Psychology of Sport and Exercise 25 (2016) 89–99

Contents lists available at ScienceDirect

Psychology of Sport and Exercise

journal homepage: www.elsevier.com/locate/psychsport

Autonomy support from parents and coaches: Synergistic or compensatory effects on sport-related outcomes of adolescent-athletes?

Patrick Gaudreau [a, *], Amélie Morinville [a], Alexandre Gareau [a], Jérémie Verner-Filion [b], Isabelle Green-Demers [c], Véronique Franche [a]

[a] University of Ottawa, Canada
[b] Université du Québec à Montréal, Canada
[c] Université du Québec en Outaouais, Canada

ARTICLE INFO

Article history:
Received 2 August 2015
Received in revised form
9 April 2016
Accepted 25 April 2016
Available online 26 April 2016

Keywords:
Self-determination theory
Autonomy
Parenting style
Performance
Need satisfaction
Flow

ABSTRACT

Objectives: This study examined how autonomy support from parents and autonomy support from coaches are associated with sport-related outcomes of adolescent-athletes. Two alternative hypotheses were proposed: (a) *a synergistic socialization interaction* in which high levels of autonomy support provided by parents and coaches are both needed to obtain the most positive sport-related outcomes, (b) *a compensatory-protective interaction* in which coaching autonomy support is more important for sport-related outcomes in athletes perceiving lower levels of parental autonomy support.
Design: Two studies using prospective designs.
Method: Study 1 was conducted with adolescent soccer players ($N = 46$) and Study 2 was conducted with gymnasts ($N = 85$). In both studies, athletes reported the extent to which they perceived their parents and coaches provided autonomy support. Athletes also completed scales assessing their motivation toward sport (Studies 1 and 2), situational motivation prior to and following a competition (Study 2), and need satisfaction (Study 1). Sport achievement and performance were also assessed in the form of goal attainment (Study 1), self-reported achievement following the competition (Study 2), and flow states (Study 2). Hierarchical moderated regressions were conducted in order to test our competing hypotheses.
Results: Analyses provided support for the *compensatory-protective interaction* hypothesis. Coaching autonomy support was more strongly related to sport motivation, need satisfaction, sport achievement, and flow in athletes who perceived lower level of parental autonomy support.
Conclusions: This research program provided support for the study of the interactive effect of perceived autonomy support from distinct socialization agents (i.e., parents and coaches) and its impact on adolescent-athletes.

1. Introduction

In their normative and volitional quest for autonomy (e.g., Van Petegem, Beyers, Vansteenkiste, & Soenens, 2012), teenagers are greatly influenced by significant adults such as their parents and their instructors (e.g., Laursen & Collins, 2009). As a result, adolescents who participate in competitive sports can be influenced, for better or for worst, by the coaches who are responsible of coordinating their athletic development (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011). Thus far, relatively little attention has been allocated to investigate the

Patrick Gaudreau, Amélie Morinville, Alexandre Gareau, and Véronique Franche are with the School of Psychology, University of Ottawa. Jérémie Verner-Filion and Isabelle Green-Demers are with the Département de Psychologie de l'Université du Québec à Montréal et de l'Université du Québec en Outaouais, respectively. The first four authors played equal roles in the preparation of this manuscript and should be considered as first authors. This research was supported by the Sport Canada Sport Participation Research Initiative from the Social Sciences and Humanities Research Council of Canada (#862-2009-0007) and a teaching release from the Faculty of Social Sciences awarded to Patrick Gaudreau.

* Corresponding author. School of Psychology, University of Ottawa, Ottawa, ON, K1N 6N5, Canada. Tel.: +1 613 562 5800x4308; fax: +1 613 562 5147.
E-mail address: pgaudrea@uottawa.ca (P. Gaudreau).

http://dx.doi.org/10.1016/j.psychsport.2016.04.006
1469-0292/

combined impact of parents and coaches on the psychological experience of adolescent-athletes. Two studies, using a prospective longitudinal design, were conducted to close this research gap by examining novel hypotheses about the *potentially interactive role* of perceived parental and coaching autonomy support.[1]

1.1. Perceived autonomy support from parents and coaches in the sport domain

Self-Determination Theory (SDT; Ryan & Deci, 2000) offers a valuable platform to delineate the psychosocial conditions through which family and sport environments can influence competitive athletes. Significant adults such as parents and coaches are frequently interacting with adolescents to instruct, guide, and support their efforts in attempting to manage the various requirements of their daily living. More precisely, SDT posits that the interpersonal quality or the *autonomy supportiveness* of the adult-adolescent encounters – rather than the mere involvement or quantity of such interactions – should determine the extent to which significant adults exert positive developmental influences (Grolnick, Ryan, & Deci, 1991).

Parents and coaches acting in an autonomy supportive manner are more likely to provide choice, to give opportunities for initiative, and to offer positive, informative, and constructive feedback. They are also more likely to take an empathic stance in which they are able to read and acknowledge the emotions experienced and expressed by the adolescents. They are also capable of offering a rationale to explain the decisional process underlying the need to respect rules and norms that are often inherent to complex social systems (e.g., family, sport team). Providers of autonomy support behave in a warm, caring, and supportive fashion while allowing the persons to express themselves and to behave in ways that are consistent with core elements of their sense of self (e.g., Conroy & Coatsworth, 2007). Overall, *autonomy supportive interpersonal style* should offer the adolescent-athletes with opportunities to express their feelings, priorities, and values. As such, autonomy support is regarded as an antecedent that exerts positive developmental influences on athletes (Ryan & Deci, 2000; Vansteenkiste, Niemiec, & Soenens, 2010). Indeed, past research has demonstrated that autonomy support from parents or coaches is positively related to various sport-related outcomes in athletes, such as their need satisfaction (Stenling, Lindwall, & Hassmén, 2015), self-determined motivation (Fenton, Duda, Quested, & Barrett, 2014), flow states (Bakker, Oerlemans, Demerouti, Slot, & Ali, 2011), and achievement (Cheon, Reeve, Lee, & Lee, 2015).

1.2. Perceived autonomy support and need satisfaction

Tenants of SDT assert that individuals are naturally inclined and predisposed to experience inner feelings of ownership and self-endorsement (i.e., autonomy), efficacy and mastery (i.e., competence), and interpersonal closeness and connectedness (i.e., relatedness). Satisfaction of these psychological needs have been related to various indicators of well-being and optimal functioning across a wide variety of life domains (Vansteenkiste et al., 2010).

Adolescent-athletes are more likely to experience feelings of need satisfaction whenever they perceive that they interact with parents or coaches with an autonomy supportive style (Ryan & Deci, 2000). A large body of research has reported a robust and replicable association between perceived autonomy support and feelings of need satisfaction in athletes (e.g., Amorose & Anderson-Butcher, 2007; Smith, Ntoumanis, Duda, & Vansteenkiste, 2011). However, only a limited portion of this research has simultaneously examined the influence of different socialization agents. Studies in the sport and exercise domains have shown that autonomy support from parents and autonomy support from coaches are both significantly associated with need satisfaction of athletes (Gagné, Ryan, & Bargmann, 2003; Vierling, Standage, & Treasure, 2007). Research in the educational domain (i.e., autonomy support from teachers and parents) has yielded similar results (D'Ailly, 2003; Soenens & Vansteenkiste, 2005). However, researchers have yet to investigate the interactive effect of the parental and coaching/teaching autonomy support in either the sport or the school domain.

1.3. Perceived autonomy support and self-determined motivation

Adolescent-athletes, like any other adolescents engaged in achievement-related domains, can perform their activities for a wide variety of reasons. These reasons can nonetheless be regrouped in six conceptually and empirically distinguishable motives (i.e., amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, intrinsic) aligned on a self-determination continuum (e.g., Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003; Wilson, Sabiston, Mack, & Blanchard, 2012). Furthermore, these six types of motivation can further be regrouped into two broader dimensions of motivation hereby referred to as *non-self-determined motivation* and *self-determined motivation*. Non-self-determined motivation is characterized by the pursuit of behaviors that are not self-determined because they are performed without a wholehearted intention to act, to obtain rewards or avoid punishments, and/or to avoid feelings of guilt and shame. In contrast, self-determined motivation is characterized by the pursuit of an activity perceived to be important for the person and/or pursued because of the mere interest for the activity.

The literature offers systematic indication that perceived autonomy support from coaches (e.g., Amorose & Anderson-Butcher, 2007; Gagné et al., 2003; Pelletier, Fortier, Vallerand, & Brière, 2001), parents (e.g., Chirkov & Ryan, 2001; Grolnick & Ryan, 1989), and even teachers (e.g., Grolnick et al., 1991; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004) is positively related to self-determined motivation. However, a majority of studies have investigated the specific role of either the parental or the coaching/teaching autonomy support. This approach is likely to overestimate the specific contribution of a socialization agent by omitting the influence of other potentially important sources of social influence. Very little research in sport psychology has examined and compared the influence of parental autonomy support and coaching autonomy support on youth motivation. Moreover, these studies have reported mixed findings. On the one hand, autonomy support (or other related facets, such as positive encouragement) from parents and autonomy support from coaches were both significantly associated with intrinsic motivation (Chan, Lonsdale, & Fung, 2012). On the other hand, other researchers have shown that parental autonomy support was the sole significant predictor of self-determined sport motivation in samples of adolescent female gymnasts (Gagné et al., 2003) and Estonian athletes (Hein & Jõesaar, 2014).

