



When change-oriented feedback enhances motivation, well-being and performance: A look at autonomy-supportive feedback in sport

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ABSTRACT

Objectives: Change-oriented feedback (aka negative feedback) serves two important functions: it motivates athletes and guides them towards performance improvement. However, it can also lead to negative consequences such as anxiety or a decrease in athletes' self-esteem and in the quality of the coach–athlete relationship. We propose that change-oriented feedback quality is key in predicting athletes' reaction to this type of feedback. Based on SDT, we further suggest that a high quality change-oriented feedback must be autonomy-supportive. To test this hypothesis, we first define and measure an autonomy-supportive change-oriented feedback. We then investigate the relative impact of change-oriented feedback's quantity and quality on athletes' phenomenological experiences and performance. **Method:** In total, 340 athletes and 58 coaches participated in this study. Coaches and athletes filled out a questionnaire after a training session. HLM analyses were used to take into consideration the hierarchical structure of the data.

Results: HLM analyses first show that an autonomy-supportive change-oriented feedback is empathic, accompanied by choices of solutions, based on clear and attainable objectives known to athletes, avoids person-related statements, is paired with tips, and given in a considerate tone of voice. Results also show that feedback quality predicts athletes' outcomes above and beyond feedback quantity and coaches' other autonomy-supportive behaviours.

Conclusion: Results are discussed in light of their contribution to self-determination theory, the feedback literature and the improvement of coaches' training.

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Coaches play a major role in athletes' lives. Not only do they represent important authority figures, they also act as models, confidants and motivators. Through their behaviours adopted within each of these roles, they can have profound cognitive, behavioural and emotional impacts on their athletes (Smoll & Smith, 2002). Feedback, defined as information conveyed to athletes about the extent to which their behaviours and performance correspond to expectations (Cusella, 1987; Hein & Koka, 2007), is one of the most crucial coaching behaviours as it directly conveys information about athletes' competence (Horn, Glenn et Wentzell, 1993).

While *promotion-oriented feedback* aims at confirming and reinforcing desirable behaviours, *change-oriented feedback* indicates that performance is inadequate and that behaviours need to

be modified in order to eventually achieve athletes' goals (Bloom & Hautaluoma, 1987; Cusella, 1987). Although past literature has often referred to these two types of feedback as positive and negative feedback respectively (e.g. Deci, Koestner, & Ryan, 1999; Kluger & DeNisi, 1996; Latting, 1992; Weinberg & Gould, 2011), the terms "promotion-oriented feedback" and "change-oriented feedback" are preferred because they better differentiate between the goals and the consequences of the feedback. Whereas the terms "positive" and "negative" in the original terminology can be interpreted as qualifying either the goals or the possible consequences of receiving the two types of feedback, the new terms specifically designate the different goals underlying the different types of feedback (i.e., promoting or changing a targeted behaviour). Given that both promotion-oriented and change-oriented feedback can have positive or negative outcomes depending on the way that it is given (e.g., Deci et al., 1999; Mouratidis, Lens, & Vansteenkiste, 2010), using more precise terms to designate the goal of the feedback avoids unnecessary confusion.

Promotion-oriented feedback is without a doubt more pleasant to give than change-oriented feedback. Research shows that people

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in a position of authority often tend to distort, delay or withhold change-oriented feedback (Fisher, 1979; Larson, 1989). However, avoiding this type of feedback prevents athletes from benefiting from it. Specifically, change-oriented feedback interventions serve two important functions (Weinberg & Gould, 2011). First, they *motivate* by informing athletes about the discrepancy between actual and desired performances, which can increase their desire to perform better in the future. This desire in turn can be translated into greater effort and energy expenditure. Second, they *guide* by focussing athletes on the specific changes they need to implement if they wish to improve future performances. However, change-oriented feedback can also have many negative consequences such as impairing athletes' performances, motivation and self-esteem, as well as the quality of the coach–athlete relationship (Baron, 1988; Fisher, 1979; Jussim, Soffin, Brown, Ley, & Kohlhepp, 1992; Sansone, 1989; Tata, 2002). As change-oriented feedback in sport is both inevitable and hard to give, tools designed to help coaches provide such feedback in a way that maximizes its potential positive consequences, while minimizing the negative ones, are greatly needed.

The goal of the present study is to investigate the relative impact of change-oriented feedback's quantity and quality on athletes' phenomenological experiences and performance. Based on past research on optimal coaches' behaviours (Lafrenière, Jowett, Vallerand, & Carbonneau, 2011; Mageau & Vallerand, 2003) and on a recent study on autonomy-supportive change-oriented feedback in sport (Mouratidis et al., 2010), we first postulate that to be of high quality, change-oriented feedback must support athletes' autonomy as defined by self-determination theory (SDT; Deci & Ryan, 1985, 2000).

SDT posits that humans' psychological health and optimal functioning are facilitated by interpersonal contexts that support the basic psychological need for autonomy, i.e., the universal desire to feel that one is at the origin of one's actions and that one's actions are concordant with one's values. Accordingly, coaches' interpersonal style has been described as either autonomy-supportive or controlling, which in turn has been found to be an important predictor of athletes' outcomes (Frederick & Ryan, 1995). Autonomy-supportive coaches consider their athletes as separate individuals with unique needs and feelings (Deci & Ryan, 1985, 2000; Ryan & Grolnick, 1986). In contrast, controlling coaches have a tendency to pressure their athletes to think, feel or be in specific ways, thereby making their athletes feel like pawns controlled by external forces (deCharms, 1968; Deci & Ryan, 1985). Autonomy-supportive behaviours (i.e., providing choice, giving a rational and acknowledging feelings) have been linked to many positive consequences such as more self-determined motivation, higher self-esteem and greater well-being as reported by athletes (Amorose & Anderson-Butcher, 2007; Gagné, Ryan, & Bargmann, 2003; Quested & Duda, 2010; Reinboth, Duda, & Ntoumanis, 2004).

While numerous specific behaviours adopted by autonomy-supportive coaches have been studied (see Mageau & Vallerand, 2003; for a review), relatively few research within SDT has looked at the way they provide feedback to their athletes. Research pertaining to change-oriented feedback within SDT has mainly either highlighted the negative impact of giving change-oriented feedback compared to providing promotion-oriented feedback or no feedback (Koka & Hein, 2003; Vallerand & Reid, 1984; Whitehead & Corbin, 1991), or documented the impact of the quantity of change-oriented feedback on various outcomes without considering its quality (Black & Weiss, 1992).

In the present research, providing change-oriented feedback (i.e., its quantity) is conceptualized as a specific aspect of structure, which refers to coaching behaviours aimed at organising athletes' environment in a way that increases competence and predictability

(e.g., limit and goal setting, rule reinforcement, guidance; Grolnick & Pomerantz, 2009; Jang, Reeve, & Deci, 2010). We also postulate that the way change-oriented feedback is provided (i.e., its quality) greatly influences its outcomes. As it is the case for other elements of structure such as communicating expectations, setting limits, or giving rewards (Deci et al., 1999; Grolnick & Ryan, 1987; Jang et al., 2010; Koestner, Ryan, Bernieri, & Holt, 1984; Mouratidis et al., 2010; Ryan, Mims, & Koestner, 1983), it is expected that positive outcomes will ensue when change-oriented feedback is presented in an autonomy-supportive way.

