitudinal, other-report), sport samples (officials, parents, volunteers), and examining mediating or moderating variables.

To conclude, sport passion does not always translate into sport engagement; to achieve the highest levels of engagement, this research shows that this passion needs to involve high levels of HP.

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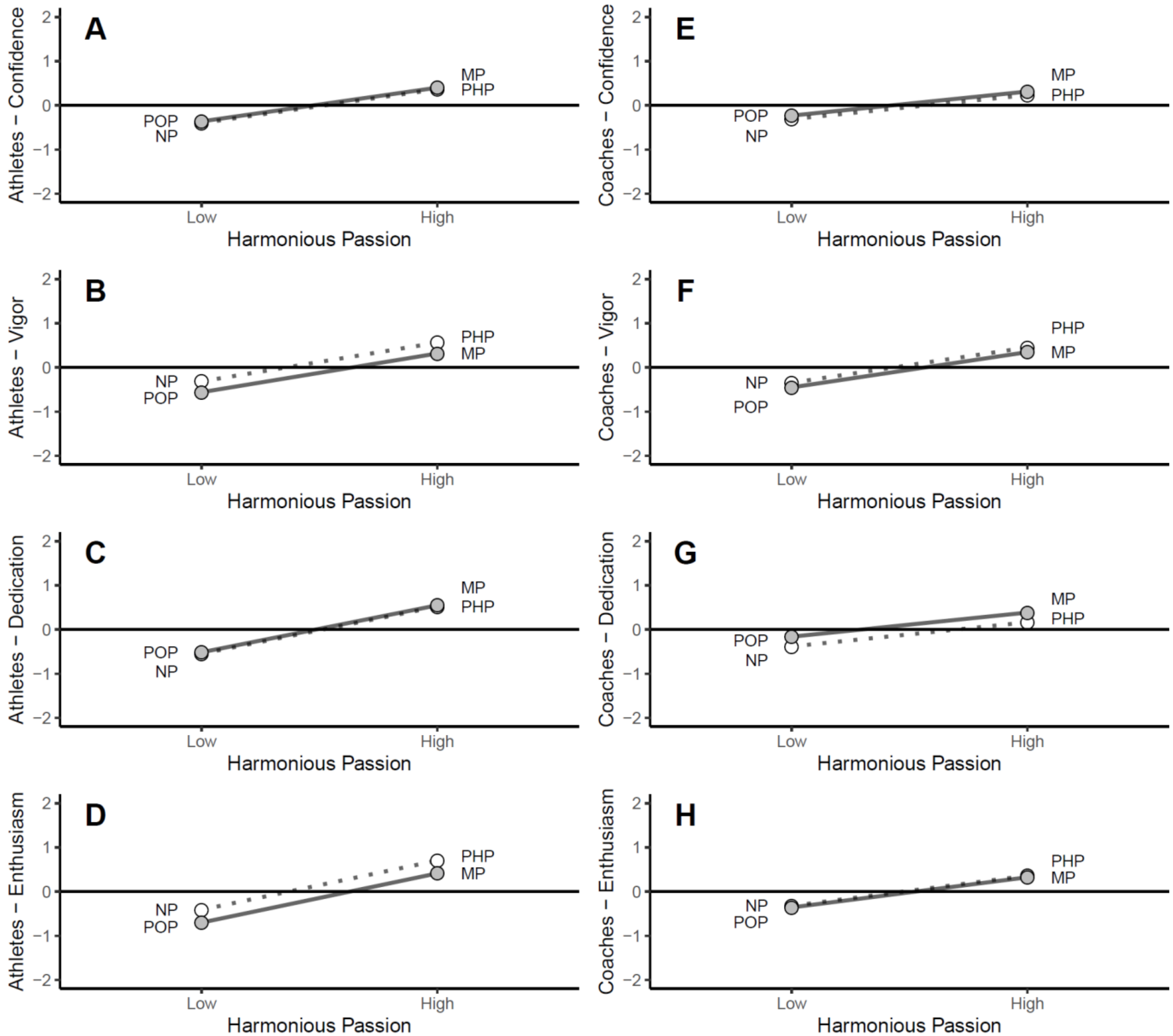
Figure Caption

Figure 1. Associations between harmonious passion, obsessive passion, and each dimension of sport engagement among samples of athletes (Panels A-D) and coaches (Panels E-H). High and low values of harmonious and obsessive passion are plotted at one standard deviation above and below the mean. Solid lines represent high obsessive passion; dotted lines represent low obsessive passion. Passion scores are mean centered and all outcomes are standardized. PHP = pure harmonious passion; POP = pure obsessive passion; MP = mixed passion; NP = non passion.