1.4. Perceived autonomy support and sport-related achievement/performance

Limited research has examined the role of perceived coaching autonomy support on indicators of sport achievement and the

[1] Autonomy support was evaluated by the athletes themselves. Throughout this manuscript, *autonomy support* should be interpreted as a diminutive of *perceived autonomy support*.

results remain largely equivocal. Studies using a cross-sectional design have indicated that coaching autonomy support is significantly associated with higher subjective evaluations of one's sport achievement (e.g., Smith, Ntoumanis, & Duda, 2007). However, studies using prospective designs (semi-longitudinal) have failed to replicate such findings (e.g., Smith et al., 2011). It has also been demonstrated that athletes whose coaches followed an autonomy-supportive intervention program received more medals at the 2012 London Paralympic Games compared to those who were in a control condition (Cheonet al., 2015). In the realm of educational psychology, in which more studies have been conducted, results have also shown a weak and inconsistent association between academic achievement and autonomy support from parents and autonomy support from teachers (e.g., D'Ailly, 2003; Grolnick et al., 1991; Soenens & Vansteenkiste, 2005; Vansteenkiste et al., 2004).

1.5. Toward an interactionist perspective on perceived autonomy support

As reviewed above, the perceived *parental autonomy support* (PAS) and *coaching autonomy support* (CAS) have rarely been studied together. In this study, we propose two competing hypotheses stemming from *an interactionist perspective*. Both hypotheses assume that CAS and PAS have a multiplicative effect – an interaction – to predict sport-related outcomes. Therefore, the focal point of this interactionist perspective is oriented toward the combined influence of CAS and PAS rather than on their separate or additive effects.

In the first interactionist hypothesis, we propose that perceived autonomy support from both the parents and the coaches would create a protective-protective synergy (Fergus & Zimmerman, 2005) to maximize the positive sport-related outcomes of adolescent-athletes. Proponents of the positive youth development theory have hypothesized that "strengths accumulating across ecological domains magnify the protective and thriving effects of positive experiences in single contexts" (Benson et al., 2006, p. 6). Such a synergy could operate implicitly as a mesosystemic process (Bronfenbrenner, 1986) in which the confluence of frequent interactions with autonomy supportive adults would offer a nexus for an enhanced positive development. This hypothesis – hereby referred to as the *synergistic socialization interaction* – presumes that athletes who perceive higher levels of both PAS and CAS should experience the highest levels of sport motivation, need satisfaction, and achievement.

In the second interactionist hypothesis, we propose that coaches (or any other significant adults, such as teachers, grand-parents, or educators) can play a *compensatory role* in children and adolescents who are exposed to dysfunctional parenting styles, non-warmth, or little parental autonomy support (Fergus & Zimmerman, 2005). Studies in preventive developmental sciences have indeed showed that positive socialization experiences outside the family are more influential in adolescents exposed to fewer positive socialization opportunities in their family (Barber & Olsen, 1997). Given that parents are primary figures of attachment, they play a predominant role in the socialization and satisfaction of the basic needs of their children and adolescents (e.g., Laursen & Collins, 2009). As such, positive extra-familial experiences are potentially less consequential for children and adolescents with more autonomy supportive relationships with their parents. In our second interactionist hypothesis – hereafter referred to as the *compensatory-protective interaction hypothesis* – we therefore propose that a significant adult outside of the family, such as a coach, should have a greater positive influence on sport-related outcomes in athletes with lower levels of perceived PAS. In contrast, perceived CAS should be less consequential for sport-related outcomes in athletes with higher levels of perceived PAS. In other words, adolescent-athletes who perceive higher levels of PAS should flourish irrespective of their level of CAS.

1.6. The present research

In this research, we examined and compared the tenability of these two interactionist hypotheses on a series of sport-related outcomes, namely sport motivation, need satisfaction, and sport achievement across two samples of competitive adolescent soccer players (Study 1) and gymnasts (Study 2). In the *synergistic socialization interaction*, we hypothesized that perceived CAS should be more strongly associated with sport-related outcomes in athletes with higher levels of perceived PAS. In contrast, in the *compensatory-protective interaction*, we hypothesized that perceived CAS should be more strongly associated with sport-related outcomes in athletes with lower levels of perceived PAS because coaches would then act as compensatory agents to athletes who evolve in low autonomy-supportive families.

2. Study 1

Study 1 was part of a longitudinal study in which a cohort of soccer players was followed during a 6-month training camp leading up to the selection of a regional U-12 soccer team. We expected that perceived CAS and PAS would significantly interact to predict three sport-related outcomes (self-determined sport motivation, need satisfaction, and goal attainment) measured four weeks later.

2.1. Method

2.1.1. Participants and procedure

Prior to the beginning of the selection camp, the coaching staff of the regional team identified the best U-12 players of the region. These athletes were then invited to participate in a 6-month selection camp to choose the members of the male and female regional U-12 soccer team for the 2010 provincial summer games in the province of Quebec in Canada. The sample of this study thus consisted of the 60 soccer players that participated in the selection camp. Athletes trained together once a week between October and April under the supervision of the coaching staff of the regional team. All parents provided a written informed consent and the children also assented to participate in the study. Importantly, athletes were informed that parents, coaches, and other members of the regional team would not be informed about their responses in order to minimize social desirability. The research was approved by a university research and ethics board. All participants had their name entered in a draw for a chance to win one of two official soccer shirts from a professional soccer team ($85). Participants completed questionnaires in October, November, December, March, and April. All of these questionnaires were completed before the team selection, which happened at the end of April. Athletes were informed that the purpose of this longitudinal study was to better understand the factors that could influence their motivation over time. All data was collected by three trained research assistants. The current study is based on data collected in March and April, as CAS was only measured in March to ensure that athletes had sufficient contact with coaches of the selection camp before making an informed evaluation of the interpersonal style of their coaches. This is consistent with several studies looking at motivational climate and coaching behavior (Ntoumanis, Taylor, & Thøgersen-Ntoumani, 2012; Reinboth & Duda, 2006; Weiss, Amorose, & Wilko, 2009).

Out of the 60 participants, 50 athletes completed the questionnaire in March (hereafter referred to as Time 1), whereas 48 athletes maintained their participation in April (hereafter referred to as Time 2). Two participants were excluded from the reported analyses because they completed the Time 2 questionnaire in a careless manner (i.e., systematic responding), thus yielding a retention rate of 77%. Our final sample consisted of 46 soccer players (female = 54.3%; male = 45.7%) ranging in age from 11 to 13 years (M = 12.40; SD = 0.62). Participants have been practicing soccer for an average of 6.48 years (SD = 1.86). Participants were training between one and 15 hours each week (M = 6.22; SD = 3.27) and they considered themselves as Caucasian (90.2%), Black/Afro-American (2.4%), Asian (2.4%), or other (4.9%).

2.1.2. Measures

At *Time 1*, we used the sport adaptation (Gillet, Vallerand, Paty, Gobancé, & Berjot, 2010) of the Perceived Autonomy Support Scale for Exercise Settings (PASSES; Hagger et al., 2007) to measure perceived autonomy support from parents (PAS) and from coaches (CAS). Twelve items were used to measure perception of CAS and the same 12 items were slightly modified to measure the perception of PAS. Using a scale from 1 (*not at all agree*) to 7 (*very strongly agree*),[2] athletes were asked to evaluate the extent to which each item corresponded to their current relationship with their parents, on the one hand, and to their current relationship with their coaches from the regional selection team, on the other hand (e.g., "My parents/coaches provide me choice regarding this sport activity"). Although athletes spent more time with one coach, they nonetheless interacted frequently with all members of the coaching staff. Therefore, they were asked to refer to their coaches (plural) rather to their coach (singular). Results of confirmatory factor analyses have provided support for a one-factor model (Gillet et al., 2010). Evidence of convergent validity, test-rest reliability, and internal consistency have also been reported by Gillet et al. (2010). In this sample, the internal consistency of PAS (α = 0.89) and CAS (α = 0.93) was good.

At *Time 2*, we used a short version (Amiot, Gaudreau, & Blanchard, 2004) of the Sport Motivation Scale (Pelletier, Fortier, Vallerand, Tuson, Briére, & Blais, et al., 1995) to assess the reasons why athletes were doing their sport. Athletes rated the extent to which each of the 15 items (3 per subscales) corresponded to the reasons why they were doing this sport (e.g. "Because I enjoy doing this sport"). Scores of self-determined sport motivation (i.e., intrinsic and identified motivation) and non-self-determined sport motivation (i.e., introjection, external, and amotivation)[3] were created because studies have also found their differential associations with a host of sport-related processes and outcomes, thus providing evidence for the concurrent and predictive validity of this questionnaire (Vallerand, Donahue, & Lafreniere, 2011). In this sample, the internal consistency of self-determined (α = 0.88) and non-self-determined sport motivation (α = 0.91) was good.