Autonomy-supportive change-oriented feedback

A recent study (Mouratidis et al., 2010) has begun the investigation of an autonomy-supportive change-oriented feedback in sport and showed that change-oriented feedback is indeed beneficial for athletes' optimal motivation and well-being when it is communicated in an autonomy-supportive fashion. The authors relied on the definition of the autonomy-supportive coaching style to identify characteristics that could define an autonomy-supportive change-oriented feedback. Specifically, this type of feedback was defined as 1) providing rationales to explain why behaviours should be changed, 2) considering athletes' perspective, 3) providing choices of solutions, and 4) avoiding the use of a controlling communication style, which induces shame, conveys conditional regard or includes threats of punishment.

In the present research and in line with Mouratidis et al. (2010), an autonomy-supportive change-oriented feedback is first characterized by being empathic (1) and paired with choices of solutions (2). "Being empathic" is defined as taking into consideration athletes' feelings and difficulties, while "being paired with choices of solutions" refers to giving athletes multiple solutions to correct the situation, whenever possible. The characteristic "providing rationales to explain why behaviours should be changed" proposed by Mouratidis et al. (2010) was also included but this dimension was operationalized more concretely as "being based on clear and attainable objectives known to athletes (3)". By assessing whether or not athletes know and understand the objectives of the feedback, and agree that these objectives are attainable, this dimension captures whether or not athletes know the rationale behind the coach's feedback. In addition, by being more concrete than the original characteristic, this dimension may be more readily used to help coaches provide autonomy-supportive feedback.

Five additional characteristics were included to measure an autonomy-supportive change-oriented feedback: avoiding person-related statements (4), pairing the feedback with tips on how to improve future performances (5), being delivered promptly (6), privately (7) and in a considerate tone of voice (8). These characteristics come from the feedback literature and needed to be integrated to the present research for two important reasons. First, they have been shown to lead to positive outcomes, which suggests that they do characterize a high quality feedback. Second, they are autonomy-supportive according to SDT's definition of autonomy support. Research pertaining to these specific characteristics is briefly reviewed below.

Avoiding person-related statements

Tenants of SDT (Koestner, Zuckerman, & Koestner, 1987; Plant & Ryan, 1985; Ryan, 1982) have proposed that, in an autonomy-supportive context, attention of the athletes should be maintained on the task to avoid ego-involvement, an internally controlling state that occurs when athletes come to view their performance as an indicator of their worth as a person (Nicholls, 1989). Results of a meta-analysis by Kluger and DeNisi (1996) also show that, in order

to enhance performances, feedback intervention should maintain the attention of the receiver on the task instead of shifting it towards the self.

An efficient strategy to maintain the attention of the receiver on the task is to avoid person-related statements. In an experimental study with young children, Kamins and Dweck (1999) showed that person-related feedback (defined as feedback concerning the person's abilities, goodness, or worthiness) can create vulnerability and a sense of contingent self-worth. To avoid linking people's self-esteem to their performance, feedback should be kept task-related through the use of comments on the process (e.g. effort and strategy use) and on specific technical changes (Hong, Chiu, Dweck, Lin, & Wan, 1999; Kamins & Dweck, 1999).

Avoiding person-related statements thus captures part of what Mouratidis et al. (2010) have termed "non-controlling communication style" and supports athletes' autonomy by preventing ego-involvement, which is considered an internally controlling state (Grolnick & Ryan, 1987; Mageau & Vallerand, 2003; Ryan, 1982). It also contributes to support athletes' autonomy by preventing the experience of controlling emotions, such as shame and fears of rejection (Assor, Roth, & Deci, 2004; Ryan & Deci, 2002).

Paired with tips

Another way to maintain the attention of athletes on the task is to provide tips on how to improve. By suggesting possible solutions, coaches focus on alternative behaviours and centre athletes on the learning process. Research on corrective or constructive feedback (Amorose & Weiss, 1998) shows that feedback targeting behaviours, instead of being limited to pointing bad performances, is positively linked to learning and later performances (Balzer, Doherty, & O'Connor, 1989; Kluger & DeNisi, 1996).

Providing tips support athletes' autonomy in four ways. First, by shifting the athletes' attention away from the self and towards the learning process, it reduces ego-involvement (Nicholls, 1989; Ryan, 1982). Second, by being actively involved in the solution to the problem and by focussing athletes on this solution, coaches protect their athletes from experiencing shame and fears of rejection (Assor et al., 2004). Third, offering tips increases athletes' sense of personal causation over outcomes by giving them tools to autonomously progress towards their goals. Finally, by providing concrete guidance, coaches communicate to their athletes that they take their perspective and recognize their actual level knowledge.

Delivered promptly, privately and in a considerate tone of voice

The feedback literature suggests that, to be effective, change-oriented feedback should also be delivered promptly (i.e., as quickly as possible after the performance), privately and in a considerate tone of voice (i.e., respectful and without yelling when possible; Cusella, 1987; Tracy, Van Dusen, & Robinson, 1987). A correlational study conducted in the work setting confirmed that giving change-oriented feedback characterized by these three dimensions is linked to positive consequences, such as enhanced employees' psychological safety (Smith, 2007).

These characteristics also contribute in making the coach's communication style *non-controlling*, an important dimension proposed by Mouratidis et al. (2010). Indeed, when change-oriented feedback targets long past behaviours, athletes can interpret this feedback as guilt-inducing criticisms because it is typically too late for them to change their behaviours. Similarly, giving change-oriented feedback publicly or with a non-respectful tone of voice can induce shame or represent a form of threat.

In sum, after merging the characteristics found in the feedback literature to the ones put forward within SDT, we propose that an

autonomy-supportive change-oriented feedback has eight characteristics. First, based on Mouratidis et al. (2010), we suggest that it must be 1) empathic, 2) paired with choices of solutions, and 3) based on clear and attainable objectives known to athletes. Based on the feedback literature, we propose that it must also 4) avoid person-related statements, 5) be paired with tips, and be delivered 6) promptly, 7) privately, and 8) in a considerate tone of voice. We do not specifically include the fourth dimension proposed by Mouratidis et al. (2010), namely "avoiding the use of a controlling communication style", because the characteristics "avoid person-related statements", "delivered promptly", "delivered privately" and "given in a considerate tone of voice" already capture this dimension.

The present investigation

The goal of the present study is to investigate the relative impact of change-oriented feedback's quantity and quality (i.e., the extent to which it is autonomy-supportive) on athletes' phenomenological experiences and performance. To reach this goal, we first (1) measure an autonomy-supportive change-oriented feedback by using the eight characteristics found in the SDT (Mouratidis et al., 2010) and the feedback (Amorose & Weiss, 1998; Balzer et al., 1989; Brewer, Van Raalte, Linder, & Van Raalte, 1991; Cusella, 1987; Jussim et al., 1992; Kamins & Dweck, 1999; Kluger & DeNisi, 1996; Smith, 2007; Tracy et al., 1987) literature, (2) test the relative impact of the quantity and quality of coaches' change-oriented feedback on athletes' phenomenological outcomes, and (3) test the impact of change-oriented feedback quantity and quality on athletes' performance as reported by coaches.