Figure 1



A
Athletes – Confidence
MP
PHP
POP
NP
Low
High
Harmonious Passion
B
Athletes – Vigor
PHP
MP
NP
POP
C
Athletes – Dedication
D
Athletes – Enthusiasm
E
Coaches – Confidence
F
Coaches – Vigor
G
Coaches – Dedication
H
Coaches – Enthusiasm

Table 1
Results from Multivariate Regression Analysis

	Harmonious Passion					Obsessive Passion				
	b	*SE*	95% CI	*p*	*B*	*b*	*SE*	95% CI	*p*	*B*
Athletes										
Confidence	0.382	0.051	[0.283, 0.482]	<.001	.601	0.019	0.040	[-0.059, 0.096]	.637	.029
Vigor	0.439	0.049	[0.344, 0.535]	<.001	.801	-0.123	0.041	[-0.203, -0.043]	.002	-.225
Dedication	0.533	0.050	[0.436, 0.630]	<.001	.703	0.016	0.048	[-0.078, 0.110]	.743	.021
Enthusiasm	0.558	0.047	[0.466, 0.649]	<.001	.837	-0.145	0.045	[-0.234, -0.056]	.001	-.218
Coaches										
Confidence	0.298	0.054	[0.192, 0.404]	<.001	.482	0.032	0.040	[-0.047, 0.111]	.431	.072
Vigor	0.436	0.050	[0.339, 0.534]	<.001	.652	-0.042	0.040	[-0.120, 0.036]	.294	-.087
Dedication	0.299	0.061	[0.178, 0.419]	<.001	.432	0.087	0.040	[0.008, 0.166]	.030	.176
Enthusiasm	0.373	0.045	[0.284, 0.461]	<.001	.580	-0.014	0.035	[-0.083, 0.055]	.690	-.030

Table 2

Athlete Sample: Associations Between Passion Subtypes and Engagement Dimensions

	d	Description	*b*	*SE*	95% CI
Confidence					
H1: PHP v. POP	1.121**	----	----	----	----
H2: MP v. PHP	0.058	OP main effect	0.019	0.040	[-0.059, 0.096]
H3: PHP v. NP	1.179**	HP main effect	0.382**	0.051	[0.283, 0.482]
H4: MP v. POP	1.179**	HP main effect	0.382**	0.051	[0.283, 0.482]
H5: POP v. NP	0.058	OP main effect	0.019	0.040	[-0.059, 0.096]
H6: MP v. NP	1.236**	----	----	----	----
Vigor					
H1: PHP v. POP	1.964**	----	----	----	----
H2: MP v. PHP	-0.430**	OP main effect	-0.123	0.041	[-0.203, -0.043]
H3: PHP v. NP	1.534**	HP main effect	0.439	0.049	[0.344, 0.535]
H4: MP v. POP	1.534**	HP main effect	0.439	0.049	[0.344, 0.535]
H5: POP v. NP	-0.430**	OP main effect	-0.123	0.041	[-0.203, -0.043]
H6: MP v. NP	1.104**	----	----	----	----
Dedication					
H1: PHP v. POP	1.343**	----	----	----	----
H2: MP v. PHP	0.041	OP main effect	0.016	0.048	[-0.078, 0.110]
H3: PHP v. NP	1.384	HP main effect	0.533	0.050	[0.436, 0.630]
H4: MP v. POP	1.384**	HP main effect	0.533	0.050	[0.436, 0.630]
H5: POP v. NP	0.041	OP main effect	0.016	0.048	[-0.078, 0.110]
H6: MP v. NP	1.425**	----	----	----	----
Enthusiasm					
H1: PHP v. POP	2.156**	----	----	----	----
H2: MP v. PHP	-0.445**	OP main effect	-0.145	0.045	[-0.234, -0.056]
H3: PHP v. NP	1.711**	HP main effect	0.558	0.047	[0.466, 0.649]
H4: MP v. POP	1.711**	HP main effect	0.558	0.047	[0.466, 0.649]
H5: POP v. NP	-0.445**	OP main effect	-0.145	0.045	[-0.234, -0.056]
H6: MP v. NP	1.266**	----	----	----	----

