

Trajectories of Affective States in Adolescent Hockey Players: Turning Point and Motivational Antecedents

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This study examined longitudinal trajectories of positive and negative affective states with a sample of 265 adolescent elite hockey players followed across 3 measurement points during the 1st 11 weeks of a season. Latent class growth modeling, incorporating a time-varying covariate and a series of predictors assessed at the onset of the season, was used to chart out distinct longitudinal trajectories of affective states. Results provided evidence for 3 trajectories of positive affect and 3 trajectories of negative affect. Two of these trajectories were deflected by team selection, a seasonal turning point occurring after the 1st measurement point. Furthermore, the trajectories of positive and negative affective states were predicted by theoretically driven predictors assessed at the start of the season (i.e., self-determination, need satisfaction, athletic identity, and school identity). These results contribute to a better understanding of the motivational, social, and identity-related processes associated with the distinct affective trajectories of athletes participating in elite sport during adolescence.

Keywords: adjustment, team selection, sport, identity, self-determination

The realm of sport competition during childhood and adolescence has been proposed to play a facilitating role in the development of a large array of transferable skills and psychological resources (e.g., Baron, 2007; Weiss, 2004). Research has indicated that structured voluntary activities, such as sport competitions, offer great opportunities to experience positive states of engagement and concentration (Larson, 2000). Such positive states can be seen as the “organizers of development,” providing the conditions needed to ensure optimal self-regulation of behaviors, learning, and the expression of a wide array of competencies (Fredrickson, 2001; Lyubomirsky, King, & Diener, 2005). As social-developmental psychologists, we conceive of sport, and particularly sport competition, as a life setting likely to promote the acquisition of transferable skills (Papacharisis, Goudas, Danish, & Theodorakis, 2005) and the development and/or maintenance of emotional adjustment (Marsh & Kleitman, 2003), but not necessarily among all athletes.

Sport participation is certainly not a monolithic homogeneous process. Over the course of a season, emotional experience is likely to evolve distinctively for different athletes. Given the

idiosyncratic nature of affective states (e.g., Cerin, Szabo, Hunt, & Williams, 2000; Hanin, 2000; Lazarus, 1999), not all athletes are likely to maintain high levels of enjoyment over the course of a season. Research in sport psychology should inform coaches, parents, and applied psychologists about the situational and psychological characteristics of athletes accounting for individual differences in the positive and negative affective outcomes of sport competition. Therefore, this longitudinal study examined how a seasonal turning point (i.e., team selection) and motivational and identity-related factors can predict trajectories of positive and negative affect with a sample of adolescent elite hockey players.

Positive and Negative Affect in Sport

A predominant line of research in the sport domain has focused on negative affective states such as anxiety (Burton, 1998), depression, and anger (Beedie, Terry, & Lane, 2000). Consistent with the positive psychology movement, a more recent line of research has examined positive states such as vitality (Reinboth, Duda, & Ntoumanis, 2004), flow (Jackson & Eklund, 2002), and sport satisfaction (Riemer & Chelladurai, 1998). Despite the advances made by each conceptual approach, we believe that a comprehensive examination of the developmental underpinnings of emotional adjustment should simultaneously consider both positive and negative affect (Vallerand & Blanchard, 2000; Watson, Clark, & Tellegen, 1988). On one hand, positive affect represents the extent to which individuals feel enthusiastic, active, and alert. A high score on positive affect denotes an optimal state of energy, concentration, and pleasurable engagement. On the other hand, negative affect represents a general state of anxiety and anger. A high score on negative affect denotes a feeling of distress closely associated with depression and hostility. Although substantial evidence has revealed that positive and negative affect can coexist at any particular point in time (e.g., an athlete may feel excited and enthusiastic about a sport competition while at the same time

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experiencing anxiety and anger; see Watson & Clark, 1997), little is known about their respective longitudinal course in competitive sport settings.

A great deal of research, using a time-to-event paradigm, has established that the mean level of negative affective states, such as anxiety, increases as a competition nears and then declines during and after the competition (Cerin et al., 2000). However, the literature on the longer term course of affective states remains rather scant. A recent study revealed considerable mean-level variations in both positive and negative affect over a 20-week period with a sample of collegiate swimmers (Lemyre, Treasure, & Roberts, 2006). Another study has reported a significant mean-level increase of subjective vitality over a 5-month interval with a sample of athletes (Reinboth & Duda, 2006).

Despite these recent research efforts, affective states can be conceived as nomothetic-idiographic processes (Lazarus, 1999, 2000) likely to change distinctly for different people. Although some athletes are likely to maintain high levels of emotional adjustment during a season, other athletes could exhibit differential patterns of increment and decrement in positive affect over time. Intuitively, affective states should follow a multinomial pattern of change (Nagin, 1999), with both the magnitude and the direction of change varying across individuals. Raudenbush (2001, p. 30) offered depressive states as an example, saying that it makes no sense to assume that everyone should increase or decrease on depression given that "many persons will never be high on depression, others will always be high, while others will become increasingly depressed." As such, a recent study of college students revealed the existence of different trajectories of emotional adjustment during the transition from high school to college (Duchesne, Ratelle, Larose, & Guay, 2007). Similar results were found for depressive symptoms during adolescence (Wiesner & Kim, 2006). It is quite probable that the longitudinal course of affective states is characterized by multinomial heterogeneity with important individual differences in both the magnitude and the direction of change over time (e.g., Nagin, 2005). Distinct profiles of change and/or stability on a variable can be uncovered with group-based modeling strategies such as latent class growth modeling (LCGM; Nagin, 1999, 2005). Furthermore, LCGM offers the opportunity to examine situational and psychological factors that could predict membership in a specific developmental trajectory.

Theoretically Driven Predictors of Positive Affect and Negative Affect Trajectories

Sport participation is inherently demanding, particularly at times when athletes must manage the challenges and uncertainties of the selection process (Fletcher, Hanton, & Mellalieu, 2006). The outcome of the selection process (i.e., selection vs. nonselection to a team) marks a turning point that abruptly alters the social environment of the athletes and the group dynamics within the team. Also, the selection process deflects, either in a positive or a negative manner, the seasonal plans and goals of athletes and their athletic identity (Grove, Fish, & Eklund, 2004). Being selected in a highly competitive league is often an intermediate step in the personal striving to make a living out of the sport activity or to fulfill a career goal of becoming an elite athlete (Gould, Dieffenbach, & Moffett, 2002). Failure to make significant progress on personally meaningful goals has been shown to relate negatively to

positive affective states while increasing negative affect (e.g., Koestner, Lekes, Powers, & Chicoine, 2002; Wiese, 2007). However, participation in sport competition is a heterotypic process, and not all athletes are likely to experience emotional adjustment decay from not being selected to highly competitive leagues. Hence, we investigated the impact of team selection within each of the distinct trajectories of positive and negative affective states. While controlling for the effect of this turning point, we proposed that the trajectories of affective states should be predicted by motivational (sport motivation and need satisfaction) and identity-related factors (sport and school identity) assessed at the onset of the season.