Measuring autonomy-supportive change-oriented feedback

A multidimensional scale is first developed to assess the proposed characteristics of an autonomy-supportive change-oriented feedback. We then test the reliability and factorial structure of this new scale. We also verify if these characteristics can differentiate between autonomy-supportive and controlling coaches. It is expected that the more coaches are autonomy-supportive, the more they should be empathic when giving change-oriented feedback, provide athletes with choices of possible solutions to correct the problem, base their feedback on clear and attainable objectives known to athletes, deliver their feedback promptly, privately, and in a considerate tone of voice, and finally, the more their feedback should avoid the use of person-related statements.

The relative impact of feedback quantity and quality on athletes' phenomenological experiences

Using the new scale, we test the relative impact of the quantity and quality of coaches' change-oriented feedback on athletes' motivation, amotivation, well-being, negative affect, self-esteem, and satisfaction of the basic psychological needs, using hierarchical linear modeling (HLM). These various outcomes were chosen based on past studies on change-oriented feedback and SDT. They were also chosen to have an overview of athletes' inner experiences and to test the stability of our findings across outcomes. We postulate that athletes' experiences will depend more on the quality than on the quantity of change-oriented feedback. Specifically, we hypothesize that, when both feedback quantity and quality are entered together in a model, the quality of change-oriented feedback will be a more important predictor of athletes' phenomenological experiences than its quantity.

Given that any behaviour is interpreted in light of the interpersonal climate in which it occurs (Darling & Steinberg, 1993), it is

possible that specific characteristics of change-oriented feedback are unimportant as long as the feedback occurs in a generally autonomy-supportive climate. To show that, on the contrary, the proposed characteristics of an autonomy-supportive feedback have an impact above and beyond other autonomy-supportive behaviours, the relative impact of the quantity and quality of coaches' change-oriented feedback is tested while controlling for coaches' autonomy-supportive style, i.e., the extent to which they generally adopt autonomy-supportive behaviours in situations other than when giving change-oriented feedback.

The relative impact of feedback quantity and quality on athletes' performances

Finally, after looking at the impact of change-oriented feedback on athletes' phenomenological experiences, we look at its impact on performance as reported by coaches. It is expected that the quality of change-oriented feedback received by athletes will be an important predictor of their performances, even when controlling for their coach's autonomy-supportive style and for the quantity of feedback they received.

Method

Participants

The sample was composed of 58 coaches and 340 athletes participating in 13 different sports, such as synchronized swimming (32%), soccer (17%), track and field (11%) or ice hockey (10%). These sports were either individual sports (20%) or team sports (50%), or included both individual and team events (30%). Coaches were about half women (52%) and half men (48%), were aged between 18 and 72 years old ($M = 31.14$), had been coaching for 10.28 years in average ($SD = 7.66$) and most (83%) received training to become coach.

The athletes' sample was composed of 134 men and 206 women, aged between 11 and 35 years old ($M = 15.21$). At the time of the study, they were training 10.85 h per week on average ($SD = 6.23$), had been practicing their sport for an average of 6.85 years ($SD = 3.62$), and were competing at the regional (20%), provincial (56%), national (18%) or international (4%) level. Finally, they had been with their coach for an average of 2 years ($SD = 2.07$).

Procedure

Coaches were recruited by email, through their provincial federation. Participants were all from the province of Quebec (Canada) and were French speaking. When needed, instruments were translated using the back-translation procedure proposed by Vallerand (1989). Participants were asked to fill out a questionnaire after a training session to ensure that coach–athlete interactions were present in their minds when they completed their questionnaire. Coaches' questionnaire included a measure assessing their autonomy-supportive style. They also evaluated each of their athletes' level of performance. Each coach had between 1 and 24 athletes ($M = 6.19$, $SD = 4.88$) participating in the study. Athletes' questionnaire included measures of perceptions of their coach's autonomy-supportive style and of the change-oriented feedback they usually received, as well as measures of motivation, well-being, self-esteem, and basic psychological needs satisfaction. Demographic variables such as age, gender, and sport experience were also included in both questionnaires.

Measures used in athletes' and coaches' questionnaires are briefly described in the next section. The details regarding each scale (number of items, sample item, response scale and Cronbach's alpha) are presented in Table 1. Athletes' self-esteem and variables

pertaining to athletes' well-being (i.e., life satisfaction and vitality) were assessed at the global level ("In general") with measures of affect being an exception. Positive and negative affect were assessed at the domain level to capture participants' affective experiences when engaging in their sport. The other variables were also assessed at the domain-level of generality (e.g. "In general, when you engage in your sport..."). These levels of generality were chosen to assess the impact of coaches' typical way of providing feedback on athletes' general psychological adaptation and sport experiences.

Athletes' measures

Quantity of change-oriented feedback

A scale was adapted from the work domain (Smith, 2007) to evaluate the quantity of change-oriented feedback given by coaches. Athletes were asked to rate the frequency with which they received change-oriented feedback (called "negative feedback" in the questionnaire because this term is most common among athletes).

Perceived autonomy support

A French adaptation for the sport setting (Gillet, Vallerand, Paty, Gobancé, & Berjot, 2010) of the Perceived Autonomy Support Scale for Exercise Settings (PASSES; Hagger et al., 2007) was used to evaluate the extent to which athletes perceived their coach to be autonomy supportive (based on behaviours other than providing change-oriented feedback).

Self-determined motivation

The Sport Motivation Scale (Pelletier et al., 1995) assesses six different types of motivation towards sport, namely intrinsic motivation (for knowledge, stimulation and accomplishment), identified regulations, introjected regulations and external regulations. Items are presented in the form of answers to the question: "Why do you practice your sport?" Self-Determination Theory posits that these different types of behavioural regulation can be situated along a self-determination continuum, with intrinsic motivation representing the prototype of a fully self-determined type of motivation and external regulation representing a complete lack of self-determined motivation. A composite score of self-determined motivation can be created using the following formula: $((2 \times (\text{intrinsic to know} + \text{intrinsic to accomplish} + \text{intrinsic to stimulation}) / 3) + \text{identified}) - (\text{introjected} + 2 \times \text{external})$ (Chirkov, Vansteenkiste, Tao, & Lynch, 2007). This index, if positive, reflects the relative prevalence of a high quality (autonomous) motivation while a negative valence of this index represents the relative dominance of a lower quality (controlled) motivation.

Amotivation

The amotivation subscale of the aforementioned Sport Motivation Scale (Pelletier et al., 1995) was used to assess the extent to which athletes experience a lack of control over the practice of their sport. Amotivation is reflected in athletes' lack of reasons for participating in their sport and in the ambivalence they feel about persevering.

Basic psychological needs satisfaction

The extent to which athletes experience autonomy, competence and relatedness in their sport was assessed using the Basic Psychological Needs Satisfaction in a Sport Context Scale (Gillet, Rosnet, & Vallerand, 2008).

Self-esteem

The Rosenberg's Self-Esteem Scale (Rosenberg, 1965) was used to assess athletes' global perception of their self-worth and their general sense of self-acceptance.

Table 1
Details of measures used in athletes' and coaches' questionnaires.