Note. HP = harmonious passion. OP = obsessive passion. PHP = pure harmonious passion. POP = pure obsessive passion. MP = mixed passion. NP = non-passion. *$p \leq .05$. **$p \leq .01$

Table 3

Coach Sample: Associations Between Passion Subtypes and Engagement Dimensions

	d	Description	*b*	*SE*	95% CI
Confidence					
H1: PHP v. POP	0.814**	----	----	----	----
H2: MP v. PHP	0.141	OP main effect	0.032	0.040	[-0.047, 0.111]
H3: PHP v. NP	0.955**	HP main effect	0.298	0.054	[0.192, 0.404]
H4: MP v. POP	0.955**	HP main effect	0.298	0.054	[0.192, 0.404]
H5: POP v. NP	0.141	OP main effect	0.032	0.040	[-0.047, 0.111]
H6: MP v. NP	1.096**	----	----	----	----
Vigor					
H1: PHP v. POP	1.522**	----	----	----	----
H2: MP v. PHP	-0.178	OP main effect	-0.042	0.040	[-0.120, 0.036]
H3: PHP v. NP	1.344**	HP main effect	0.436	0.050	[0.339, 0.534]
H4: MP v. POP	1.344**	HP main effect	0.436	0.050	[0.339, 0.534]
H5: POP v. NP	-0.178	OP main effect	-0.042	0.040	[-0.120, 0.036]
H6: MP v. NP	1.165**	----	----	----	----
Dedication					
H1: PHP v. POP	0.529	----	----	----	----
H2: MP v. PHP	0.358*	OP main effect	0.087	0.040	[0.008, 0.166]
H3: PHP v. NP	0.887**	HP main effect	0.299	0.061	[0.178, 0.419]
H4: MP v. POP	0.887**	HP main effect	0.299	0.061	[0.178, 0.419]
H5: POP v. NP	0.358*	OP main effect	0.087	0.040	[0.008, 0.166]
H6: MP v. NP	1.244**	----	----	----	----
Enthusiasm					
H1: PHP v. POP	1.277**	----	----	----	----
H2: MP v. PHP	-0.063	OP main effect	-0.014	0.035	[-0.083, 0.055]
H3: PHP v. NP	1.214**	HP main effect	0.373	0.045	[0.284, 0.461]
H4: MP v. POP	1.214**	HP main effect	0.373	0.045	[0.284, 0.461]
H5: POP v. NP	-0.063	OP main effect	-0.014	0.035	[-0.083, 0.055]
H6: MP v. NP	1.151**	----	----	----	----

Note. HP = harmonious passion. OP = obsessive passion. PHP = pure harmonious passion. POP = pure obsessive passion. MP = mixed passion. NP = non-passion. *$p \leq .05$. **$p \leq .01$

Supplementary Material

Passion and engagement in sport: A look at athletes and coaches using a quadripartite approach

1. An Overview of the Quadripartite Approach

The quadripartite approach (Schellenberg et al., 2019) is a way of assessing outcomes that are associated with different within-person combinations of harmonious passion (HP) and obsessive passion (OP). The approach adopts variable-centered analyses (e.g., regression analyses, structural equation modeling) to predict scores of an outcome variable based on pre-specified scores of HP and OP. The approach uses pre-specified scores of 1 *SD* above and below the mean of HP and OP. Using +/- 1 *SD* allows for the estimation of outcome scores for participants with scores on HP and OP that are higher or lower than sample averages. This procedure means that four prototypical passion subtypes can be specified: pure HP (high HP combined with low OP), pure OP (low HP combined with high OP), mixed passion (high HP combined with high OP), and non-passion (low HP combined with low OP).

It is important to stress that, unlike person-centered approaches (e.g., profile analysis), the quadripartite approach does *not* classify people into groups or categories. Again, it estimates scores on outcome variables based on a specific combination of scores (i.e., +/- 1 *SD*) on both HP and OP. This means that this approach allows researchers to ask the general question: if a person had a certain HP score and a certain OP score, what would we predict their score to be on a dependent variable? For example, if a person had a high HP score and a low OP score (i.e., pure HP), what would be their predicted level of sport dedication? And would this predicted score differ from a person who had a high HP score and a high OP score (i.e., mixed passion)?