Athletes can pursue their sport activities for a variety of reasons or motives. Self-determination theory proposes that motives can be aligned on a self-determination continuum (Deci & Ryan, 2002). Self-determined behaviors are emitted out of choice and pleasure because they allow the individual to attain important goals and because they are coherent with one's deepest values and lifestyle (i.e., intrinsic, integrated, and identified regulations, respectively). Behaviors that are not chosen but rather emitted out of internal (e.g., guilt—introjected regulation) or external pressure (e.g., rewards or punishments—extrinsic regulation) are non-self-determined. Non-self-determined forms of motivation also include amotivation, which can be considered as a lack of motivation (Ryan & Deci, 2000). On the basis of mounting empirical evidence using cross-sectional and prospective designs in the sport domain (Vallerand & Rousseau, 2001), we propose that a more self-determined sport motivation should contribute to predicting trajectories associated with optimal psychological functioning, such as maintaining high levels of positive affect and low levels of negative affect.

According to self-determination theory, psychological need satisfaction is a crucial predictor of individuals' well-being. Three needs have been recognized as being fundamental to well-being, namely, those for autonomy, competence, and relatedness (e.g., Deci & Ryan, 2002; Ryan & Deci, 2000). The need for autonomy refers to feeling authentic and agentic in one's environment. In the context of competitive sports, this need is crucial because it allows athletes to stay in touch with their inner selves and to feel accepted for whom they are. The need for competence refers to feeling efficacious in one's interactions with the environment. The need for relatedness refers to feeling strong, positive, and meaningful ties with others. Studies in the sport domain have supported the positive association of need satisfaction with subjective vitality, satisfaction, and interest (Reinboth et al., 2004). Interestingly, the daily variations in need satisfaction of gymnasts have also been found to predict daily fluctuations in positive affect, negative affect, and subjective vitality (Gagné, Ryan, & Bargmann, 2003). In a recent prospective study with competitive athletes, changes in the satisfaction of the needs for autonomy and relatedness were significant predictors of change in subjective vitality over a 5-month period (Reinboth & Duda, 2006). Therefore, we expect that the satisfaction of the three basic psychological needs would be likely to fuel high and stable levels of positive affect while preventing athletes from experiencing increases in negative affect.

Adolescent athletes are multifaceted individuals who have to manage the requirements of their school lives and those of their sporting activities. We focus herein on the sport and school identities because they are fundamental dimensions of the lives of

adolescent elite athletes (e.g., Mignano, Brewer, Winter, & Van Raalte, 2006; Miller & Kerr, 2003). Athletic identity can be seen as a double-edged sword. On one hand, it should allow players to be involved and committed to their sport (Blanchard, Perreault, & Vallerand, 1998), to experience more successes (Marsh & Perry, 2005), and to derive more positive well-being (Cameron, 1999). On the other hand, this identity could make athletes more vulnerable to the ups and downs of their sport, which could exacerbate negative affect experienced over the course of a season (Brewer, 1993; Brewer, Van Raalte, & Linder, 1993; R. L. Jones, Glintheyer, & McKenzie, 2005; Settles, Sellers, & Damas, 2002). In contrast, identification with school is likely to have a quite different effect. Sporting authorities (e.g., coaches and league administrators) and researchers have increasingly recognized the need for adolescent athletes to value school and education to incorporate this life domain into their self-concept (Miller & Kerr, 2003; Settles et al., 2002). Having a strong school identity can be useful to developing a balanced lifestyle and a more multidimensional identity. Involvement of the self in school activities increases the pool of opportunities to experience diversified successes and to derive general feelings of self-worth. Hence, a higher level of identification with school could act as a stabilizer likely to promote the emotional well-being of adolescent student hockey players.

Goals of the Study

A first goal of this study was to chart out the distinct trajectories of positive affect and negative affect with a sample of adolescent elite hockey players across three measurement points spanning an 11-week period at the start of the season. Given the paucity of longitudinal research in the sport domain, we compared the tenability of models with one, two, three, and four subgroups of athletes with varying developmental courses rather than putting forward hypotheses regarding the specific number and shape of trajectories for positive and negative affective states. A second goal was to study the effect of team selection as a seasonal turning point likely to deflect some, if not all, of the trajectories of affective states. Hence, the LCGM treated the team selection variable as a time-varying covariate (Nagin, Pagani, Tremblay, & Vitaro, 2003) appearing between the training camp (Time 1) and the second measurement wave 2 weeks later (Time 2). We also examined theoretically driven psychological characteristics, measured at the onset of the season (Time 1), that could predict the trajectories of positive affect and negative affect after controlling for the effect of team selection. Specifically, we expected that the reasons for which hockey players engage in their sport (i.e., self-determination), their school and athletic identities, and the satisfaction of psychological needs would predict the trajectories of positive affective and negative affective states.

Method

Participants

A total of 265 male hockey players constituted our final sample.¹ Participants were between 13 and 20 years old ($M = 16.3$ years) and French was predominantly their mother tongue (96%). They had been competing in hockey for an average of 8.33 years, and they trained for a weekly average of 11 hr. Athletes were

competing either at the midget (13–16 years old; 59%) or at the junior (16–20 years old; 41%) age categories. They were enrolled in high school (81%), preuniversity college (17%), or university (1%). Four participants did not report information about their level of education. Other information regarding the ethnicity, income, and socioeconomic background of the participants was not available in this study.

Procedure

Participants were recruited by Catherine E. Amiot during the training camps held by teams from the three most competitive nonprofessional hockey leagues of the Province of Quebec (i.e., 59% from the Quebec Midget AAA Hockey League, 26% from the Quebec Junior AAA Hockey League, and 15% from the Quebec Junior Major Hockey League). In fact, these three leagues have been found to be associated with higher status and to require a greater involvement on the part of athletes (Amiot, Vallerand, & Blanchard, 2006). When not selected to these leagues, the majority of athletes played in less competitive yet still demanding leagues (e.g., Junior AA, Bantam AA, or Midget AA). Data collection closely followed the ethical guidelines of the American Psychological Association.