Construct	Number of items	Sample item	Response scale minimum	Response scale maximum	α
<i>Athletes' questionnaire</i>					
1. Quantity of change-oriented feedback	3	"When I am not performing well, my coach points it out to me"	"Never" (1)	"Always" (7)	.68
2. Perceived autonomy-supportive style of coach	12	"My coach makes sure I understand why I need to do this sport activity"	"Strongly disagree" (1)	"Strongly agree" (7)	.92
3. Self-determined motivation					
Intrinsic motivation for knowledge	4	"For the pleasure it gives me to know more about the sport that I practice"	"Does not correspond at all" (1)	"Corresponds exactly" (7)	.87
Intrinsic motivation for stimulation	4	"For the intense emotions I feel doing a sport that I like"	"Does not correspond at all" (1)	"Corresponds exactly" (7)	.82
Intrinsic motivation for accomplishment	4	"For the pleasure I feel while improving some of my weak points"	"Does not correspond at all" (1)	"Corresponds exactly" (7)	.83
Identified regulations	4	"Because, in my opinion, it is one of the best ways to meet people"	"Does not correspond at all" (1)	"Corresponds exactly" (7)	.72
Introjected regulations	4	"Because I must do sports regularly"	"Does not correspond at all" (1)	"Corresponds exactly" (7)	.81
External regulations	4	"For the prestige of being an athlete"	"Does not correspond at all" (1)	"Corresponds exactly" (7)	.83
4. Amotivation	4	"I often ask myself; I can't seem to achieve the goals that I set for myself"	"Does not correspond at all" (1)	"Corresponds exactly" (7)	.79
5. Basic psychological needs satisfaction					
Autonomy	4	"In my sport, I generally feel free to express my feelings and opinions"	"Not true at all" (1)	"Totally true" (7)	.78
Competence	4	"In my sport, I feel that I am doing well"	"Not true at all" (1)	"Totally true" (7)	.71
Relatedness	4	"In my sport, I get along well with people that I interact with"	"Not true at all" (1)	"Totally true" (7)	.77
6. Subjective well-being					
Life satisfaction	5	"I am satisfied with my life"	"Not at all in agreement" (1)	"Very strongly in agreement" (7)	.75
Subjective vitality	4	"I look forward to each new day"	"Not at all in agreement" (1)	"Very strongly in agreement" (7)	.70
Positive affect	10	Proud	"Very slightly or not at all" (1)	"Extremely" (5)	.82
7. Negative affect	10	Upset	"Very slightly or not at all" (1)	"Extremely" (5)	.87
8. Self-esteem	10	"I feel that I am a person of worth, at least on an equal basis with others"	"Not at all in agreement" (1)	"Very strongly in agreement" (7)	.82
Construct	Number of items	Sample item	Response scale minimum	Response scale maximum	α
<i>Coaches' questionnaire</i>					
1. Coach's self-reported autonomy-supportive style					
Highly controlling	8	"Prod her into interactions and provide her with much praise for any social initiative"	"Totally inappropriate" (1)	"Totally appropriate" (7)	.74
Moderately controlling	8	"Talk to her and emphasize that she should make friends so she'll be happier"	"Totally inappropriate" (1)	"Totally appropriate" (7)	.76
Highly autonomy-supportive	8	"Encourage her to observe how other athletes relate and to join in with them"	"Totally inappropriate" (1)	"Totally appropriate" (7)	.77
2. Athlete's performance	4	"Since the beginning of the training season, to what extent do you consider that this athlete has progressed technically?"	"Strong regression" (1)	"Strong progression"(7)	.86

Note. Details for feedback quality may be found in the text.

Life satisfaction

The Satisfaction with Life Scale (Blais, Vallerand, Pelletier, & Brière, 1989; Diener, Emmons, Larsen, & Griffin, 1985) was used to evaluate participants' level of satisfaction with their life in general.

Subjective vitality

A 4-item version ($\alpha = .70$) of the Ryan and Frederick (1997) scale was used to evaluate the extent to which athletes generally felt alive and energetic.

Positive and negative affect

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was used to measure the extent to which participants experienced positive and negative emotions when engaging in their sport.

In line with past research (e.g., Massé et al., 1998; Ware & Sherbourne, 1992) and with the definition of mental health adopted by the World Health Organization (2009), psychological health

was conceptualized as the absence of ill-being and the presence of well-being. Indicators of well- and ill-being were thus considered separately, with indicators of well-being combined to create a well-being index. The well-being index was created by taking the mean of the standardized scores of the life satisfaction scale, the subjective vitality scale and the positive affect scale. A factorial analysis confirmed that these three well-being indicators formed a single well-being factor ($\alpha = .77$). Such manipulation was not necessary for ill-being because negative affect was the only indicator.

Coaches' measures

Coach-level autonomy-supportive style

Because, to our knowledge, there is no published self-report to assess coaches' autonomy-supportive style, we adapted existing scales for the purpose of this study, namely the Problems in Schools (Deci, Schwartz, Sheinman, & Ryan, 1981) and Problems at Work (Deci, Connell, & Ryan, 1989) questionnaires, to create the

“Problems in Sport Questionnaire”. This questionnaire comprises 8 vignettes, each describing a problem that is typically experienced by coaches. It is important to note that coaches are not presented with problems that concern technical difficulties and that would require providing change-oriented feedback, such that coaching behaviours targeted by this measure are different from providing feedback. For example, one vignette describes an athlete that is quiet, somewhat blundering and that has a very rough time being accepted by her teammates. Three items follow each vignette and coaches rated the extent to which they considered each response to be an appropriate way to deal with the described problem. These three responses vary along a continuum of autonomy support and can be qualified as either “highly controlling” (HC), “moderately controlling” (MC) or “highly autonomy-supportive” (HA). For the “highly controlling” responses, the coach usually decides the appropriate solution to the problem by himself and then uses rewards or punishments to reinforce his decision. “Moderately controlling” answers imply that the coach tells the athletes what they *should* do. Finally, “highly autonomy-supportive” items describe a coach who encourages athletes to find the solution by themselves. Each subscale score was computed by averaging the ratings across the eight vignettes. The scores from the three subscales were then combined as follows: Autonomy-supportive style = HA – MC – HC.¹ High scores on this index represent high levels of autonomy support, whereas low scores indicate a more controlling style.

Athletes-level performance

To assess athletes' performance, coaches were asked to rate the extent to which each athlete had progressed technically, tactically, physically, and psychologically from the beginning of the training year to the time of the testing. For each athlete, the average of the four responses was then used to form a measure of athletes' performance. This has been shown to be a reliable procedure in previous studies (e.g., Mouratidis, Vansteenkiste, Lens, & Sideris, 2008).

Data analysis

The present study involves a hierarchically structured data set, where athletes' measures (level 1) are nested under coaches' measures (level 2). Hierarchical Linear Modeling (HLM) analyses were used because these analyses consider the hierarchical structure of the data by computing relationships between level-1 variables (i.e., athlete-level) independently for each level-2 unit (i.e., each coach), with an intercept (β_0) and a slope (β_1) per coach. From these regression equations, HLM analyses first provide the grand mean of the dependent variable (γ_{00}), which represents the averaged intercepts (β_{0j}) of each regression equation, and the grand slope (γ_{10}), which represents the averaged slopes (β_{1j}) of each regression equation. Second, HLM analyses enable one (1) to estimate the variability of each group's mean around the grand mean as well as the variability of slopes around the grand slope, and (2) to predict this variability of means and slopes from level-2 predictors. During HLM analyses, all level-1 variables were centred on the group mean while level-2 variables were centred on the sample

mean (Raudenbush & Bryk, 2002). Robust standard errors were used to calculate inference statistics.