Scores for the four prototypical passion subtypes can be estimated using models that include main effects only (i.e., HP, OP), or both main and interactive effects (i.e., HP, OP HP ×

OP). Note that either main or interactive effect models can be used to compare the four subtypes. To maintain model parsimony, main effects models are often interpreted when the HP × OP interactive effect is not significant, as was the case in our analysis (see Gaudreau, 2012). In previous passion research, obtaining a significant HP × OP interactive effect is not very common.

Once predicted values are computed for each subtype, they can be compared by either (a) calculating simple slopes for the relationship between one dimension of passion and high and low levels of the other passion dimension, or (b) computing Cohen's *d* values using predicted scores for two subtypes and the standard deviation of the outcome variable. Note that comparing pure HP with pure OP and mixed passion with non-passion cannot be done using simple slopes. These comparisons are critical for testing the six hypotheses of the quadripartite approach. The first three hypotheses predict that pure HP will be associated with greater levels of adaptive outcomes than pure OP (Hypothesis 1), mixed passion (Hypothesis 2), and non-passion (Hypothesis 3). Hypothesis 4 predicts that mixed passion will be associated with greater levels of adaptive outcomes than pure OP. Hypothesis 5 was originally presented as two competing hypotheses predicting that pure OP will be associated with better (Hypothesis 5a) or worse (Hypothesis 5b) outcomes than non-passion; however, the evidence accumulated so far has strongly supported Hypothesis 5b, and almost no support has been attained to support Hypothesis 5a (Schellenberg et al., 2019, 2021, 2023). Finally, competing hypotheses were also originally proposed for Hypothesis 6, which predicts that mixed passion will be associated with better (Hypothesis 6a) or worse (Hypothesis 6b) outcomes than non-passion.

2. Power Analyses

Athlete Sample

The analysis with pwrSEM (Wang & Rhemtulla, 2021) included the following specifications: all loadings = .70, all regression coefficients = .20 (all specified as target effects), correlation between HP and OP = .40, α = .05, 1,000 simulations, desired power = .80. A main effects model was specified because it is not very common to observe interactions between HP and OP.

Coach Sample

The analysis with G*Power (Faul et al., 2009) included the following specifications: test = linear multiple regression: fixed model, R^2 increase; effect size f^2 = .085 (small-to-medium effect); α = .05; power = .80; number of tested and total predictors = 2. Again, a main effects model was specified (i.e., 2 predictors: HP and OP).

3. Quality Control Procedures

We took steps to check for dishonest or careless responses. First, at the end of each survey, all participants responded to the following question: “Did you answer all the questions on this survey honestly? If so, please enter ‘yes’ in the box below”. Those who reported that they did not respond honestly were excluded from the analysis (athlete n = 8; coach n = 0). Second, dispersed throughout each survey was the 5-item Conscientious Responders Scale (Marjanovic et al., 2014), which asked participants to respond to questions in a specific way (e.g., “To answer this question, please choose option number four, ‘Moderately Agree’”). Participants who did not answer at least three of the five items in the specified way were removed (athlete n = 3; coach n = 8).

We also inspected the results for suspicious response patterns, particularly those from coaches recruited via social media, given the growing concerns with automatic survey-takers (i.e., bots; Storozuk et al., 2020). We identified 30 responses that were almost certainly from bots because they provided *identical* responses for each survey item. This series of responses was also submitted sequentially and included unique emails that were structured similarly (e.g., alphabetic characters only, identical domain names). These 30 responses were excluded from all analyses.

4. Measurement Models with the Athlete Sample

Athlete Engagement Questionnaire (AEQ)

We tested an independent clusters model of confirmatory factor analysis (ICM-CFA) in which each item loaded onto the corresponding factor only. The results of this model yielded acceptable levels of model fit (Table S1, Model 1). We used this ICM-CFA model as the basis for subsequent analyses because it is the most parsimonious representation of the scale scores (Morin et al., 2013).