A total of 835 athletes received and completed the first questionnaire during the training camps under the supervision of Catherine E. Amiot. The training camps were held in August, and the season started in early September. The second questionnaire was sent out by mail in early September approximately 2 weeks after Time 1. The mailing of this questionnaire was synchronized to reach participants as closely as possible to the moment when they were informed whether they had been selected by a team from a highly competitive league. Four hundred fifty participants completed and returned this questionnaire, representing a response rate of 54%. The third questionnaire was sent to athletes' homes 2 months after the end of the selection process because this time lag seemed clinically appropriate to differentiate between athletes with a transitory versus a more persistent pattern of affective states. Two hundred sixty-five athletes returned this questionnaire, yielding a 59% response rate from the Time 2 questionnaire. Results of attrition analyses on the variables measured at Time 1 revealed that the athletes who failed to complete the three questionnaires had lower levels of school identity, $F(1, 820) = 6.11, p < .05, d = -0.19$. Furthermore, they were older, $F(1, 810) = 8.94, p < .01, d = 0.23$, and they were training more hours weekly, $F(1, 829) = 4.89, p < .05, d = 0.16$, than the participants who completed the three questionnaires. A significant chi-square, $\chi^2(2, N = 835) = 7.74, p < .05$, also suggested that attrition was slightly lower in the midget league (64%) compared with the two junior leagues (74% and 72%). Finally, the measure of selection was completed by 430 participants at Time 2. A significant chi-square, $\chi^2(1, N = 430) = 5.89, p < .05$, suggested that attrition was slightly lower in the group of nonselected athletes (34%) compared with the group of selected athletes (45%). Despite these significant differences, the effect sizes were small, accounting for less than 2% of the variance (Schafer & Graham, 2002).

¹ This sample was used by Amiot et al. (2006) for the purpose of examining the relationship between passion and psychological adjustment.

Measures

Affective states. At each measurement occasion, we used five positive adjectives (i.e., *enthusiastic, strong, proud, determined, and active*) and five negative adjectives (i.e., *upset, hostile, distressed, irritable, and nervous*) from the Positive Affect and Negative Affect Schedule (Watson et al., 1988) that we considered particularly applicable to the hockey context to assess positive and negative affect. Each adjective was rated on a 5-point Likert-type scale ranging from 1 (*not at all or a little*) to 5 (*extremely*). At Time 1, athletes were asked to indicate the extent to which, in the past 2 weeks, each of the adjectives described their feelings in their life in general. Two weeks was deemed an appropriate time frame to judge one's current global emotions. At Time 2, the same adjectives were presented, and athletes were asked to indicate the extent to which each applied to how they felt, in their life in general, since finding out whether they made the team. At Time 3, athletes were asked to indicate how, in the past 2 weeks, each of the adjectives described how they felt in their life in general. Descriptive statistics are reported in Table 1.

Sport Motivation Scale (SMS). At Time 1, we used a 24-item version of the SMS (Brière, Vallerand, Blais, & Pelletier, 1995) to measure individuals' level of motivation toward sport. Participants were asked to indicate on a 7-point Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) the extent to which each of the items represented the reasons why, in general, they practice hockey. We measure four types of motivation in this study, from the lowest to the highest level of self-determination: amotivation ($\alpha = .67$), external ($\alpha = .78$), identified ($\alpha = .74$), and intrinsic ($\alpha = .89$). We computed an overall self-determination index ($\alpha = .78$) using the weights associated with the respective motivations on the self-determination continuum (e.g., Vallerand, Fortier, & Guay, 1997): amotivation $\times -2$ + external $\times -1$ + identified $\times 1$ + intrinsic $\times 2$.

Need satisfaction. At Time 1, we used a 13-item scale to assess the degree of satisfaction of the needs for autonomy (Blais & Vallerand, 1991), competence (Losier, Vallerand, & Blais, 1993), and relatedness (Richer & Vallerand, 1998) in the context of hockey. All items were rated using a 7-point Likert-type scale ranging from 1 (*disagree completely*) to 7 (*agree completely*). The reliability of the three subscales was acceptable (competence, $\alpha = .81$; autonomy, $\alpha = .63$; and relatedness, $\alpha = .82$), despite the small number of items and the inclusion of a reversed item that artificially lowered the consistency of the autonomy subscale

(Barnette, 2000; Streiner, 2003). Results of an exploratory factor analysis indicated that all items loaded substantially ($\lambda > 0.40$, average = 0.54) on a global factor of need satisfaction ($\alpha = .83$). Hence, the 13 need satisfaction items were aggregated in one global variable for the purpose of ensuring parsimony of the reported analyses (Standage, Duda, & Ntoumanis, 2005).

Athletic and school identity. At Time 1, we adapted the Inclusion of the Other in the Self Scale (e.g., Aron, Aron, & Smollan, 1992), originally designed to assess the degree of closeness experienced with significant others, to assess participants' identification with hockey and with their academic studies (see Aron et al., 2004, for a discussion of the applicability of this scale). This pictorial one-item measure has been found to be valid when measuring components of identity related to the sport domain (Blanchard et al., 1998; Vallerand et al., 2003). Participants were asked to select, among seven Venn-like diagrams overlapping to differing degrees (1 = *no overlap*; 7 = *total overlap*), the one that best illustrated the relation between themselves and hockey and between themselves and school.

Overview of Analyses

We examined trajectories of positive affect and negative affect using a LCGM approach with the SAS PROC TRAJ program (B. L. Jones, Nagin, & Roeder, 2001). Models with one, two, three, and four distinct trajectories were tested to assess the possibility that different subgroups of athletes could increase, decrease, and remain stable with different levels on the variable (i.e., high or low). As specified previously, our goal was to explore these different models rather than putting forward hypotheses regarding the specific number and shape of seasonal trajectories for positive and negative affective states. We then compared the models using the Bayesian information criterion (BIC). Although there are no absolute guidelines for interpreting the BIC, higher values indicate better model fit. As suggested by B. L. Jones et al. (2001), we compared nested models using an estimate of the log Bayes factor ($2 \times \Delta BIC$). The $2 \times \Delta BIC$ value can be used to interpret the degree of evidence for the more complex model: Values ranging from 0 to 3 equal weak evidence for the more complex model; from 3 to 6, moderate evidence; from 6 to 10, strong evidence; and more than 10, very strong evidence. For every participant, we calculated the probability of belonging to each of the various trajectories (i.e., posterior probabilities of group membership). Average posterior probabilities above .70–.80 were taken to suggest the acceptable