We assessed need satisfaction using a 12-item version of the Basic Need Satisfaction Scale from Deci and Ryan (2000) measuring the need for autonomy (e.g., "I am free to express my ideas and opinions in my sport"), competence (e.g., "I feel like I am a competent athlete"), and relatedness (e.g., "I get along with people in my sport"). This scale was adapted to fit the sport setting. Athletes were asked to rate the extent to which the items corresponded to their feelings in their sport. Several researchers have combined autonomy (α = 0.72), competence (α = 0.84), and relatedness (α = 0.86) to create a need satisfaction score (Sheldon & Filak, 2008). This decision was acceptable given the moderately high inter-scale correlations in this sample and the good level of internal consistency of a global score (α = 0.86).

We measured goal attainment with the three subscales of the Attainment of Sport Achievement Goal Scale (e.g., Amiot et al., 2004). This questionnaire uses a theoretically-driven approach to measure perceived sport performance using three criteria generally used by individuals to evaluate their level of competence/achievement on a task: mastery ("I executed my movements correctly"), self-improvement ("I did better than my usual performances"), and normative ("I did better than most other athletes"). Athletes were asked to evaluate the extent to which each of the 12 items corresponded to their level of sport performance over the last month. Results of structural equation models have lent credence to the validity of a hierarchical model in which the three inter-related subscales can be used to form a global index of goal attainment (e.g., Soucy Chartier, Gaudreau, & Fecteau, 2011). As per prior research (e.g., Amiot et al., 2004), the inter-scale correlations (average r = 0.55) in this sample were moderately high. The subscales were averaged to form a global index (α = 0.87).

2.2. Results and brief discussion

2.2.1. Preliminary analyses

We compared our final sample (n = 46) to the participants who did not participate in the March and/or April measurement wave (n = 12). Our final sample did not significantly differ from the total sample on the available information collected at the start of the project in October: self-determined sport motivation, F (1, 50) = 1.54, $p > 0.10$, non-self-determined sport motivation, F (1, 50) = 0.01, $p > 0.10$, age, F (1, 55) = 0.56, $p > 0.10$, years of experience in the sport, F (1, 50) = 0.01, $p > 0.10$, weekly hours of training, $F(1, 48) = 1.36$, $p > 0.10$, and gender, $\chi^2(1) = 0.61$, $p > 0.10$. Overall, our final sample was deemed quite comparable to the athletes who were invited to the 6-month selection camp. Descriptive statistics and bivariate correlations are presented in Table 1.

2.2.2. Main analyses

We conducted four moderated hierarchical regression analyses, one for each of the four outcome variables (Cohen, Cohen, West, & Aiken, 2003). The scores of PAS and CAS were centered. Centered scores of PAS and CAS were entered at the first step, followed by their multiplicative term at the second step (the same approach was taken in Study 2). Provided a significant interaction, two simple slope analyses were performed to examine the relationships between CAS and each of the dependent variables at low (-1SD) and high (+1SD) levels of PAS (see Fig. 1, panel A to C). As displayed in Table 2, the interactive effect of PAS and CAS was a significant predictor of self-determined sport motivation, need satisfaction, and goal attainment, but not non-self-determined motivation. For athletes reporting low levels of PAS, CAS was significantly associated with self-determined motivation (B = 0.53, 95% CI = [0.04, 1.02], $p < 0.05$, $\beta = 0.43$), need satisfaction (B = 0.44, 95% CI = [0.23, 0.65], $p < 0.05$, $\beta = 0.68$), and goal attainment (B = 0.44, 95% CI = [0.11, 0.78], $p < 0.05$, $\beta = 0.52$). In contrast, the relationships with self-determined sport motivation (B = −0.10, 95% CI = [−0.52, 0.32], $p > 0.05$, $\beta = -0.08$), need satisfaction (B = 0.14, 95% CI = [−0.04, 0.32], $p > 0.05$, $\beta = 0.22$), and goal attainment (B = −0.22, 95% CI = [−0.51, 0.07], $p > 0.05$, $\beta = -0.26$) were not significant for athletes reporting high levels of PAS. Overall, results lent credence to a *compensatory-protective interaction hypothesis* in which the positive relationship between CAS and sport-related

[2] All the instruments used in this paper were assessed using this same rating scale.

[3] Our analyses were conducted with and without amotivation and the results were virtually identical in both cases (see supplementary file, Appendix A and B).

Table 1
Study 1: Descriptive statistics and bivariate correlations

Variables	*M*	*SD*	α	1	2	3	4	5
1. T1 parental autonomy support	6.29	0.72	0.89	–				
2. T1 coaching autonomy support	5.74	1.05	0.93	0.44**	–			
3. T2 self-determined sport motivation	5.35	1.42	0.88	0.58**	0.38**	–		
4. T2 non-self-determined sport motivation	3.27	1.22	0.91	0.24	0.02	0.54**	–	
5. T2 need satisfaction	5.96	0.67	0.86	0.65**	0.63**	0.53**	0.04	–
6. T2 goal attainment	5.80	0.85	0.89	0.52**	0.30**	0.46**	0.39**	0.64**

Note. *$p < 0.05$. **$p < 0.01$. All variables ranged from 1 to 7.

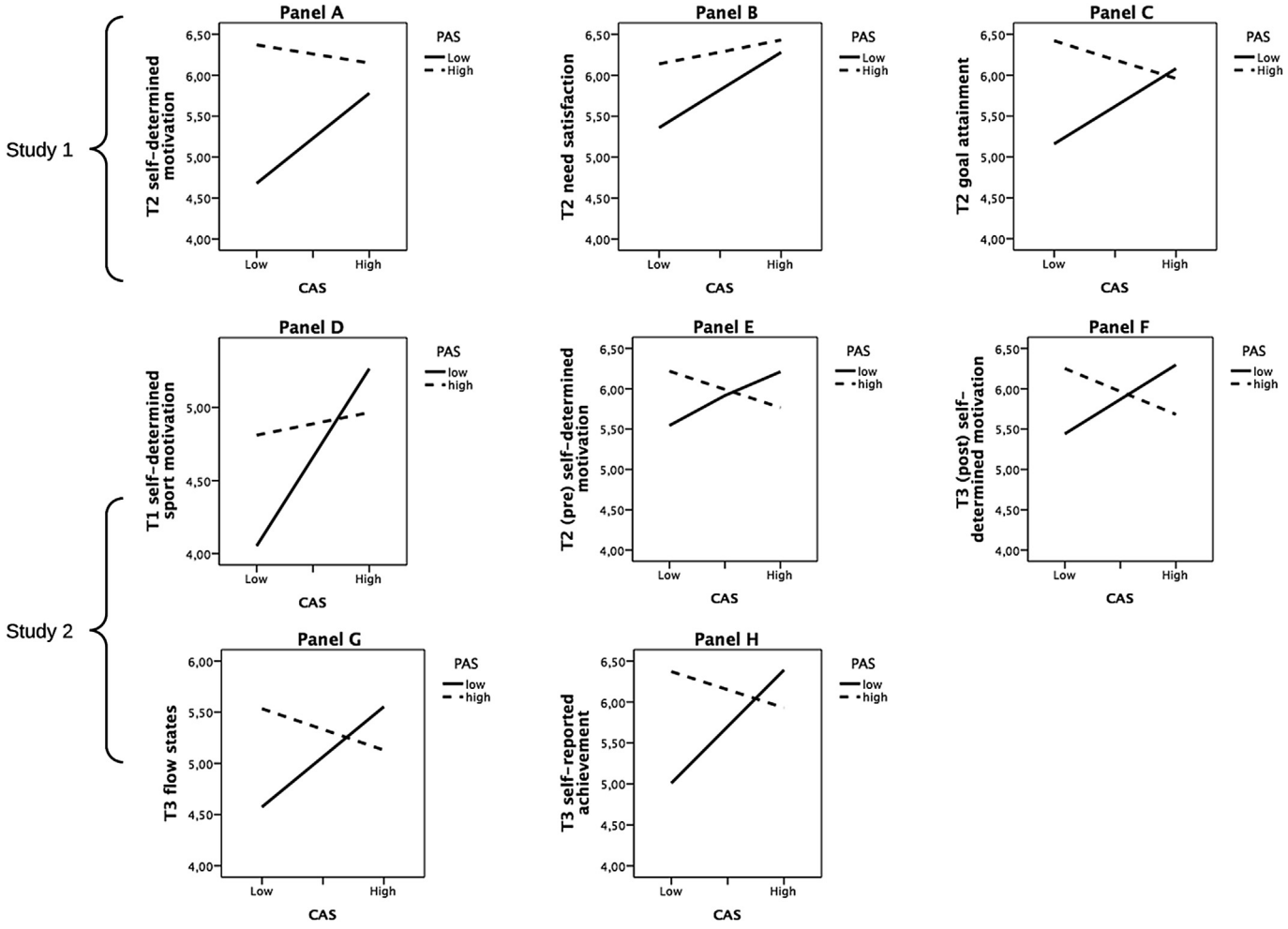

Fig. 1. Results of simple slopes for Study 1 (Panel A to C) and Study 2 (Panel D to H). .

outcomes was significantly stronger for athletes with lower levels of PAS.[4]

3. Study 2

Results of Study 1 provided initial support for the *compensatory-protective interaction hypothesis*. However, it was deemed important to replicate findings from Study 1 with an independent sample in order to strengthen the support obtained for these results. Thus, the aim of Study 2 was to expand the findings of Study 1 within the confine of a built-in differentiated replication approach (Uncles & Kwok, 2013). More specifically, we introduced slight methodological variations in order to start establishing the empirical generalizability of the PAS × CAS effect. Among these changes, a different questionnaire of perceived autonomy support was used in Study 2 to determine whether the compensatory-protective interaction generalizes across slightly different but complementary operationalizations of PAS and CAS.