Results

Descriptive statistics

With the exception of amotivation, all variables were normally distributed, as indicated by skewness and kurtosis scores ranging from -1.28 to 2.35 , which is between the recommended range of -3 to 3 (Kline, 1998). Scores on amotivation were transformed with the logarithm to obtain a more normal distribution. After the transformation, this variable was also normally distributed (skewness = 1.72 , kurtosis = 2.13). Apart from the “performance” variable, all level-1 variables showed an acceptable number of missing data, with the maximum percentage of missing data (i.e., 5.88%) being only slightly above the 5% limit fixed by Tabachnick and Fidell (2007). The “performance” variable, which was assessed by coaches for each of their athletes, showed an important number of missing values (32.65%). Yet, one important advantage of HLM analyses is the use of estimation procedures that allow for level-1 missing data without decreasing power. Coaches who have at least one assessment are included in the analyses because their missing data is estimated from the information of other similar coaches. These procedures have been shown to yield unbiased coefficients, whether data is missing at random or completely at random (Enders & Bandalos, 2001). There were no level-2 missing data.

Descriptive statistics for the coaches' measures and the aggregated athletes' measures are presented in Table 2 together with their correlations.² To obtain the descriptive statistics for athlete-level variables, we aggregated the data from the athletes who were trained by the same coach. These preliminary analyses reveal a negative correlation between change-oriented feedback quantity and quality ($r = -.43$, $p < .01$). This correlation will be addressed in the discussion section.

Measuring autonomy-supportive change-oriented feedback

Development of the quality of change-oriented feedback scale

In line with SDT, we propose that a high quality change-oriented feedback is autonomy-supportive. Based on Mouratidis et al. (2010) study and on the feedback literature (e.g. Balzer et al., 1989; Kamins & Dweck, 1999; Kluger & DeNisi, 1996; Smith, 2007), we further propose that to be autonomy-supportive, change-oriented feedback must be 1) empathic, 2) paired with choices of solutions, and 3) based on clear and attainable objectives known to athletes. It must also 4) avoid the use of person-related statements, 5) be paired with tips, and be delivered 6) promptly, 7) privately, and 8) in a considerate tone of voice. Items were first created to assess each of these characteristics. After a preliminary study, a 32-item version was retained, where the 8 characteristics were each measured using 4-item subscales. For each item, participants were asked to indicate the extent to which each statement corresponded to the way their coach gave change-oriented feedback using a 7-point scale ranging from “Never” (1) to “Always” (7). This version was submitted to exploratory factor analyses using Maximum

¹ Originally, the Problems in Schools and Problems at Work scales also comprised a “moderately autonomy-supportive” (MA) answer. However, because past studies have shown that the validity of the MA subscale is problematic (Deci et al., 1981; Reeve et al., 1999) and because Reeve et al. (1999) recommended to give a weight of “0” to this dimension when the four dimensions are combined into a total score, we decided not to include this type of answer. In addition, Reeve et al. (1999) recommended using the following formula to create an index of autonomy-supportive style: $2*HA - 1*MC - 2*HC$. However, because the three styles did not form a simplex pattern in our data, equal weight was conferred to each dimension.

² Analyses were conducted to test for gender differences in the reported variables. Differences pertaining to athletes' gender were found only for the satisfaction of the needs for competence and for autonomy, with girls reporting significantly less satisfaction of these two needs than boys. The main analyses were conducted with and without controlling for gender and similar results were obtained. Because results remained the same and because of the complexity of HLM analyses, we decided to present the analyses without controlling for this variable.

Table 2
Descriptive statistics and correlations among level-2 and aggregated level-1 variables.

Variables	Correlations												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Coaches measures (level-2)													
1. Self-reported autonomy-supportive style	–	–.38**	.31*	.27†	.13	–.24	.21	.15	.33*	.22	–.30*	.35*	.03
Aggregated level-1 measures (from athletes)													
2. Quantity of change-oriented feedback	–	–	–.43***	–.16	–.27*	.39**	–.20	–.34**	–.38**	–.29*	.31*	–.33*	–.16
3. Quality of change-oriented feedback	–	–	–	.83***	.21	–.26*	.25†	.42***	.65***	.50***	–.37**	.46***	.27**
4. Perceived autonomy-supportive style	–	–	–	–	.22†	–.25†	.26*	.43***	.62***	.55***	–.40**	.47***	.37**
5. Self-determined motivation	–	–	–	–	–	–.45***	.44***	.13	.27*	.12	–.45***	.09	–.03
6. Amotivation	–	–	–	–	–	–	–.45***	–.32*	–.23†	–.48***	.38**	–.44***	–.33*
7. Relatedness	–	–	–	–	–	–	–	–.45***	–.32*	–.23†	–.48***	.38**	–.44***
8. Competence	–	–	–	–	–	–	–	–	.16	.28*	.21	–.45***	.41***
9. Autonomy	–	–	–	–	–	–	–	–	–	.37**	.57***	–.60***	.64***
10. Well-being	–	–	–	–	–	–	–	–	–	–	.43***	–.38**	.26*
11. Negative affect	–	–	–	–	–	–	–	–	–	–	–	–.37*	.57***
12. Self-esteem	–	–	–	–	–	–	–	–	–	–	–	–	–.53***
Aggregated level-1 measures (from coaches)													
13. Performance	–	–	–	–	–	–	–	–	–	–	–	–	–
N	48	58	58	58	58	58	58	58	58	57	58	57	51
Mean	–2.22	4.71	5.51	5.79	.45	1.50	6.04	5.42	4.74	.00	1.83	5.70	5.25
SD	1.78	.84	.73	.70	2.77	.57	.65	.64	.90	.83	.48	.55	.77

Note. † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Likelihood (ML) and oblimin rotation to evaluate its factorial structure. Following these analyses, two characteristics were deleted from the scale because their items did not differentiate into separate factors. Specifically, the dimensions “delivered promptly” and “given privately” did not form distinct factors and were therefore deleted. Finally, two additional items were deleted because of low factor loadings (<.35).

The final version of the Quality of Change-Oriented Feedback Scale thus had 22 items and assessed six characteristics of change-oriented feedback (i.e., empathic, includes choices of solutions, based on clear and attainable objectives known to athletes, avoids person-related statements, paired with tips, and given in a considerate tone of voice) using 3 or 4-item subscales. A committee of experts in self-determination theory and in sport (i.e., professors, graduate students, coaches and athletes) confirmed the face validity of these 22 items. Each item loaded on its respective factor and there was no cross loading. Items, factor loadings, eigen values, percentages of explained variance and Cronbach’s alphas for each factor are presented in Table 3. The factorial solution accounted for a total variance of 71.5%. A score for each characteristic was created using the mean of the corresponding subscale’s items. With the exception of the dimension “avoid person-related statements”, all variables were normally distributed, as indicated by skewness and kurtosis scores ranging from –1.41 to 1.96. Scores on the “avoid person-related statements” subscale were transformed with the reflection and the inverse to obtain a more normal distribution. The variable was normally distributed after the transformation (skewness = .89, kurtosis = .56). Importantly, correlations among the six characteristics reveal that they are highly inter-correlated (see Table 4), suggesting that they represent different aspects of a common element, i.e., supporting athletes’ autonomy.