Table 1
Descriptive Statistics and Mean-Level Differences of Affective States Across Measurement Points

Affective state	Time 1			Time 2			Time 3			Time 1–Time 2		Time 2–Time 3	
	<i>M</i>	<i>SD</i>	α	<i>M</i>	<i>SD</i>	α	<i>M</i>	<i>SD</i>	α	<i>F</i>	η^2	<i>F</i>	η^2
Positive affect	4.19	0.58	.74	3.60	1.05	.87	3.88	0.72	.83	78.01**	0.24	15.46**	0.06
Negative affect	2.80	0.83	.70	2.23	0.89	.75	2.34	0.84	.76	98.30**	0.28	2.81	0.01
Self-determination index	6.35	3.08	.78										
Athletic identity	5.80	1.28	NR										
School identity	4.88	1.70	NR										
Need satisfaction	5.67	0.63	.83										

Note. NR = Not relevant because of the single-item measure.

** $p < .01$.

level of homogeneity of a given trajectory, meaning that people within the trajectory had a highly similar longitudinal pattern of change or stability on the variable (Nagin, 1999). We compared the slopes (i.e., linear and quadratic) and the intercept across trajectories and calculated the 95% confidence intervals of the slopes using recent developments in LCGM presented by B. L. Jones and Nagin (2007).

We also used LCGM to examine whether a turning point could deflect each of the trajectories of positive affect and negative affect (Nagin et al., 2003). Turning points, such as team selection, are time-varying covariates appearing during the course of development (Nagin, 2005). For the athletes who were selected, the selection variable was set as a zero for all measurement points because these athletes maintained their membership in the team throughout the season. For the athletes who were not selected, the variable equaled zero at Time 1, but was set as 1 for the subsequent points because these athletes were discarded from the team after Time 1. Simultaneously, the LCGM included predictors measured at Time 1: self-determination, sport and school identities, and needs satisfaction. This analysis provided a test of whether the trajectories can be significantly discriminated on the basis of Time 1 predictors after controlling for the effect of team selection. A test of significance is provided by the Z score associated with the log odds ratio. The odds ratio, which can be taken as a measure of effect size, is easily obtained by exponentiation of the log odds ratio. The odds ratio can be converted into a standardized mean difference effect size (Cohen's *d*) and vice versa (Lipsey & Wilson, 2001). Therefore, odds ratios of 1.50, 3.50, and 5.10 can be interpreted as small, medium, and large effect sizes, respectively.

Results

Trajectories of Positive Affect

We performed a first analysis to delineate the number and the shape of the trajectories of positive affect.² Results provided very strong evidence for the tenability of a three-trajectory model ($2*\Delta\text{BIC} = 29.58$). Adding a fourth trajectory did not substantially improve the model fit ($2*\Delta\text{BIC} = 3.00$) and resulted in a fourth trajectory representing only 3% of the sample. Results were equivalent for models with and without the time-varying covariate (see Table 2). The first group (17%), *high and decreasing positive affect*, represented athletes with a high level of positive affect at Time 1 followed by a significant linear decrease across time. The second group (23%), *unstable positive affect*, had moderately high levels of positive affect at Time 1 with a significant quadratic function of strong decrease from Time 1 to Time 2, followed by a strong increase from Time 2 to Time 3. The third group (60%), *medium and decreasing positive affect*, had a moderately high level of positive affect at Time 1, followed by a significant linear decrease across time. The average posterior membership probabilities of belonging to a trajectory were .84, .89, and .89 for the three trajectories, respectively. The trajectories of positive affect are displayed in Figure 1, and their 95% confidence intervals are reported in Table 3. The slope of the first group did not significantly differ from that of the third group in the model with the time-varying covariate, $\chi^2(1, N = 204) = 0.24, p > .05$. However, the intercepts of these two groups were significantly different, $\chi^2(1, N = 204) = 25.91, p < .01$. Overall, these results provide

evidence for the tenability of the label attributed to the first and third trajectories.

Results of the model with the time-varying covariate indicated that only the medium and decreasing positive affect trajectory was significantly altered by failure to be selected to the team (see Table 2 and Figure 2). Specifically, athletes who were selected to the team maintained a high level of positive affect, whereas athletes who were not selected to the team suffered a significant decline in positive affect immediately after the selection process. The high and decreasing positive affect trajectory, given its more healthy-adaptive nature, was set as the contrast group to which the two other trajectories were compared on predictors assessed at Time 1.³ On the one hand, the odds of belonging to the high and decreasing positive affect trajectory compared with those of belonging to the unstable positive affect trajectory were 1.20 for players with high levels of self-determined motivation, 5.00 for high athletic identity, and 5.64 for high satisfaction of basic psychological needs. On the other hand, the odds of belonging to the high and decreasing positive affect trajectory compared with those of belonging to the medium and decreasing positive affect trajectory were 5.81 for players with high athletic identity and 2.80 for high need satisfaction. Overall, results indicated that high levels of self-determination, need satisfaction, and athletic identity at the start of the season substantially increased the likelihood of membership in the high and decreasing positive affect trajectory compared with that of membership in the other two less adaptive trajectories of positive affect (see Table 4).

Trajectories of Negative Affect

Results provided moderate evidence for the tenability of a three-trajectory model ($2*\Delta\text{BIC} = 5.74$). Nonetheless, the third trajectory depicted a meaningful and distinct developmental course of negative affect representing 13% of the sample. Adding a fourth trajectory worsened the fit of the model ($2*\Delta\text{BIC} = -2.04$). Results were equivalent for models with and without the time-varying covariate (see Table 5). The first group (35%), the *low unstable negative affect* group, represented athletes with low levels of negative affect throughout the measurement points with a significant quadratic function of decrease from Time 1 to Time 2, followed by an increase from Time 2 to Time 3. The second group (52%), the *moderate and unstable negative affect* group, had moderate levels of negative affect at the onset of the season with a quadratic function of sharp decrease from Time 1 to Time 2, followed by stability from Time 2 to Time 3. The third group (13%), the *high and decreasing negative affect* group, had high

² As shown in Table 1, the mean level of both positive affect, $F(1, 257) = 38.44, p < .01$, and negative affect, $F(1, 257) = 27.39, p < .01$, significantly changed across measurement waves. Low rank-order stability was also reported for positive affect ($r_{12} = .24$ and $r_{23} = .22$; intraclass correlation coefficient = .21) and for negative affect ($r_{12} = .45$ and $r_{23} = .29$; intraclass correlation coefficient = .36).