[4] A multivariate regression was conducted to predict a multivariate vector of all dependent variables. The effects of PAS (Wilk's $\lambda = 0.72$, $F_{(4, 39)} = 3.76$, $p < 0.05$), CAS (Wilk's $\lambda = 0.70$, $F_{(4, 39)} = 4.15$, $p < 0.05$), and PAS × CAS (Wilk's $\lambda = 0.73$, $F_{(4, 39)} = 3.59$, $p < 0.05$) all reached statistical significance.

Table 2
Study 1: Results of hierarchical moderated regressions

	Time 2							
	Self-determined motivation		Non-self-determined motivation		Need satisfaction		Goal attainment	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1	0.35**		0.07		0.06*		0.27*	
Step 2	0.06*		0.05		0.05*		0.15*	
PAS		0.41**		0.21		0.45**		0.33
CAS		0.17		−0.08		0.36**		0.13
PAS × CAS		−0.27*		−0.25		−0.24**		−0.41**

Note. *$p < 0.05$ (t values of the β were higher than 1.96). **$p < 0.01$ (t values of the β were higher than 2.56). PAS = Parental autonomy support. CAS = Coaching autonomy support. All standardized beta parameters were taken from Step 2.

In Study 2, we focused on four additional issues. The first issue relates to the nature of the coach-athlete relationship. We conducted Study 1 during a selection camp in which athletes interacted less frequently with the coaches (once a week) compared to a more traditional training/competitive setting in which they usually interact several times per week. The infrequent interactions and the evaluative nature of the selection process may have interfered with the development of a more proximal and nurturing coaching relationship, as coaches knew they would eventually have to make consequential decisions impacting the career path of the adolescent-athletes. As a result, "coaches" may have been perceived more as evaluators and selectors rather than as long-term partners of a mutually important overarching athletic project. Given these contextual specificities, we conducted a second study to replicate the interactive effect of PAS and CAS in a more traditional context. Thus, our first goal in Study 2 was to test if the *compensatory-protective interaction hypothesis* would prevail in settings where coaches and athletes interact in a more proximal and frequent fashion (more than once a week) and have been involved with one-another for a longer period of time.

Our second goal was to examine the generalizability of the findings at a distinct phase of competitive sport encounters. In Study 1, participants were engaged in an intensive selection process in which they did not compete against other teams. Such a context characterizes a preparatory phase in which athletes are training for the upcoming competitive season. In Study 2, we tried to replicate the compensatory-protective interaction effect during the preparatory phase of the season, while expanding to both the pre (one week before) and post (one week after) phases of a competition.

The soccer players who participated in Study 1 were still at an early stage of adolescence. The changing nature of the roles played by parents and coaches during adolescence (e.g., Côté, 1999) could perhaps alter the significance or the shape of the PAS × CAS interaction from early to late adolescence. Although parents remain important socialization agents in the lives of adolescents (for a review see Laursen & Collins, 2009), some studies conducted with adolescent-athletes suggest that the influence of PAS might be circumscribed to early adolescence (e.g., Chan et al., 2012). Our third goal in Study 2 was to try to replicate and extend the results from Study 1 by using a sample of athletes spanning the entire adolescence.

Finally, sport success can be regarded as a multifaceted construct encompassing two distinct but empirically related elements: achievement/outcome and performance/process (VandenBos, 2007). In Study 1, we focused on sport achievement by measuring the extent to which athletes felt like they had mastered the tasks, improved across time, and outperformed other athletes near the end of the selection camp. In Study 2, we tried to further this analysis by incorporating a measure of flow to capture the experiential process of performing complex sport-related tasks under the heat of competitive sport encounters (Jackson, Martin, & Eklund, 2008). Flow can be characterized as a state of graceful, effortless, and pleasurable performance during which the person feels in close unity with and capable of handling the challenges of the task (e.g., Csikszentmihalyi, 1990). Interestingly, Csikszentmihalyi (2014) stated that flow states are fostered by environments (i.e., family, school, sport) that provide support and challenge. Researchers in sport and education contexts have indeed found mastery-oriented climate (Harwood, Keegan, Smith, & Raine, 2015) and autonomy support (Bakker et al., 2011; Palaniappan & Swaminathan, 2014) to be significantly associated with flow states. Despite their inherently positive feelings, flow states should be seen as facilitators rather than prerequisites of outstanding sport achievements (e.g., Schüler & Brunner, 2009). High levels of achievement can be obtained with or without flow through different channels of deliberate "making it happen" or automatic "letting it happen" processes (Swann, Keegan, Crust, & Piggott, 2016). As such, adding a measure of flow was needed to offer a complementary perspective to differentiate the experiential-like process of performance from the typical measures of perceived sport achievement. Our fourth goal in Study 2 was to re-examine the interactive effect of PAS and CAS using a measure of flow and a measure of perceived sport achievement.

3.1. Method

3.1.1. Participants and procedure

The initial sample of this study consisted of 89 female gymnasts enrolled in a highly competitive regional training center. All parents provided a written informed consent and the children also assented to participate in the study. The research was approved by a university research and ethics board.

Athletes were recruited because they were regularly competing in provincial level gymnastic competitions. At Time 1 (beginning of the competitive season; January 2011), all participants completed questionnaires measuring their perceptions of PAS and CAS as well as their contextual sport motivation. At that time, they had enough experience training with their coaches to reliably evaluate their CAS. At Time 2 (one week before an important provincial competition; February 2011), exactly one month after Time 1, participants completed a questionnaire to measure their situational pre-competitive sport motivation. Finally, at Time 3 (the week after the competition), participants completed a questionnaire to measure their situational post-competitive sport motivation and to retrospectively assess their flow states and their overall perception of achievement during the competition.

Although the 89 gymnasts participated at Time 1, four participants carelessly completed the questionnaire. Hence, our sample consisted of 85 female gymnasts between 9 and 18 years of age ($M = 12.71$; $SD = 2.36$). All gymnasts regularly competed at the provincial level and they had an average of 5.13 years of competitive experience ($SD = 2.56$). Moreover, they had been practicing at the regional training center for 4.98 years ($SD = 2.60$). Eleven athletes had injuries and four had personal/family obligations and did not participate in the provincial competition selected for this study. Analyses that pertained to the perceived sport achievement and flow states during the competition were thus conducted on a subsample of 70 gymnasts.

3.1.2. Measures

At *Time 1,* we used the Interpersonal Behavior Inventory (Legault, Green-Demers, & Pelletier, 2006) to measure perceived PAS and CAS. Twelve items were used to measure perception of PAS

and the same 12 items were slightly modified to measure the perception of CAS.[5] Athletes evaluated the extent to which each item corresponded to their relationship with their coaches, on the one hand, and with their parents, on the other hand (e.g., "My coaches/parents display interest in what I do in gymnastics"). As per Study 1, they were asked to refer to their coaches (plural) rather to their coach (singular). In this sample, the internal consistency of PAS ($\alpha = 0.86$) and CAS ($\alpha = 0.80$) was good.

We used the Sport Motivation Scale (Pelletier et al., 1995) as per Study 1. However, we used the full 28-item version (4 items per subscale) to replicate our results with the original and traditionally used version of this questionnaire (Vallerand et al., 2011). Athletes reported the extent to which each item corresponded to reasons why they were generally doing their sport. This questionnaire contains seven subscales (three types of intrinsic motivation combined in one score, identified, introjection, external, and amotivation). The scores of self-determined ($\alpha = 0.90$) and non-self-determined motivation ($\alpha = 0.76$) were created as per Study 1.