Change-oriented feedback provided by autonomy-supportive vs. controlling coaches

To test the validity of the six characteristics, we verified if they could differentiate between autonomy-supportive and controlling coaches. Following a procedure previously used by Reeve and his colleagues (Reeve, Bolt, & Cai, 1999; Reeve & Jang, 2006), we expected that the six characteristics would be positively associated with an autonomy-supportive style. A global index of coaches’

autonomy-supportive style was first created by taking the mean of the standardized scores on the Problem in Sports Questionnaire and the Perceived Autonomy Scale. Because only one characteristic was included as the dependent variable in each model, we tested 6 different models to see which characteristic could be predicted by coaches’ autonomy-supportive style. To protect from the inflation of type I error probabilities that occurs with multiple testing, a Bonferroni correction was applied and the acceptable level of significance was fixed at $p = .008$.

As presented in Table 5, results showed that coaches’ autonomy-supportive style significantly predicted mean levels of all characteristics of change-oriented feedback. Specifically, the more coaches were autonomy supportive, the more their feedback tended to be empathic ($\gamma_{01} = .63, p < .001$), accompanied by choices of solutions ($\gamma_{01} = .50, p < .001$), based on clear and attainable objectives known to athletes ($\gamma_{01} = .44, p < .001$), free from person-related statements ($\gamma_{01} = .12, p < .001$), paired with tips ($\gamma_{01} = .65, p < .001$), and given using a considerate tone of voice ($\gamma_{01} = .86, p < .001$). Coaches’ autonomy-supportive style explained between 39% and 78% of the between-group variability on the six characteristics.

The relative impact of feedback quantity and quality on athletes’ phenomenological experiences

The main goal of this study was to test the relative impact of the quality and quantity of change-oriented feedback on athletes’ outcomes, while controlling for the influence of other autonomy-supportive behaviours adopted by coaches. Eight different models, one per outcome (i.e., self-determined motivation, well-being, negative affect, self-esteem, satisfaction of basic psychological needs, and amotivation), were tested. Applying a Bonferroni correction, the level of significance was fixed at $p = .006$. In these models, the quality and quantity of change-oriented feedback were entered as within-group predictors of athletes’ outcomes, while coaches’ autonomy-supportive style was entered as a level-2 predictor of means.

Results showed that when the quality and quantity of change-oriented feedback are entered in the equation alongside coaches’ autonomy-supportive style, quality of change-oriented feedback is a significant predictor of all athletes’ outcomes (Table 6). Indeed, athletes who received a more autonomy-supportive feedback

Table 3
Factor loadings with oblimin rotation for the quality of change-oriented feedback scale, eigenvalues, and percentages of explained variance for each factor.

Item	Factor loadings					
	1	2	3	4	5	6
1. Empathic						
When my coach tells me that he is not satisfied with my performance, I don't feel that he realizes how much efforts I had to put in to overcome the obstacles. (recoded)	.57					
Often, my coach keeps giving me the same correctives during a same training session, without giving me the time needed to correct them. (recoded)	.54					
My coach expects me to immediately correct everything he asks me. (recoded)	.45					
When my coach tells me that he is not satisfied, he doesn't take into account the difficulties that I had to face during my performance. (recoded)	.39					
2. Choices of solutions						
My coach often suggests many ideas to correct my mistakes. He then lets me choose the one I prefer.		.85				
My coach lets me try various strategies to correct my mistakes so that I can see which one suits me best.		.79				
When my coach wants me to correct something, he gives me many possible solutions so that I can choose the one that suits me best.		.77				
3. Based on clear and attainable objectives						
The corrections asked by my coach are generally meant to gradually bring me closer to an objective that is clear.			.73			
When my coach wants me to correct something, I know which objective this change will eventually allow me to reach.			.64			
When my coach is not satisfied with my performance, I generally agree that I can do better.			.52			
In general, when my coach asks me to improve something, his demands are reasonable.			.51			
4. Avoid person-related statements						
Following a bad performance, my coach has a tendency to depreciate me as an individual. (recoded)				.85		
Following a bad performance, my coach's negative comments often concern what I am as a person. (recoded)				.75		
When my coach is not satisfied with my performance, he often offends me personally. (recoded)				.58		
I often feel that there are personal attacks in the way my coach tells me that he is not satisfied with my performance. (recoded)				.47		
5. Paired with tips						
When my coach is not satisfied with my performance, he gives me tips so that I can improve in the future.					.77	
My coach often points out my mistakes without offering solutions to help me correct them. (recoded)					.56	
When my coach is not satisfied with my performance, he helps me find a solution instead of only criticizing what I have done.					.52	
6. Considerate tone of voice						
When my coach is not satisfied with my performance, he yells at me. (recoded)						.89
My coach yells when he has negative feedback to give me. (recoded)						.80
In general, when my coach talks about a problem with me, he does so without yelling as much as possible.						.66
When my coach is not satisfied with my performance, he tells me using a respectful tone of voice.						.57
Alpha	.70	.85	.80	.84	.82	.89
Eigen value	1.15	2.14	.82	1.41	1.30	8.92
% of variance	5.21	9.71	3.74	6.39	5.90	40.54

experienced higher levels of self-determined motivation ($\gamma_{10} = .92$, $p < .001$), well-being ($\gamma_{10} = .35$, $p < .001$), self-esteem ($\gamma_{10} = .45$, $p < .001$) and satisfaction of their need for relatedness ($\gamma_{10} = .34$, $p < .006$), competence ($\gamma_{10} = .54$, $p < .001$) and autonomy ($\gamma_{10} = .62$, $p < .001$). A more autonomy-supportive change-oriented feedback was also linked to lower levels of negative affect ($\gamma_{10} = -.27$, $p < .001$) and amotivation ($\gamma_{10} = -.07$, $p < .001$). These effects were found above and beyond the effects of both the coach's autonomy-supportive style and the quantity of change-oriented feedback.

In general the quantity of change-oriented feedback had no effect, with one exception. Specifically, quantity only *positively*

predicted well-being ($\gamma_{20} = .14$, $p < .006$) when the influences of feedback quality and coaches' autonomy-supportive style were controlled (see Table 6).

As was also found in previous research (Mageau & Vallerand, 2003), the autonomy-supportive style was related to many positive outcomes in the present study. It was positively linked to athletes' self-determined motivation ($\gamma_{01} = .93$, $p < .006$), well-being ($\gamma_{01} = .24$, $p < .001$), self-esteem ($\gamma_{01} = .32$, $p < .001$), and satisfaction of the needs for competence ($\gamma_{01} = .19$, $p < .006$) and autonomy ($\gamma_{01} = .51$, $p < .001$), while being negatively linked to negative affect ($\gamma_{01} = -.24$, $p < .001$) and amotivation ($\gamma_{01} = -.04$, $p < .006$). These effects were found above and beyond what could be accounted for by change-oriented feedback quality and quantity. However, considering the Bonferroni correction, the positive impact of coaches' autonomy-supportive style on the satisfaction of the need for relatedness ($\gamma_{01} = .17$, $p = .01$) was only marginally significant.

Entering quantity and quality of change-oriented feedback as level-1 predictors explained between 4.74% and 23.08% of the within-group variability on the various outcomes, while entering coaches' autonomy-supportive style as a level-2 predictor explained between 5.25% and 29.80% of the between-group variability. It is important to note that testing interactions between quantity and quality of change-oriented feedback for each outcome revealed no significant interaction effect.

Table 4
Correlations among aggregated scores on the six characteristics of an autonomy-supportive change-oriented feedback.