³ For ease of interpretation, the results are discussed in light of the possibility of belonging to the adaptive trajectory compared with that of belonging to the other two trajectories. Therefore, we reversed the log odds ratios to obtain positive values, so odd ratios greater than 1 can be taken to estimate the increased likelihood of belonging to the adaptive trajectory given the score on a specific covariate.

Table 2
Trajectories of Positive Affect for a Model Excluding Selection (Regular Model) and for a Model Including Selection (Time-Varying Covariate Model)

Trajectory	Model without selection		Model with selection	
	Log odds ratio	Z score	Log odds ratio	Z score
1: High and decreasing positive affect				
Intercept	4.45	40.73**	4.68	47.42**
Linear	-0.09	-2.02*	-0.15	-1.86†
Team selection	NI	NI	0.17	1.04
2: Unstable positive affect				
Intercept	4.10	43.36**	3.99	42.86**
Linear	-3.81	-14.62**	-3.76	-10.81**
Quadratic	1.83	14.49**	1.80	12.00**
Team selection	NI	NI	0.06	0.39
3: Medium and decreasing positive affect				
Intercept	3.95	32.95**	4.13	71.30**
Linear	-0.25	-3.06**	-0.10	-2.50**
Team selection	NI	NI	-0.33	-3.89**

Note. NI = Selection was not included in this model.
* $p < .05$. ** $p < .01$. † $p = .07$.

levels of negative affect throughout the measurement points with a small linear decrease. The average posterior membership probabilities of belonging to a trajectory were .83, .82, and .84 for the three trajectories, respectively. The trajectories of negative affect are displayed in Figure 3, and their 95% confidence intervals are reported in Table 6. The quadratic slope of the first group did not significantly differ from that of the second group in the model with the time-varying covariate, $\chi^2(1, N = 231) = 0.03, p > .05$. However, the intercepts of these two groups were significantly different, $\chi^2(1, N = 231) = 36.00, p < .01$. Overall, these results provide evidence for the tenability of the label attributed to the first and second trajectories.

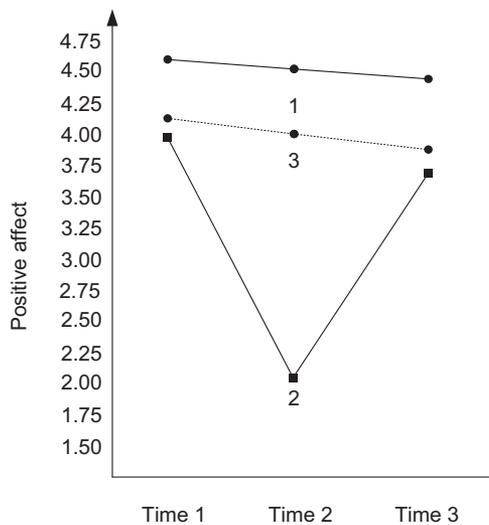


Figure 1. Trajectories of positive affect. 1 = high and decreasing positive affect; 2 = unstable positive affect; 3 = medium and decreasing positive affect.

Results of the model with the time-varying covariate indicated that only the high and decreasing negative affect trajectory was significantly altered by failure to be selected to the team (see Table 5 and Figure 4). Specifically, athletes who were selected to the team had a substantial decrease of negative affect, whereas athletes who were not selected to the team suffered from a significant increase in negative affect immediately after the selection process. The low and unstable negative affect trajectory, given its more healthy adaptive nature, was set as the contrast group (see footnote 2). The odds of belonging to this trajectory compared with those of belonging to the moderate and unstable negative affect trajectory, on one hand, and to the most maladaptive pattern of negative affect (i.e., high and decreasing negative affect) on the other hand, were, respectively, 1.58 and 2.72 for players with low athletic identity; 1.99 and 3.86 for high satisfaction of basic psychological needs; and 1.36 and 1.55 for high academic identity. Overall, results indicated that high academic identity and need satisfaction as well as low athletic identity substantially increased the likelihood of membership in the more healthy, adaptive trajectory compared with the other two less adaptive trajectories of negative affect (see Table 7).

Discussion

In this study, adolescent elite hockey players were followed during a critical period of the season, namely, before and after the process of being selected or not selected to highly competitive teams. As expected, their affective states did not follow a monotonic course of development during the first 11 weeks of a hockey season, with both the magnitude and the direction of change differing substantially across individuals. As such, developmental trajectories were useful heuristics in uncovering meaningful subgroups of athletes with internally homogeneous yet distinct courses of positive and negative affect. Of particular interest, not all athletes were equally affected by the failure to be selected to the highly competitive teams. Specifically, the

Table 3
95% Confidence Intervals of the Positive Affect Trajectories

Trajectory	Time 1	Time 2	Time 3
1: High and decreasing positive affect	4.67 (4.47–4.87)	4.53 (4.35–4.71)	4.37 (4.10–4.64)
2: Unstable positive affect	4.00 (3.81–4.19)	2.03 (1.69–2.37)	3.68 (3.37–3.99)
3: Medium and decreasing positive affect	4.14 (4.02–4.26)	4.03 (3.92–4.14)	3.93 (3.77–4.09)

course of two trajectories was deflected by team selection, thus alluding to the importance of considering athletes' own subjective meaning of this seasonal turning point. From a theoretical standpoint, the reasons underlying athletic participation, the satisfaction of psychological needs in the context of hockey, and the degree of athletic identity were useful in discriminating between the adaptive and the more maladaptive trajectories of affective states. Of particular relevance, school-related identity was a substantial predictor of the negative affect trajectories, thus highlighting the importance of considering nonsport factors for a more thorough understanding of athletes' adjustment (Miller & Kerr, 2003). Overall, the size of these effects varied from small to moderate, which is not surprising because the covariates and the affective outcomes (i.e., trajectories) were not measured contemporaneously and because the model took into account the effect of an important seasonal turning point. We briefly summarize the results observed and then discuss the practical implications of these findings and avenues for future research.