At *Time 2* and *Time 3,* we used the Situational Motivation Scale (Guay, Vallerand, & Blanchard, 2000) to assess the situational sport motivation that athletes experienced during the week before and after a sport competition, respectively. This measure contains 16 items (4 items per subscale) divided into four subscales (intrinsic motivation, identified regulation, external regulation, and amotivation). Athletes evaluated the extent to which each item corresponded to the reasons why they were currently engaged in their sport (e.g., "Because I think that this activity is pleasant"). Internal consistency of self-determined motivation (Time 2, $\alpha = 0.82$; Time 3, $\alpha = 0.77$), which combined intrinsic and identified motivation, and non-self-determined motivation (Time 2, $\alpha = 0.79$; Time 3, $\alpha = 0.87$), which combined external motivation and amotivation, was good. Ample evidence of factorial and predictive validity has recently been reviewed for the usage of this scale in sport (Vallerand et al., 2011).

At *Time 3,* we used six items from the Short Flow States Scales (Jackson et al., 2008) to measure perception of flow during the competition. Participants were asked to retrospectively recall the extent to which each item corresponded to their experience during the competition with items such as "I was fully concentrated on what I was doing". In this sample, the internal consistency was acceptable ($\alpha = 0.72$). Evidence has been reported for the factorial, convergent, and concurrent validity of this short scale (Jackson et al., 2008). Finally, one item was used in which the participants retrospectively evaluated their level of achievement during the competition (i.e., "Overall, I did well during competition").

3.2. Results

3.2.1. Preliminary analyses

The athletes who took part in the competition ($n = 70$) were compared to those who participated in the project without actually competing in the competition ($n = 15$). These participants did not complete the self-reported achievement and flow state measures (Time 3) but their pre-competitive (Time 2) and post-competitive motivation (Time 3) were nonetheless measured. Participants who competed and those who did not compete had comparable self-determined motivation before, $F\ (1, 81) = 0.01$, $p > 0.10$, and after the competition, $F\ (1, 81) = 0.41$, $p > 0.10$. Their non-self-determined motivation was also comparable before, $F\ (1, 81) = 017$, $p > 0.10$, and after competition, $F\ (1, 81) = 0.39$, $p > 0.10$. Finally, our analyses revealed a significant difference in age, $F\ (1, 83) = 4.60$, $p < 0.05$, but no significant difference was observed in terms of years of experience in the sport, $F\ (1, 83) = 3.72$, $p > 0.05$. Descriptive statistics and bivariate correlations are presented in Table 3. The analyses reported hereafter were identical to the hierarchical moderated regressions from Study 1 (see the main analyses of Study 1 for further details).

3.2.2. Time 1

As displayed in Table 4, the interactive effect of PAS and CAS was significantly related to Time 1 self-determined sport motivation, but not to non-self-determined sport motivation. For athletes who reported lower levels of PAS, CAS was significantly associated with Time 1 self-determined sport motivation (B = 0.79, 95% CI = [0.31, 1.28], $p < 0.05$, $\beta = 0.58$). The relationship was not significant (B = 0.10; 95% CI = [−0.30, 0.50], $p > 0.05$, $\beta = 0.07$) for athletes who reported higher levels of PAS (see Fig. 1, panel D).

3.2.3. Time 2: Pre-competition motivation

The interactive effect of PAS and CAS was significantly related to pre-competition self-determined motivation, but not to non-self-determined motivation. At lower levels of PAS, CAS was positively and significantly associated with Time 2 self-determined sport motivation (B = 0.50, 95% CI = [0.05, 0.96], $p < 0.05$, $\beta = 0.42$). The relation was negative but not significant at higher levels of PAS (B = −0.31, 95% CI = [−0.66, 0.05], $p = 0.09$, $\beta = -0.26$; see Fig. 1, panel E).

3.2.4. Time 3: Post-competition motivation

The interactive effect was significantly associated with post-competition self-determined motivation, but not to non-self-determined sport motivation. CAS was positively and significantly associated with Time 3 self-determined motivation for athletes reporting lower levels of PAS (B = 0.58, 95% CI = [0.13, 1.02], $p < 0.05$, $\beta = 0.48$). The relation was significant but negative at higher levels of PAS (B = −0.38, 95% CI = [−0.73, −0.04], $p < 0.05$, $\beta = -0.32$; see Fig. 1, panel F).

3.2.5. Time 3: Flow during the competition

The interactive effect was significantly related to flow states. CAS was significantly and positively associated with flow perception at lower levels of PAS (B = 0.71, 95% CI = [0.18, 1.25], $p < 0.05$, $\beta = 0.54$). The relation was negative but not significant for athletes at higher levels of PAS (B = −0.39; 95% = [−0.81, 0.04], $p = 0.08$, $\beta = -0.29$; see Fig. 1, panel G).

3.2.6. Time 3: Achievement during the competition

The PAS × CAS interactive effect was significantly associated with perceived achievement. CAS was a significant predictor at lower levels of PAS (B = 0.88, 95% CI = [0.28, 1.49], $p < 0.05$, $\beta = 0.59$) but not at higher levels of PAS (B = −0.28, 95% CI = [−0.76, 0.20], $p > 0.05$, $\beta = -0.19$; see Fig. 1, panel H).

3.2.7. Ancillary analyses[6]

We conducted hierarchical moderated regressions in which a three-way interaction was added to the model to examine the

[5] This measure uses a broader operational definition of autonomy support in which coaches and parents are supporting one's autonomy (e.g., providing choice and rationale), but also supporting competence (e.g., giving constructive feedback) and relatedness (e.g., being empathic). Although our analyses were conducted using all items, more specific analyses with the 4 autonomy supportive items yielded virtually identical results (see supplementary file, Appendix C). The term "autonomy support" was thus conserved in Study 2 to avoid any confusion.

[6] A multivariate regression was conducted to predict a multivariate vector of all dependent variables. The effects were as follow: PAS (Wilk's $\lambda = 0.91$, $F_{(8, 58)} = 0.76$, $p > 0.10$), CAS (Wilk's $\lambda = 0.85$, $F_{(8, 58)} = 1.33$, $p > 0.05$), and PAS × CAS (Wilk's $\lambda = 0.79$, $F_{(8, 58)} = 1.92$, $p = 0.07$).

Table 3
Study 2: Descriptive statistics and bivariate correlations

	M	*SD*	α	1	2	3	4	5	6	7	8	9
1. T1 parental autonomy support	5.41	1.13	0.86	–								
2. T1 coaching autonomy support	5.92	0.76	0.80	0.05	–							
3. T1 self-determined sport motivation	4.75	1.04	0.90	0.13	0.28**	–						
4. T1 non-self-determined sport motivation	3.26	0.92	0.76	0.10	−0.03	0.45**	–					
5. T2 (pre) self-determined motivation	5.94	0.88	0.82	0.06	0.01	0.29**	0.00	–				
6. T2 (pre) non-self-determined motivation	2.00	1.01	0.79	−0.18	−0.10	−0.16	0.38**	−0.44**	–			
7. T3 (post) self-determined motivation	5.91	0.89	0.77	0.08	0.00	0.33**	0.09	0.78**	−0.38**	–		
8. T3 (post) non-self-determined motivation	2.05	1.10	0.87	−0.18	−0.04	−0.11	0.39**	−0.41**	0.82**	−0.39**	–	
9. T3 flow states during competition	5.18	1.04	0.79	0.15	0.06	0.43**	0.06	0.45**	−0.34**	0.53**	−0.29**	–
10. T3 self-reported achievement	5.89	1.17	–	0.21	0.13	0.32**	0.15	0.30*	−0.17	0.26*	−0.09	0.52**

Note. $^{*}p < 0.05$. $^{**}p < 0.01$. All variables ranged from 1 to 7.

Table 4
Study 2: Results of hierarchical moderated regressions

	Time 1				Time 2 pre-competition				Time 3 post-competition							
	Self-determined motivation		Non-self-determined motivation		Self-determined motivation		Non-self-determined motivation		Self-determined motivation		Non-self-determined motivation		Flow states		Self-reported achievement	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1	0.10*		0.01		0.01		0.04		0.01		0.04		0.03		0.06	
Step 2	0.04*		0.01		0.08**		0.01		0.11**		0.01		0.12**		0.10**	
PAS		0.11		0.09		0.04		−0.16		0.06		−0.05		0.14		0.19
CAS		0.33**		−0.02		0.08		−0.12		0.08		−0.18		0.12		0.20
PAS × CAS		−0.22*		−0.09		−0.30**		0.12		−0.35**		0.09		−0.35**		−0.33**

Note. $^{*}p < 0.05$ (*t* values of the β were higher than 1.96). $^{**}p < 0.01$ (*t* values of the β were higher than 2.56). PAS = Parental autonomy support. CAS = Coaching autonomy support. All standardized beta parameters were taken from Step 2.

moderating role of age (PAS × CAS × Age). Both the main effect of age and the three-way interactions failed to reach statistical significance (*ps* > 0.50) or to explain a practically significant amount of variance in the dependent variables ($\Delta R^2 < 0.01$). These results were taken to suggest that age did not significantly moderate the PAS × CAS interactive effect.