Variables	Correlations					
	1	2	3	4	5	6
1. Empathic	–	.49	.74	.64	.79	.61
2. Choices of solutions		–	.60	.43	.67	.48
3. Based on clear and attainable objectives			–	.71	.83	.74
4. Avoid person-related statements				–	.64	.68
5. Paired with tips					–	.69
6. Considerate tone of voice						–

Note. All correlations are significant at the $p < .001$ level.

Table 5

Fixed effects and variance components of the multilevel models predicting characteristics of change-oriented feedback (Level 1) from coaches' autonomy-supportive style (Level 2).

	Parameters	Empathic	Choices of solutions	Clear/attainable objectives	Avoid person-related statements	Paired with tips	Considerate tone of voice
Fixed effects							
Grand mean: initial status	γ_{00} (SE)	4.92* (.08)	4.25* (.10)	5.83* (.05)	.80* (.02)	5.70* (.08)	5.68* (.12)
Grand mean: autonomy-supportive style	γ_{01} (SE)	.63* (.08)	.50* (.11)	.44* (.06)	.12* (.02)	.65* (.09)	.86* (.16)
Variance components							
Level-1 within-person residual variability	σ^2	1.18	1.94	.73	.05	1.16	.97
Level-2 residual variability of means	σ^2_{00}	.15	.22	.04	.01	.19	.83

Note. All coefficients are unstandardized.

* Significant at the $p < .008$ level.

The relative impact of feedback quantity and quality on athletes' performances

After showing that receiving an autonomy-supportive change-oriented feedback is positively associated with athletes' phenomenological experiences, we looked at its impact on a behavioural measure, namely athletes' performance, as evaluated by their coach. When change-oriented feedback quality was entered as a level-1 predictor of performance, alongside change-oriented feedback quantity and coaches' autonomy-supportive style, results showed that change-oriented feedback quality is an important predictor of athletes' performance. Indeed, while coaches' autonomy-supportive style ($p = .09$) and change-oriented feedback quantity ($p = .73$) were not linked to athletes' performance, the more athletes received autonomy-supportive change-oriented feedback, the more their performance improved ($\gamma_{10} = .24, p = .05$). This finding is particularly important because it confirms the positive link between change-oriented feedback quality and athletes' outcomes using a design where the independent and dependent variables are reported by two different informants, thereby eliminating the common variance bias. Quantity and quality of change-oriented feedback accounted for 21.45% of the within-group variability on performance, while coaches' autonomy-supportive style explained 0.31% of the between-group variability.

Discussion

This research examined the relative effect of change-oriented feedback quantity and quality on athletes' phenomenological experiences and performance. Based on SDT (Deci & Ryan, 1985, 2000), it was proposed that a high quality change-oriented feedback is autonomy-supportive. The Quality of Change-Oriented Feedback

Scale was created to assess the characteristics that define an autonomy-supportive change-oriented feedback. Specifically, an autonomy-supportive change-oriented feedback is empathic, accompanied by choices of possible solutions to correct the problem, based on clear and attainable objectives known to athletes, free from person-related statements, is paired with tips, and given in a considerate tone of voice. This multidimensional measure has a sound factor structure and satisfactory reliability. Its validity was also confirmed by showing that the more coaches are autonomy supportive, the more they provide change-oriented feedback that is characterized by the six dimensions of the Quality of Change-Oriented Feedback Scale. In addition, the present findings highlighted the importance of change-oriented feedback quality in the prediction of athletes' phenomenological experiences and performance above and beyond what could already be explained by quantity of change-oriented feedback and by other autonomy-supportive behaviours adopted by coaches.

A negative correlation was also found between change-oriented feedback quantity and quality, which indicates that coaches who provide autonomy-supportive feedback also provide feedback less frequently. In light of its numerous positive correlates, it might be that autonomy-supportive feedback is more efficient than controlling feedback and, as a result, it might be needed less often. Another possible interpretation is that coaches who provide more controlling feedback differ from more autonomy-supportive coaches in the reasons why they provide feedback. Past research shows that controlling behaviours are more frequent under stressful and pressuring situations (e.g., Flink, Boggiano, & Barrett, 1990) and that being controlling does not feel particularly unpleasant for authority figures (Deci, Spiegel, Ryan, Koestner, & Kauffman, 1982). Grolnick and Apostoleris (2002) also suggested that being controlling might actually alleviate the pressure one

Table 6

Fixed effects and variance components of the multilevel models predicting athletes' outcomes (Level 1) from quality and quantity of change-oriented feedback (Level 1) and coaches' autonomy-supportive style (Level 2).

	Parameters	Self-determined motivation	Well-being	Negative affect	Self-esteem	Relatedness	Competence	Autonomy	Amotivation
Fixed effects									
Grand mean: initial status	γ_{00} (SE)	4.52* (.32)	.01 (.06)	1.82* (.05)	5.70* (.06)	6.04* (.06)	5.50* (.06)	4.72* (.09)	.11* (.01)
Grand mean: autonomy-supportive style	γ_{01} (SE)	.93* (.32)	.24* (.06)	-.24* (.05)	.32* (.06)	.17† (.06)	.19* (.06)	.51* (.07)	-.04* (.01)
Grand slope: quality of change-oriented feedback	γ_{10} (SE)	.92* (.24)	.35* (.08)	-.27* (.07)	.45* (.08)	.34* (.11)	.54* (.10)	.62* (.12)	-.07* (.02)
Grand slope: quantity of change-oriented feedback	γ_{20} (SE)	.14 (.15)	.14* (.04)	-.03 (.03)	.11† (.04)	.06 (.03)	.07 (.04)	.00 (.08)	.00 (.01)
Variance components									
Level-1 Within-person residual variability	σ^2	10.71	.47	.31	.59	.56	.83	1.49	.03
Level-2 residual variability of means	σ^2_{00}	3.45	.08	.06	.07	.11	.05	.16	.00
Residual variability of slopes	σ^2_{10}	.08	.10	.05	.07	.23	.09	.13	.00
Residual variability of slopes	σ^2_{20}	.03	.02	.00	.01	.00	.00	.08	.00

Note. All coefficients are unstandardized.

* Significant at the $p < .006$ level.

† $p < .05$, nonsignificant due to Bonferonni correction.

feels in stressful environments. It is thus possible that more controlling coaches use frequent change-oriented feedback as a way to deal with their own stress level, thereby forgetting to focus on their athletes' needs and feelings. Future research is needed to further understand the relation between the quantity and the quality of change-oriented feedback.

Taken together, the present findings add to the literature on SDT in several ways. First, they show that it is possible to support athletes' autonomy even when change-oriented feedback must be given. Until very recently, research within SDT had mainly focused on the importance of giving promotion-oriented feedback in an autonomy-supportive fashion (Deci et al., 1999; Mageau & Vallerand, 2003). When change-oriented feedback was studied, the investigation focused on its detrimental impacts (Deci et al., 1999). By showing positive relations between the six characteristics identified as potentially belonging to an autonomy-supportive change-oriented feedback and measures of coaches' autonomy support and athletes' perceptions of autonomy, the results of the present study point towards the confirmation of our assumption that change-oriented feedback can also be autonomy supportive.