Trajectories of Positive Affect and Negative Affect

A limited number of hockey players (17%) maintained relatively high levels of positive affect with a significant, albeit very small, linear change from Time 1 to Time 3. This developmental trajectory, labeled *high and decreasing positive affect*, represents an adaptive developmental course in which hockey players feel energized, excited, and enthusiastic with

only a small decrease from training camp to the 11th week of the season. In contrast, a majority of athletes followed more maladaptive developmental courses with either dramatic ups and downs in their levels of positive affective states (i.e., unstable positive affect; 23%) or an incapacity to sustain their initially moderate levels of enthusiasm and excitement (i.e., medium and decreasing positive affect; 60%). Furthermore, the course of this latter trajectory was deflected by a seasonal turning point: Athletes who were not selected to the team suffered from a significant decrease in positive affect immediately after the training camp, and athletes from this trajectory who were selected to the team maintained a moderate level of positive affect throughout the 11th week of the season. We must note that all athletes surveyed at Time 2 were still playing hockey in highly competitive leagues, which could buffer, at least to some extent, the probability of their suffering from sharper decreases in positive affectivity. The analyses comparing athletes from the high and decreasing positive affect trajectory to athletes who followed the course of the two maladaptive trajectories revealed that non-self-determined motivation, low athletic identity, and a social environment thwarting the satisfaction of basic psychological needs were substantial risk factors of membership in the less adaptive unstable positive affect or medium and decreasing positive affect trajectories.

We also identified three distinct trajectories for negative affect. A moderate number of hockey players (35%) maintained relatively low levels of negative affect, despite significant but small ups and downs over adjacent time periods. This developmental trajectory, labeled *low and unstable negative affect*, represents an adaptive developmental course in which hockey players experienced calmness and serenity from the training camp onward. Another trajectory was somewhat adaptive, with 52% of athletes reporting moderate and unstable negative affect, with stability from the team selection onward. Finally, 13% of the athletes were regrouped in a maladaptive trajectory characterized by high levels of negative affect spanning the first 11 weeks of the season. The proportion of athletes in this most maladaptive trajectory is similar to a trajectory of high depressive symptoms with adolescent boys (Wiesner & Kim, 2006). Furthermore, the course of this trajectory was deflected by team selection. Specifically, athletes who were selected to the team had a substantial decrease in negative affect, whereas athletes who were not selected maintained their high levels of negative affect after the selection process. Finally, when comparing athletes from the low and unstable negative affect trajectory to those who followed the course of the more maladaptive trajectories, the results revealed that high athletic identity, low school identity, and a social environment thwarting the satisfaction of basic psychological needs were substantial risk factors for membership in the latter trajectories of negative affect.

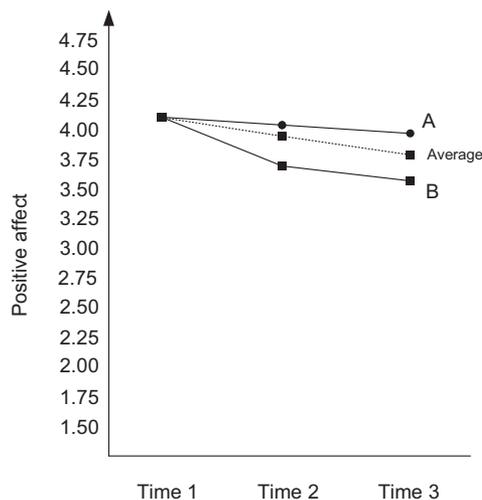


Figure 2. Effect of team selection on the medium and decreasing positive affect trajectory. A = selected athletes; B = unselected athletes.

Table 4
Multivariate Predictors of Positive Affect Trajectories for a Model Excluding Selection (Regular Model) and for a Model Including Selection (Time-Varying Covariate Model)

Trajectory	Model without selection		Model with selection	
	Log odds ratio	Z score	Log odds ratio	Z score
1: High and decreasing positive affect (contrast group)				
2: Unstable positive affect				
Self-determination index	-0.08	-0.87	-0.18	-1.71 [‡]
Athletic identity	-0.24	-1.00	-1.61	-1.58 [§]
Academic identity	0.03	0.22	0.10	0.56
Need satisfaction	-1.16	-2.34 ^{**}	-1.73	-3.02 ^{**}
3: Medium and decreasing positive affect				
Self-determination index	-0.11	-1.15	-0.14	-1.33
Athletic identity	-0.48	-2.26 [*]	-1.76	-1.74 [†]
Academic identity	0.14	0.90	0.21	1.18
Need satisfaction	-1.09	-2.40 [*]	-1.03	-1.96 [*]

Note. ^{*} $p < .05$. ^{**} $p < .01$. [†] $p = .08$. [‡] $p = .09$. [§] $p = .12$.

Practical Implications

Knowing which covariates relate to adaptive versus maladaptive trajectories of affective states has meaningful implications for practitioners in the realm of sport. On the basis of these results, interventions could be targeted toward athletes with a profile of low need satisfaction, self-determination, and academic identity at the onset of the season because these individuals are more vulnerable to follow maladaptive trajectories of affective states.

We know from past research that a number of social factors—on which coaches can intervene—predict need satisfaction and self-determination. Sporting environments that foster feelings of ownership and choice while providing informational feedback, encouragement, and opportunities to develop satisfying social relationships are likely to satisfy the psychological needs of adolescent athletes. A motivational climate focusing on learning,

self-improvement, and mastery has also been found to promote the satisfaction of these basic needs (e.g., Reinboth & Duda, 2006; Standage & Treasure, 2002). Similarly, an autonomy-supportive coaching style—in which the coach acknowledges the feelings of the athletes, takes the time to consider individual needs, and provides rationales for their training schemes—could bolster the satisfaction of psychological needs (Gagné et al., 2003; Mageau & Vallerand, 2003). Despite the “win-at-all-cost” atmosphere of contemporary elite sport, coaches such as Phil Jackson in basketball and Joe Torre in baseball testify to the effectiveness of this democratic coaching style. Such coaching environments could also promote self-determined forms of motivation (e.g., Hollembeak & Amorose, 2005), which have been related to a variety of positive outcomes, including effective coping strategies (Amiot, Gaudreau, & Blanchard, 2004), psychological adjustment (Vallerand & Rous-

Table 5
Trajectories of Negative Affect for a Model Excluding Selection (Regular Model) and for a Model Including Selection (Time-Varying Covariate Model)

Trajectory	Model without selection		Model with selection	
	Log odds ratio	Z score	Log odds ratio	Z score
1: Low and unstable negative affect				
Intercept	2.12	16.36 ^{**}	2.13	16.40 ^{**}
Linear	-0.93	-4.41 ^{**}	-0.97	-4.35 ^{**}
Quadratic	0.40	3.81 ^{**}	0.40	3.84 ^{**}
Team selection	NI	NI	0.12	0.95
2: Medium and unstable negative affect				
Intercept	3.05	26.50 ^{**}	3.06	29.57 ^{**}
Linear	-1.10	-6.02 ^{**}	-1.19	-5.77 ^{**}
Quadratic	0.39	4.29 ^{**}	0.43	4.42 ^{**}
Team selection	NI	NI	0.07	0.61
3: High and decreasing negative affect				
Intercept	3.61	25.87 ^{**}	3.59	25.82 ^{**}
Linear	-0.16	-1.15	-0.28	-2.25 [*]
Team selection	NI	NI	0.40	1.99 [*]

Note. NI = Selection was not included in this model.
^{*} $p < .05$. ^{**} $p < .01$.