4. General discussion

4.1. Evidence for the compensatory-protective interaction hypothesis

Our overarching goal in this study was to generate and investigate novel, yet theoretically-driven hypotheses, that could explain how autonomy support from significant adults (i.e., parents and coaches) interacts to fuel and predict the sport motivation, need satisfaction, and athletic success of adolescent-athletes. Two theoretically defensible interactionist hypotheses were proposed a priori based on distinct lines of reasoning (Fergus & Zimmerman, 2005). Results of two studies, using a short-term prospective semi-longitudinal design, provided robust support for our *compensatory-protective interaction hypothesis*. On the one hand, athletes who perceive that their parents are providing high levels of PAS seem, under most circumstances, to be thriving regardless of their level of perceived CAS. For these athletes, most of the associations between CAS and sport-related outcomes were null and statistically non-significant. On the other hand, the positive relation between CAS and sport-related outcomes was significant for athletes who perceived their parents as offering lower levels of PAS. From a preventive developmental standpoint, these results are highly encouraging because they suggest that perceived CAS is acting as a powerful *compensatory-protective factor* that can largely compensate for a perceived parenting style characterized by lower levels of PAS.

Of foremost importance, these results suggest the potential of an *interactionist autonomy support perspective* to better inform theory, research, and practice. The significant PAS × CAS effect explained a substantial amount of incremental/unique variance that ranged from 5.5% to 14.5% in Study 1 (average of 8.8%) and from 4.4% to 11.7% in Study 2 (average of 9.1%). Guidelines to appraise the size of main effects are likely to undervalue the practical significance of interactive effects because the latter are obtained after controlling for the main effects (Laursen & Collins, 2009). Therefore, the effect sizes of our two studies should be regarded as encouraging evidence for the added benefits of moving toward a more complex theorizing of PAS and CAS.

4.2. Generalizability of the compensatory-protective interaction hypothesis

Support for the compensatory-protective interaction was initially obtained in a sample of soccer players in their early adolescence (Study 1). Study 2 replicated this finding in a sample of gymnasts ranging from 9 to 18 years of age. Some researchers have indicated that the strength of the relationship between parental encouragement and intrinsic motivation might diminish from early to late adolescence (Chan et al., 2012). Given that the roles of parents and coaches are changing during adolescence (Côté, 1999), it was deemed appropriate to explore the moderating role of age in our ancillary analyses of Study 2. Of great importance, age did not moderate nor significantly alter the significance of our interactive effect. A three-way PAS × CAS × age interaction would have required a much larger sample of athletes to reach statistical significance. For now, this result provides some preliminary evidence for the potential invariance of our interactionist perspective that will nonetheless need to be re-examined in longitudinal studies with larger samples of athletes followed from early to late adolescence.

The compensatory-protective interaction was found in a sample of athletes participating in an individual (i.e., gymnastics) and a team sport (i.e., soccer). This finding suggests that the compensatory-protective role of perceived CAS might generalize to contexts in which athletes work individually or in collaboration with other members of a team. Of particular interest, the results of a recent multilevel study indicated that the positive relationship between team-level perceived autonomy support and the team members' job creativity was stronger for teams that were working in units or departments that provided lower levels of autonomy support (Liu, Chen, & Yao, 2011). This finding, which bears a striking resemblance to our compensatory-protective interaction hypothesis, illustrates how future research could consider perceived CAS at both the person and group levels of analysis. In team settings, CAS could possess the characteristics of both an ambient and a discretionary interpersonal process whereby individual athletes may have a different perception of how the coaches interact more broadly with the team and more specifically with each of them. Such a possibility would explain why individuals in the same team have a similar but nonetheless different perception about the autonomy supportive style of a coach, teacher, or employer (Liu et al., 2011). Future studies should not only ask the athletes to report their perceptions of support, but also the coaches to describe their provision of autonomy support offered to the team (ambient support) and to each member of the team (discretionary support). This measurement scheme would enable a deeper examination of the interplay between the perceptions of both the providers (i.e., coaches) and the receivers (i.e., athletes) of ambient and discretionary types of autonomy support.

We intentionally conducted our two studies in different but complementary sport settings. In both studies, PAS and CAS interacted to predict self-determined sport motivation in a context that can be characterized as representing a preparatory phase that precedes the start of the competitive season. In time of social evaluation stress, such as after a sport competition (Time 3 of Study 2), CAS was *negatively* associated with post-competitive self-determined motivation for the athletes who perceived high levels of PAS. This unexpected result is extremely intriguing because it might underlie a complex self-handicapping dynamic. After a performance setback, individuals should experience more disappointment and sadness when they had invested considerable effort and resources into the pursuit of an activity (Weiner, 1985). Similarly, perceiving high levels of both CAS and PAS might create the impression for athletes that all external resources were reunited to reach outstanding levels of achievement. In such an ideal condition, failure holds very high diagnostic value because athletes cannot easily blame significant others for their performance setback, even if their autonomy was adequately supported. As such, the diminishing level of self-determined motivation might be seen as a proactive attempt – be it deliberate or unintentional – to protect the ego through reducing the level of perceived importance (i.e., identified motivation) and pleasure (i.e., intrinsic motivation) attached to the activity (Zuckerman & Tsai, 2005). However, this effect might be specific to this study, and more evidence is needed to directly investigate this potential explanation.

This unexpected result should not overshadow the robustness of the positive association between perceived CAS and several of the outcomes across all time points for the athletes who perceived lower levels of PAS. It is pivotal to outline that our results were replicated in two field studies using a prospective design in which the contexts (selection camp vs. competition), the types of sport (i.e., individual vs. team), the age span of the participants (i.e., 11–13 vs. 9–18), the operational definition of sport achievement/performance (i.e., goal attainment, perceived achievement, flow), and the instruments used to measure autonomy support were not held constant. Overall, the robustness of our findings across two distinct but complementary studies offers evidence for the generalizability of our findings.

4.3. Limitations and future directions

In this study, we did not measure PAS separately for the mother and the father. Therefore, family was implicitly conceptualized as a homogeneous cell in which children should perceive their parents as possessing a similar PAS (Steinberg, 2001). In future studies, participants should evaluate their relation with each of their parents rather than having to use some mental heuristics to average or weigh them in a global evaluation of PAS. Some studies have depicted maternal autonomy support as a stronger predictor of school-related outcomes than paternal autonomy support (e.g., D'Ailly, 2003; Soenens & Vansteenkiste, 2005). However, it remains uncertain whether these findings are overlooking an interactive effect of maternal and paternal autonomy support. Having a good relationship with another family member can compensate, at least partially, for the detrimental relationship with one parent (Bogard, 2005). Overall, our hypotheses offer a springboard to revisit the respective roles of perceived maternal and paternal autonomy support from an interactionist perspective.

Small sample sizes, like the one used in our two studies, offers some advantages and many disadvantages. It is extremely difficult to recruit large and homogeneous samples of athletes. Large samples require the inclusion of participants from multiple sports and multiple levels of expertise. This decision is defendable to maximize statistical power but can also create challenges in interpreting the findings. Our smaller samples offered some advantages because they ensured that participants were exposed to a comparable competitive context in which they shared the norms, values, and specificities of a single sport. Such samples are adequate to maximize internal validity, but they indeed create challenges to external validity and statistical power. Potential limitations to external validity were partially addressed by replicating our findings across two studies in which we introduced slight variations in our research method (e.g., type of sport, design, measures). Such a differentiated replication (Uncles & Kwok, 2013) minimizes the risk that our findings were a methodological artefact resulting from mere chance while offering some evidence for the robustness of the PAS $\times$ CAS interaction. Nonetheless, small samples are increasing the risk of not rejecting null hypotheses even when they are false in the population. For athletes with high PAS, the negative relations of CAS with flow ($\beta = -0.29$), perceived achievement $\beta = -0.19$), and goal attainment ($\beta = -0.26$) were non-negligible and would have potentially reached statistical significance with larger samples. At a first glance, these negative relations are counterintuitive because they are theoretically unexpected and substantially different from the positive effects of CAS that are generally observed in the extant literature. Nonetheless, the lowered sport achievement and performance observed in athletes with high PAS and CAS could explicate why athletes with lower PAS are still capable of catching up (compensatory-protective effect) if they can have access to high levels of CAS. Small samples can also increase the risk of rejecting the null hypothesis by artificially increasing the estimation of an effect size (e.g., Button et al., 2013). Overall, we agree with the comments of both anonymous reviewers in that future studies with larger samples are required to maximize statistical power, on the one hand, and to reliably estimate the effect size of the PAS $\times$ CAS effect, on the other hand.

Our findings indicated that CAS and PAS were not significantly correlated with non-self-determined motivation. Researchers have recently suggested that the positive autonomy supportiveness and the negative psychological controllingness might be distinctively

associated with consequential life outcomes (e.g., Bartholomew et al., 2011). In future research, researchers should examine the supporting and controlling interpersonal styles of both coaches and parents to explore whether coaches can also shield the detrimental effects of psychologically controlling interpersonal styles of some parents.