The Passion Scale (PS)

We began by testing an ICM-CFA with scores from the PS. The results yielded poor indices of fit (Table S1, Model 2). In alignment with previous tests of the factor structure of the PS (Marsh et al., 2013; Schellenberg et al., 2014), we proceeded to test a model using exploratory structural equation modeling (ESEM) in which items are specified to load onto their corresponding factors and also to cross-load onto non-target factors. Target rotation was used to constrain cross-loadings to be as close to zero as possible. The results of this model were better than the ICM-CFA model, but were still not acceptable (Table S1, Model 3). Adding three correlated residuals, which is a practice that is common in tests of the factor structure of the PS (see Marsh et al., 2013), yielded acceptable indices of fit (Table S1, Model 4).

Measurement/Structural Models

We used the final models of scores from the AEQ (model 1) and PS (model 4) as the basis for our measurement and structural models. However, we modeled PS scores using the

ESEM-within-CFA (EWC) approach (Morin et al., 2013). With EWC, the results of an initial ESEM model are used as starting values for a subsequent CFA model. Put differently, the EWC approach re-expresses an ESEM model as a CFA model, using starting values derived from the ESEM model. This results in a CFA model that, within rounding error, yields the same item loading and indices of fit as the ESEM model. We used this EWC approach because it overcomes several limitations of ESEM models and allows for the estimation of more complex models (van Zyl & ten Klooster, 2022). The EWC model was generated automatically using the output from the initial ESEM and an online tool developed by van Zyl and ten Klooster (2022; see De Beer and Van Zyl, 2019). The results of the measurement model, including scores from both the AEQ (see Model 1) and PS (see Model 5) yielded acceptable fit indices (Table S1, Model 6). The structural model, in which scores on each subscale of the AEQ were regressed on both HP and OP (and one outlier was removed from the analysis), also yielded acceptable indices of fit (Table S1, Model 7).

Table S1
Model fit indices

Model #	Model Description	χ^2 Value	*df*	*p*	RMSEA Value	RMSEA 90% CI	CFI	TLI
1	ICM-CFA: AEQ	156.065	98	<.001	.038	[.027, .049]	.976	.971
2	ICM-CFA: PS	276.614	53	<.001	.102	[.091, .114]	.872	.841
3	ESEM: PS	199.863	43	<.001	.095	[.082, .109]	.910	.862
4	ESEM: PS with CRs	87.983	40	<.001	.055	[.039, .070]	.973	.955
5	ESEM within CFA: PS with CRs	87.981	40	<.001	.055	[.039, .070]	.973	.955
6	Measurement Model	492.908	322	<.001	.036	[.030, .043]	.965	.959
7	Structural Model	495.276	322	<.001	.037	[.030, .043]	.964	.958

Note. CFA = confirmatory factor analysis. ESEM = exploratory structural equation modeling. AEQ = athlete engagement questionnaire. PS = passion scale. CR = correlated residual. Measurement model includes scores from the AEQ (see Model 1) and PS (see Model 5).

Table S2

Athlete Sample: Descriptive Statistics and Correlations between Latent Variables

	M	*SD*	1	2	3	4	5	6
1. Harmonious Passion	4.98	0.99	.843					
2. Obsessive Passion	3.01	1.30	.394**	.864				
3. Confidence	3.73	0.76	.628**	.271**	.847			
4. Vigor	4.20	0.63	.728**	.103	.717**	.820		
5. Dedication	3.84	0.79	.719**	.297**	.840**	.786**	.861	
6. Enthusiasm	4.37	0.56	.757**	.114	.653**	.949**	.749**	.796

Note. $N = 403$. Cronbach's alpha are reported on the diagonal. *$p \leq .05$. **$p \leq .01$.

Table S3

Coach Sample: Descriptive Statistics and Correlations between Latent Variables

	M	*SD*	1	2	3	4	5	6
1. Harmonious Passion	4.94	0.97	.810					
2. Obsessive Passion	2.82	1.30	.411**	.829				
3. Confidence	4.16	0.59	.511**	.270**	.799			
4. Vigor	4.15	0.61	.616**	.181*	.858**	.857		
5. Dedication	4.19	0.64	.505**	.353**	.937**	.822**	.860	
6. Enthusiasm	4.35	0.59	.567**	.208**	.827**	.913**	.839**	.894

Note. $N = 208$. Cronbach's alpha are reported on the diagonal. Note that Cronbach alpha values used in the single indicator latent variable models are not identical to those reported here because they exclude 3 outliers. *$p \leq .05$. **$p \leq .01$.

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