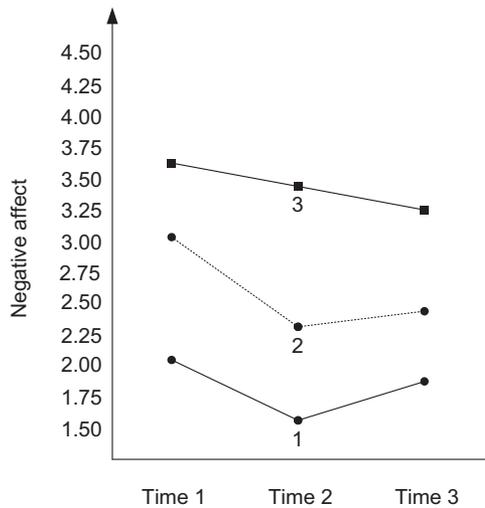


Figure 3. Trajectories of negative affect. 1 = low and unstable negative affect; 2 = moderate and unstable negative affect; 3 = high and decreasing negative affect.

seau, 2001), and reduced risks of alcohol and drug abuse in competitive athletes (Rockafellow & Saules, 2006). Together, these findings provide insights into how coaches, parents, and league administrators can create the conditions likely to foster self-determination and satisfy basic psychological needs.

This study also uncovered the role of two important identities—the athletic and the school identities—in predicting athletes' affective trajectories. Consistent with prior research (e.g., Blanchard et al., 1998; Brewer et al., 1993), athletic identity was associated with a mixture of positive affective outcomes (i.e., high and decreasing positive affect) and negative affective outcomes (i.e., medium and unstable and high and decreasing negative affect). Specifically, it seems like athletic identity could help athletes feel more enthusiastic and actively engaged in their sport while at the same time making them more vulnerable to the ups and downs of their sport. Expanding the self through sport-related goal investment could promote antagonist self-regulation processes by which the athletes respectively try to approach successes and to avoid failures. Individuals also have a stronger tendency to develop a passion for sport compared with school activities (Vallerand et al., 2003). Hence, individuals with a high level of identification with their passionate activities have a tendency to pursue their passion in an obsessive manner, which could explain the mixed affective outcomes associated with athletic identity. In contrast, a high degree of school identity reduced the likelihood of following the two more maladaptive trajectories of negative affect. These results

suggest that athletes should seek to expand their self-concept to incorporate elements related to school activities.

Whereas research in developmental sport psychology has mainly focused on sport and neglected other socialization factors related to the school experience (Miller & Kerr, 2003), adopting a more multidimensional perspective on athletes' identity has the potential to shed new light on their psychological experience. Investment in school (or in other nonsport areas) as a source of identity could also help athletes who are strongly identified with the athlete role become less affectively vulnerable to the ups and downs of their sporting career. Thus, an important underlying factor concerns the degree of diversification of the self-concept (i.e., unidimensional vs. multidimensional), which could be a key ingredient in limiting vulnerability (e.g., Linville, 1985). However, diversification of the self-concept must always be made with an eye toward the harmonious integration of the different identities to prevent feelings of conflict among different self-aspects (e.g., Amiot, de la Sablonnière, Terry, & Smith, 2007; Donahue, Robins, Roberts, & John, 1993). One way of dealing with the simultaneous requirements of sport and school could be to promote reliance on the life management strategies of selection and optimization (e.g., Freund & Baltes, 2002). Doing so would allow athletes to select and focus on the identities that are most important to them rather than spreading themselves too thin across many different life domains. Similarly, athletes could use compensation strategies in which they are encouraged to think of how the abilities and skills in their preferred life domain (e.g., sport) could be transferred and applied to other life domains (e.g., school or interpersonal relations). These strategies have been found to reduce subjective experience of conflicts between life domains (Baltes & Heydens-Gahir, 2003).

Future Research Directions and Limitations

Throughout his distinguished career, Richard Lazarus (1999) has advocated a nomothetic–idiosyncratic approach to delineating the complexity of affective states in each individual while at the same time deriving global trends in the constantly changing nature of emotional experience. In that regard, group-based statistical procedures, such as LCGM and growth mixture modeling (Muthén & Muthén, 2000), provide a number of desirable features: Not only do they allow a synthesis of individual change patterns (idiosyncratic aspect) into subgroups of athletes with a similar longitudinal course (nomothetic aspect), but they also estimate the effect of covariates and situational events on these distinct trajectories. In line with the work of Lazarus (1999), an important direction for future research would involve investigating the role of coping strategies in predicting multinomial affective states of athletes over the course of a hockey season. Recent studies with university

Table 6
95% Confidence Intervals of the Negative Affect Trajectories

Trajectory	Time 1	Time 2	Time 3
1: Low and unstable negative affect	2.11 (1.85–2.37)	1.58 (1.34–1.82)	1.86 (1.66–2.05)
2: Medium and unstable negative affect	3.05 (2.82–3.28)	2.35 (2.11–2.59)	2.43 (2.24–2.62)
3: High and decreasing negative affect	3.61 (3.33–3.89)	3.45 (3.17–3.73)	3.30 (2.82–3.76)

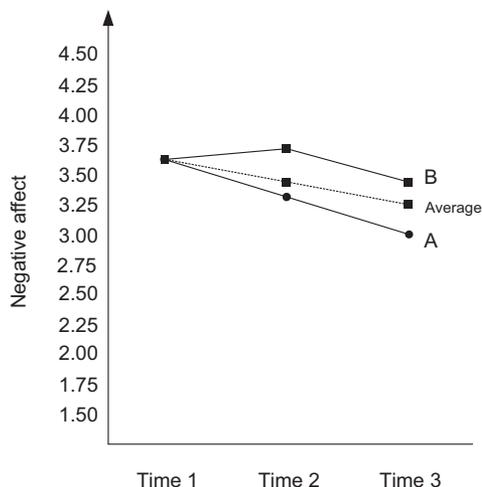


Figure 4. Effect of team selection on the high and decreasing negative affect trajectory. A = selected athletes; B = unselected athletes.

students have outlined the role of task-oriented coping strategies in producing substantial increments in school identity and academic self-determination (Amiot, Blanchard, & Gaudreau, 2008; Thompson & Gaudreau, 2008). Coping has also been related to myriad emotional and performance outcomes in the realm of competitive sport (Hoar, Kowalski, Gaudreau, & Crocker, 2006). In the highly stressful context of team selection, coping could contribute to predicting athletes' affective trajectories. In the face of setbacks, such as nonselection to a team, strategies such as cognitive reappraisal, benefits finding, logical analysis, and goal reengagement could prevent athletes from experiencing a sharp and persistent decline in emotional well-being. Over the long haul, the use of these coping strategies could ensure that nonselection to a team would be perceived as a learning experience rather than as a threat to one's self-worth.