In this study, we relied exclusively on self-reported measures but we aimed at minimizing the biases associated with shared method variance by adding a time lag between the perceived autonomy support and dependent variables (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). In future studies, researchers should triangulate our findings with informant reports of need satisfaction and goal attainment. Reports from a close friend or a training partner might be preferable to avoid measuring the outcome of PAS and CAS with reports produced by the parents or the coaches themselves. Despite the moderately high level of convergence generally observed between objective and subjective reports of performance among sport participants (e.g., McAuley, 1985), adding an objective indicator of achievement, such as ranking or rating of performance-goal discrepancy, would be useful to convince sport federations about the importance of our findings.

Autonomy support encompasses several characteristics (Mageau & Vallerand, 2003). In this study, we measured perceived autonomy support with items tapping more specifically into the support for autonomy (Study 1) or more broadly using a pool of items capturing the support for autonomy, competence, and relatedness (Study 2). The CAS × PAS effect was replicated using both measures of autonomy support. Nonetheless, researchers should try to incorporate both types of measures in order to examine which one possesses the best predictive and/or incremental validity to predict consequential developmental outcomes.

In this article, we presented novel hypotheses and empirical tests to demonstrate the effect of the PAS × CAS interaction on a series of sport-related outcomes. Tenants of SDT propose that need satisfaction mediates the association between autonomy support and autonomous motivation. However, mediators are also dependent variables. Therefore, we analyzed need satisfaction, sport motivation, and sport achievement as dependent variables in order to initially demonstrate and replicate the PAS × CAS interaction on each of these variables before venturing into more complex mediated-moderation models. The results of this study provided the needed building block to better understand the combined effects of the autonomy support provided by parents and coaches on both need satisfaction and sport motivation. Future research with larger sample sizes and ideally at least three time points (e.g., autonomy support at time 1, need satisfaction at time 2, and sport motivation at time 3) could examine the potential processes (e.g., mediators) involved in the *compensatory-protective interaction hypothesis*.

5. Conclusion

Parents and coaches are important socialization agents in the micro-system of adolescent-athletes. Yet, autonomy support from coaches and autonomy support from parents are not often studied together. Our studies tried to close this research gap by examining the combined influence of coaches and parents within an interactionist perspective. In this study, we have tried to make a significant theoretical contribution by formulating competing synergistic and compensatory-protective hypotheses. Across two studies, our results showed that coaches offer a compensatory-protective influence that is beneficial for the sport motivation, need satisfaction, and sport achievement of adolescent-athletes with lower perceived parental autonomy support. Coaches possess a more limited influence in athletes with higher perceived parental autonomy support insofar as parents might already offer a securing, harbouring, and shielding influence that help their children thrive even when they perceive levels of autonomy support from their coaches. For athletes with lower parental autonomy support, lower coaching autonomy support has the potential to generate the type of “double whammy” that could prevent adolescent-athletes from accruing the benefits generally expected from participating in sport activities. Coaches need to be informed that their autonomy supportive style has the potential to transform their typical pedagogical influence into a compensatory-protective role capable of yielding desirable sport-related outcomes in the lives of several adolescent-athletes.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.psychsport.2016.04.006.

References

Amiot, C. E., Gaudreau, P., & Blanchard, C. M. (2004). Self-determination, coping, and goal attainment in sport. *Journal of Sport & Exercise Psychology, 26*(3), 396–411.

Amorose, A. J., & Anderson-Butcher, D. (2007). Autonomy-supportive coaching and self-determined motivation in high school and college athletes: a test of self-determination theory. *Psychology of Sport and Exercise, 8*, 654–670. http://dx.doi.org/10.1016/j.psychsport.2006.11.003.

Bakker, A. B., Oerlemans, W., Demerouti, E., Slot, B. B., & Ali, D. K. (2011). Flow and performance: a study among talented Dutch soccer players. *Psychology of Sport and Exercise, 12*, 442–450. http://dx.doi.org/10.1016/j.psychsport.2011.02.003.

Barber, B. K., & Olsen, J. A. (1997). Socialization in context: connection, regulation, and autonomy in the family, school, and neighborhood, and with peers. *Journal of Adolescent Research, 12*, 287–315. http://dx.doi.org/10.1177/0743554897122008.

Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: the role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin, 37*, 1459–1473. http://dx.doi.org/10.1177/0146167211413125.

Benson, P. L., Scales, P. C., Hamilton, S. F., Sesma, A., Jr., Hong, K. L., & Roelkepartain, E. C. (2006). Positive youth development so far: core hypotheses and their implications for policy and practice. *Insights and Evidence: Promoting Healthy Children, Youth, and Communities, 3*(1), 1–13.

Bogard, K. L. (2005). Affluent adolescents, depression, and drug use: the role of adults in their lives. *Adolescence, 40*(158), 281–306.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: research perspectives. *Developmental Psychology, 22*, 723–742. http://dx.doi.org/10.1037/0012-1649.22.6.723.

Button, K. S., Ioannidis, J. P. A., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S. J., et al. (2013). Power failure: why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience, 14*, 365–376. http://dx.doi.org/10.1038/nrn3475.

Chan, D. K., Lonsdale, C., & Fung, H. H. (2012). Influences of coaches, parents, and peers on the motivational patterns of child and adolescent athletes. *Scandinavian Journal of Medicine & Science in Sports, 22*, 558–568. http://dx.doi.org/10.1111/j.1600-0838.2010.01277.x.

Chatzisarantis, N. L. D., Hagger, M. S., Biddle, S. J. H., Smith, B., & Wang, J. C. K. (2003). A meta-analysis of perceived locus of causality in exercise, sport, and physical education contexts. *Journal of Sport & Exercise Psychology, 25*(3), 284–306.

Cheon, S. H., Reeve, J., Lee, J., & Lee, Y. (2015). Giving and receiving autonomy support in a high-stakes sport context: a field-based experiment during the 2012 London Paralympic Games. *Psychology of Sport and Exercise, 19*, 59–69. http://dx.doi.org/10.1016/j.psychsport.2015.02.007.

Chirkov, V., & Ryan, R. M. (2001). Parent and teacher autonomy-support in Russian and U.S. Adolescents: common effects on well-being and academic motivation. *Journal of Cross-Cultural Psychology, 32*, 618–635. http://dx.doi.org/10.1177/0022022101032005006.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum.

Conroy, D. E., & Coatsworth, J. (2007). Assessing autonomy-supportive coaching strategies in youth sport. *Psychology of Sport and Exercise, 8*, 671–684. http://dx.doi.org/10.1016/j.psychsport.2006.12.001.

Côté, J. (1999). The influence of family in the development of talent in sport. *The Sport Psychologist, 13*(4), 395–417.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row.

Csikszentmihalyi, M. (2014). *Flow and the Foundations of Positive Psychology: The Collected Works of Mihaly Csikszentmilhayi*. Dordrecht, Netherlands: Springer.

D'Ailly, H. (2003). Children's autonomy and perceived control in learning: a model of motivation and achievement in Taiwan. *Journal of Educational Psychology, 95*, 84–96. http://dx.doi.org/10.1037//0022-0663.95.1.84.

Fenton, S. A. M., Duda, J. L., Quested, E., & Barrett, T. (2014). Coach autonomy support predicts autonomous motivation and daily moderate-to-vigorous physical activity and sedentary time in youth sport participants. *Psychology of Sport and Exercise, 15*, 453–463. http://dx.doi.org/10.1016/j.psychsport.2014.04.005.

Fergus, S., & Zimmerman, M. A. (2005). Adolescent resilience: a framework for understanding healthy development in the face of risk. *Annual Review of Public Health, 26*, 399–419. http://dx.doi.org/10.1146/annurev.publhealth.26.021304.144357.

Gagné, M., Ryan, R. M., & Bargmann, K. (2003). Autonomy support and need satisfaction in the motivation and well-being of gymnasts. *Journal of Applied Sport Psychology, 15*, 372–390. http://dx.doi.org/10.1080/714044203.

Gillet, N., Vallerand, R. J., Paty, E., Gobancé, L., & Berjot, S. (2010). French validation and adaptation of the perceived autonomy support scale for exercise settings to the sport context. *International Journal of Sport and Exercise Psychology, 8*, 118–128. http://dx.doi.org/10.1080/1612197X.2010.9671937.

Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-regulation and competence in school. *Journal of Educational Psychology, 81*, 143–154. http://dx.doi.org/10.1037/002243663/89/$00.75.

Grolnick, W. S., Ryan, R. M., & Deci, E. L. (1991). Inner resources for school achievement: motivational mediators of children's perceptions of their parents. *Journal of Educational Psychology, 83*, 508–517. http://dx.doi.org/10.1037/0022-0663.83.4.508.

Guay, F., Vallerand, R. J., & Blanchard, C. M. (2000). On the assessment of situational intrinsic and extrinsic motivation: the situational motivation scale (SIMS). *Motivation and Emotion, 24*, 175–213. http://dx.doi.org/10.1023/A:1005614228250.