Another line of future investigation will be to conduct studies that are specifically designed to test the role of age in athletes' affective trajectories. In this study, we analyzed hockey players from midget and junior leagues together because the sample size prevented a reliable examination of their distinct affective trajectories.⁴ On one hand, older athletes might deal more effectively with nonselection because they have learned to know themselves and have developed strategies for dealing with failures and challenges throughout their athletic career. On the other hand, we could predict that as elite hockey players age and approach their 20s, they might realize that little time is left for them to be selected to the most competitive leagues. Such a realization could be particularly distressful for athletes who are less self-determined and whose identity is less multidimensional. Now that this study has provided a better understanding of the trajectories of elite hockey players as a whole, future research with larger samples will be able to examine these trajectories and their covariates across subgroups of athletes of different ages. Longer term longitudinal research could prove particularly useful in mapping the trajectories of athletes as they face different setbacks across varying developmental stages of their athletic careers.

Another shortcoming of this study was that the predictors were measured at only one point at the start of the season. Studies have

indicated that self-determination (Amorose & Horn, 2001) and identity-related processes (Grove et al., 2004) also change during a sport season. Despite the burden of measuring all variables at every wave of a longitudinal study, future work should examine the co-occurring longitudinal patterns of motivation, identity, and affective states using the dual-trajectory extension of LCGM (Nagin & Tremblay, 2001). Research has also indicated that goal attainment and subjective well-being have bidirectional effects and can influence one another (e.g., Lyubomirsky et al., 2005). Studying the co-occurring longitudinal trajectories of goal attainment and affective states could help to untangle the influence of seasonal turning points (e.g., team selection and injuries) in the complex relationships between affective states and performance. A particular effort should also be made to create a multimethod design with both quantitative and qualitative measures to provide a richer understanding of the psychological meaning associated with the processes of team selection.

In recent years, social scientists have seen a proliferation of different techniques specifically tailored to the analysis of change (Collins & Sayer, 2001). Despite the positive features of SAS PROC TRAJ, this application does not rely on latent variable modeling, thus limiting the capacity of correcting for measurement error in the variables that make up the longitudinal trajectories (Nagin & Tremblay, 2001). Balanced against this limitation, researchers can always test the factor invariance of their constructs before deciding whether their variables are stable enough to warrant a valid examination of distinct longitudinal trajectories (Louvet, Gaudreau, Menaut, Genty, & Deneuve, in press). Furthermore, we should note that LCGM has been criticized for constraining to zero the variance of the intercept and growth parameters within the trajectories. Nonetheless, fixing the within-trajectory variance is a tenable approach when the homogeneity of each trajectory is sufficiently high (i.e., average of the posterior membership probabilities), such as in the analyses reported herein. In such cases, the small improvement that could result from including random effects would be counterbalanced by increasing model complexity (Nagin, 2005). However, we should note that one can release these constraints for some or all of the trajectories, thus producing an LCGM random-effect model comparable to those estimated in growth mixture modeling (Muthén & Muthén, 2000). Regardless of the modeling approach selected, future longitudinal research with athletes should implement effective retention and tracking strategies to limit the loss of generalizability caused by nonrandom attrition (Ribisl et al., 1996).

Conclusion

This study has a number of positive features and strengths. Theoretically, the study brings together motivational, identity, and situational variables in a more thorough explanation of multino-

⁴ Complementary analyses revealed that affective states did not change differently across athletes of differing age groups (i.e., midget vs. junior). Specifically, the age (2) \times time (3) interaction was nonsignificant for both positive affect, $F(1, 257) = 0.25, p > .05$, and negative affect, $F(1, 257) = 0.43, p > .05$. Also, the effect of selection was not significantly different across age groups because the age (2) \times selection (2) \times time (3) interaction failed to reach significance for both positive affect, $F(1, 253) = 2.20, p > .05$, and negative affect, $F(1, 253) = 0.03, p > .05$.

Table 7
Multivariate Predictors of Negative Affect Trajectories for a Model Excluding Selection (Regular Model) and for a Model Including Selection (Time-Varying Covariate Model)

Trajectory	Model without selection		Model with selection	
	Log odds ratio	Z score	Log odds ratio	Z score
1: Low and unstable negative affect (contrast group)				
2: Medium and unstable negative affect				
Self-determination index	-0.12	-1.38	-0.12	-1.48
Athletic identity	0.45	2.33*	0.46	2.39*
Academic identity	-0.31	-2.23*	-0.31	-2.25*
Need satisfaction	-0.69	-1.75†	-0.69	-1.70‡
3: High and decreasing negative affect				
Self-determination index	-0.05	-0.46	-0.05	-0.51
Athletic identity	0.99	3.15**	1.00	3.26**
Academic identity	-0.43	-2.48*	-0.44	-2.54**
Need satisfaction	-1.34	-2.51*	-1.35	-2.58**

* $p < .05$. ** $p < .01$. † $p = .08$. ‡ $p = .09$.

mial change patterns associated with participation in competitive sport. Methodologically, the study is among the first to investigate multinomial heterogeneity in athletes' psychological processes (Louvet, Gaudreau, Menaut, Genty, & Deneuve, 2007; Rodriguez & Audrain-McGovern, 2004) and to take advantage of the time-varying covariate extension of LCGM (Nagin et al., 2003). Conceptually, relying on LCGM analyses is timely because it allows a more direct test of some of Lazarus's (1999) fundamental propositions regarding the factors associated with nomothetic-idiosyncratic patterns of change not only in affective states but also in coping (Louvet et al., 2007) and motivational processes (Ratelle, Guay, Vallerand, Larose, & Senécal, 2007).

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