Hagger, M. S., Chatzisarantis, N., Hein, V., Pihu, M., Soos, I., & Karsai, I. (2007). The perceived autonomy support scale for exercise settings (PASSES): development, validity, and cross-cultural invariance in young people. *Psychology of Sport & Exercise, 8*, 632–653. http://dx.doi.org/10.1016/j.psychsport.2006.09.001.

Harwood, C. G., Keegan, R. J., Smith, J. M. J., & Raine, A. S. (2015). A systematic review of the intrapersonal correlates of motivational climate perceptions in sport and physical activity. *Psychology of Sport and Exercise, 18*, 9–25. http://dx.doi.org/10.1016/j.psychsport.2014.11.005.

Hein, V., & Jõesaar, H. (2014). How perceived autonomy support from adults and peer motivational climate are related with self-determined motivation among young athletes. *International Journal of Sport and Exercise Psychology, 13*, 1–12. http://dx.doi.org/10.1080/1612197X.2014.947304.

Jackson, S. A., Martin, A. J., & Eklund, R. C. (2008). Long and short measures of flow: the construct validity of the FSS-2, DFS-2, and new brief counterparts. *Journal of Sport & Exercise Psychology, 30*(5), 561–587.

Laursen, B., & Collins, W. A. (2009). Parent-child relationships during adolescence. In R. M. Lerner, & L. Steinberg (Eds.) (3rd ed.,*Contextual influences on adolescent development: 2. Handbook of adolescent psychology* (pp. 3–42). Hoboken, NJ: Wiley.

Legault, L., Green-Demers, I., & Pelletier, L. G. (2006). Why do high school students lack motivation in the classroom? toward an understanding of academic amotivation and the role of social support. *Journal of Educational Psychology, 98*, 567–582. http://dx.doi.org/10.1037/0022-0663.98.3.567.

Liu, D., Chen, X.-P., & Yao, X. (2011). From autonomy to creativity: a multilevel investigation of the mediating role of harmonious passion. *Journal of Applied Psychology, 96*, 294–309. http://dx.doi.org/10.1037/a0021294.

Mageau, G., & Vallerand, R. J. (2003). The coach-athlete relationship: a motivational model. *Journal of Sport Sciences, 21*, 883–904. http://dx.doi.org/10.1080/0264041031000140374.

McAuley, E. (1985). Success and causality in sport: the influence of perception. *Journal of Sport Psychology, 7*(1), 13–22.

Ntoumanis, N., Taylor, I. M., & Thøgersen-Ntoumani, C. (2012). A longitudinal examination of coach and peer motivational climates in youth sport: implications for moral attitudes, well-being, and behavioral investment. *Developmental Psychology, 48*, 213–223. http://dx.doi.org/10.1037/a0024934.

Palaniappan, D., & Swaminathan, V. D. (2014). Influence of self-efficacy, perceived parental autonomy support, perceived social support on subjective well-being of adolescents through flow experiences. *International Journal of Education and Psychological Research, 3*(1), 32–36.

Pelletier, L. G., Fortier, M. S., Vallerand, R. J., & Brière, N. M. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: a prospective study. *Motivation and Emotion, 25*, 279–306. http://dx.doi.org/10.1023/A:1014805132406.

Pelletier, L. G., Fortier, M. S., Vallerand, R. J., Tuson, K. M., Brière, N. M., & Blais, M. R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: the Sport Motivation Scale (SMS). *Journal of Sport & Exercise Psychology, 17*(1), 35–53.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*, 879–903. http://dx.doi.org/10.1037/0021-9010.88.5.879.

Reinboth, M., & Duda, J. L. (2006). Perceived motivational climate, need satisfaction and indices of well-being in team sports: a longitudinal perspective. *Psychology of Sport and Exercise, 7*, 269–286. http://dx.doi.org/10.1016/j.psychsport.2005.06.002.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*, 68–78. http://dx.doi.org/10.1037/0003-066X.55.1.68.

Schüler, J., & Brunner, S. (2009). The rewarding effect of flow experience on performance in a marathon race. *Psychology of Sport and Exercise, 10*, 168–174. http://dx.doi.org/10.1016/j.psychsport.2008.07.001.

Sheldon, K. M., & Filak, V. F. (2008). Manipulating autonomy, competence and relatedness support in a game-learning context: new evidence that all three needs matter. *British Journal of Social Psychology, 47*, 267–283. http://dx.doi.org/10.1348/014466607X238797.

Smith, A. L., Ntoumanis, N., & Duda, J. L. (2007). Goal striving, goal attainment, and well-being: adapting and testing the self-concordance model in sport. *Journal of Sport & Exercise Psychology, 29*(6), 763–782.

Smith, A. L., Ntoumanis, N., Duda, J. L., & Vansteenkiste, M. (2011). Goal striving, coping, and well-being: a prospective investigation of the self-concordance model in sport. *Journal of Sport & Exercise Psychology, 33*(1), 124–145.

Stenling, A., Lindwall, M., & Hassmén, P. (2015). Changes in perceived autonomy support, need satisfaction, motivation, and well-being in young elite athletes. *Sport, Exercise, and Performance Psychology, 4*, 50–61. http://dx.doi.org/10.1037/spy0000027.

Soenens, B., & Vansteenkiste, M. (2005). Antecedents and outcomes of self-determination in 3 life domains: the role of parents' and teachers' autonomy support. *Journal of Youth and Adolescence, 34*, 589–604. http://dx.doi.org/10.1007/s10964-005-8948-y.

Soucy Chartier, I., Gaudreau, P., & Fecteau, M.-C. (2011). From dispositional affect to academic goal attainment: the mediating role of coping. *Anxiety, Stress & Coping, 24*, 43–58. http://dx.doi.org/10.1080/10615801003725360.

Steinberg, L. (2001). We know some things: adolescent-parent relationships in retrospect and prospect. *Journal of Research on Adolescence, 11*, 1–19. http://dx.doi.org/10.1111/1532-7795.00001.

Swann, C., Keegan, R., Crust, L., & Piggott, D. (2016). Psychological states underlying excellent performance in professional golfers: “Letting it happen” vs. “making it happen”. *Psychology of Sport and Exercise, 23*, 101–113. http://dx.doi.org/10.1016/j.psychsport.2015.10.008.

Uncles, M. D., & Kwok, S. (2013). Designing research with in-built differentiated replication. *Journal of Business Research, 66*, 1398–1405. http://dx.doi.org/10.1016/j.jbusres.2012.05.005.

Vallerand, R. J., Donahue, E. G., & Lafreniere, M.-A. K. (2011). A review and critique of measures of intrinsic and extrinsic motivation in sport and exercice. In G. Tenenbaum, R. C. Eklund, & A. Kamata (Eds.), *Measurement in sport and exercice psychology* (pp. 279–292). Champaign, IL: Human Kinetics.

Van Petegem, S., Beyers, W., Vansteenkiste, M., & Soenens, B. (2012). On the association between adolescent autonomy and psychosocial functioning: examining decisional independence from a self-determination theory perspective. *Developmental Psychology, 48*, 76–88. http://dx.doi.org/10.1037/a0025307.

VandenBos, G. R. (2007). *APA dictionary of psychology*. Washington, DC: American Psychological Association.

Vansteenkiste, M., Niemiec, C. P., & Soenens, B. (2010). The development of the five mini-theories of self-determination theory: an historical overview, emerging trends, and future directions. In T. Urdan, & S. A. Karabenick (Eds.), *Vol. 16A. The decade ahead: Theoretical perspectives on motivation and achievement* (pp. 105–166). Bingley, UK: Emerald.

Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating learning, performance, and persistence: the synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *Journal of Personality and Social Psychology, 87*, 246–260. http://dx.doi.org/10.1037/0022-3514.87.2.246.

Vierling, K. K., Standage, M., & Treasure, D. C. (2007). Predicting attitudes and physical activity in an “at-risk” minority youth sample: a test of self-determination theory. *Psychology of Sport and Exercise, 8*, 795–817. http://dx.doi.org/10.1016/j.psychsport.2006.12.006.

Weiner, B. (1985). An attributional theory of achievement, motivation, and emotion. *Psychological Review, 94*, 548–573. http://dx.doi.org/10.1037/0033-295X.92.4.548.

Weiss, M. R., Amorose, A. J., & Wilko, A. M. (2009). Coaching behaviors, motivational climate, and psychosocial outcomes among female adolescent athletes. *Pediatric Exercise Science, 21*(4), 475–492.

Wilson, P. M., Sabiston, C. M., Mack, D. E., & Blanchard, C. M. (2012). On the nature and function of scoring protocols in exercise motivation research: an empirical study of the behavior regulation in exercise questionnaire. *Psychology of Sport and Exercise, 13*, 614–622. http://dx.doi.org/10.1016/j.psychsport.2012.03.009.

Zuckerman, M., & Tsai, F.-F. (2005). Costs of self-handicapping. *Journal of Personality, 73*, 411–442. http://dx.doi.org/10.1111/j.1467-6494.2005.00314.x.