The present study also shows that change-oriented feedback can have positive outcomes when given properly. Indeed, athletes who received more autonomy-supportive feedback were more motivated, had higher well-being and self-esteem, reported greater satisfaction of their basic psychological needs for relatedness, competence and autonomy, and experienced less negative affect and amotivation. Athletes' performances were also positively linked to receiving more autonomy-supportive change-oriented feedback. It thus seems that, as it is the case for promotion-oriented feedback (Deci et al., 1999), the way that coaches provide change-oriented feedback actually predicts athletes' outcomes better than the occurrence of such feedback.

Nevertheless, it is important to note that the impact of change-oriented feedback quality on athletes' satisfaction of the need for relatedness seemed to differ across athletes. Indeed, the residual of the variability of slopes of the change-oriented feedback quality coefficient in the model predicting athletes' satisfaction of the need for relatedness is higher than in models predicting other outcomes. Past studies reveal that students perceived autonomy-supportive teachers as less competent, interested and enthusiastic than their controlling counterparts (Boggiano, Flink, Shields, Seelbach, & Barrett, 1993; Flink et al., 1990), even though these teachers were found to be objectively more effective in their teachings. Applied to the coaching setting, it is possible that some athletes have a similar negative perception of coaches who adopt autonomy-supportive behaviours and would relate less to them as a result. Future research should investigate the impact of change-oriented feedback quality on more specific components of relatedness such as trust or respect to better understand the relation between autonomy support and perceptions of relatedness.

The present research also extends the results of a recent study that looked at autonomy-supportive change-oriented feedback in sport (Mouratidis et al., 2010). First, the definition of an autonomy-supportive feedback has been refined by integrating past work from the feedback literature. Second, the impact of change-oriented feedback quality on athletes' outcomes was examined while considering the hierarchical structure of the data. Error terms were thus better estimated. Third, we examined the relation between change-oriented feedback quality and athletes' outcomes while controlling for the impact of coaches' other autonomy-supportive behaviours. One can thus be sure that the impact of change-oriented feedback quality on athletes' outcomes may not be explained by differences in the general interpersonal climate that coaches create. Finally, while Mouratidis et al. (2010) only assessed athletes' perceptions, the present research included multiple

sources of information, i.e., athletes and coaches, thereby reducing the risk of a common variance bias. This constitutes an important strength of the present study.

As a final contribution to SDT, this research identifies a new behaviour that seems to be commonly used by autonomy-supportive coaches. Past research has shown that autonomy-supportive coaches have a positive influence on their athletes through behaviours such as 1) providing opportunities for choice within specific limits, 2) providing rationale for tasks and rules, 3) acknowledging athletes' feelings, 4) offering opportunities for initiatives taking, 5) giving promotion-oriented feedback that is informational, targets controllable features of performance, and conveys high but realistic expectations, and 6) refraining from adopting controlling behaviours such as threatening athletes to lose material privileges, offering tangible rewards, keeping a constant watch on athletes, using guilt-inducing criticisms, and comparing athletes with each other (see Mageau & Vallerand, 2003; for a review). The present research shows that autonomy-supportive coaches also differ from their controlling counterparts in the type of change-oriented feedback they provide. It thus appears that providing change-oriented feedback that is empathic, paired with tips and choices of solutions, given in a considerate tone of voice, and that avoids person-related statements as well as being based on clear and attainable objectives known to athletes, represents an additional behaviour in autonomy-supportive coaches' behavioural repertoire. This new behaviour should be added to future scales assessing coaches' autonomy-supportive style.

In addition to contributing to the literature on SDT, the present study contributes to the feedback literature. First, past results on the impact of change-oriented feedback quantity on athletes' outcomes are contradictory. Indeed, studies have shown that while limited exposition to failure cues results in increased control expectations and, ultimately, to improved performances, motivation and well-being, repeated exposure to change-oriented feedback leads to feelings of incompetence and helplessness that undermine subsequent performances (Mikulincer, 1988; Mouratidis et al., 2010; Pittman & Pittman, 1979; Wortman & Brehm, 1975). In the present study, when we controlled for change-oriented feedback quality and coaches' autonomy-supportive style, change-oriented feedback quantity only had a positive impact on athletes' well-being. It is possible that, in the sport domain, athletes want and expect to receive constant change-oriented feedback from their coach in order to improve. Athletes receiving more change-oriented feedback may therefore report higher levels of well-being because they perceive their coaches' feedback as high involvement on his/her part. Importantly, the fact that feedback quantity was initially negatively correlated with most of the outcomes but that these correlations disappeared when the impact of feedback quality was controlled suggests that to understand the impact of change-oriented feedback, one must evaluate its quality.

Second, the present study uses a theoretical framework that can integrate various characteristics of a high quality change-oriented feedback. While previous studies have shown that these characteristics are linked to positive consequences, the present study extends these findings in showing that these characteristics share the distinctive feature of being autonomy-supportive, which may account for their positive impact on athletes' outcomes.

Finally, the present study offers a new multidimensional scale to assess the perceived quality of change-oriented feedback. Although future research is needed to replicate the factorial structure of this new scale in a new sample, in the present study, its factorial structure was sound and each subscale was reliable. In addition, by being positively related to measures of autonomy support, the scale proved to assess autonomy-supportive change-oriented feedback, defined by SDT as a high quality feedback. Importantly, results

showed that the scale predicts positive athletes' outcomes, while controlling for coaches' autonomy-supportive style, which also suggests that this type of feedback is of high quality. Taken together, these results thus confirm that the six characteristics included in the new Quality of Change-Oriented Feedback Scale assess a type of change-oriented feedback whose quality contributes in maximizing its positive impact.

Although this study contributes to the SDT and feedback literature, two principal limitations need mentioning. First, the present list of characteristics identified as belonging to an autonomy-supportive change-oriented feedback might not be exhaustive. When the literature on feedback and SDT were reviewed, eight characteristics were originally identified as potential dimensions for the Quality of Change-Oriented Feedback Scale. Two of these characteristics (i.e., delivered promptly and privately) were eliminated because in the present sample they did not form distinct factors in the factorial analysis. Although it seems that these characteristics do not differentiate from the other characteristics of the scale, it is also possible that with better items, they could be included as additional characteristics. In addition, the dimension "given privately" might be best studied using a sample where all athletes are involved in team sports. Future research should also aim at including additional controlling characteristics to the scale. In the current scale, only the "avoiding person-related statements" dimension assesses the presence of a potentially controlling aspect of change-oriented feedback (which is then recoded to obtain the absence of such behaviour). Given that autonomy support is defined as the presence of autonomy-supportive behaviours combined to the absence of controlling behaviours (Black & Deci, 2000), additional characteristics that make change-oriented feedback controlling should be identified and assessed.

Second, the correlational design used in the present study makes causality inferences impossible. For example, one may argue that motivation or performances do not improve because of the type of change-oriented feedback athletes receive, but that it is coaches that are likely to give different types of feedback to athletes that they perceive as being intrinsically motivated or as having greater potential. Future research should replicate these findings using an experimental design where change-oriented feedback quality would be manipulated.

Despite these limitations, the present study should greatly contribute to coaches' training. Even if authority figures are aware that controlling behaviours may not always have the expected effects, many often spontaneously use them to attain their goals (Newby, 1991; Sarrazin, Tessier, Pelletier, Trouilloud, & Chanal, 2006). Although the reasons why they do so are not clear, one hypothesis is that controlling behaviours are still commonly used because coaches do not know other ways to reach the fixed goals. By clearly defining six characteristics of a high quality change-oriented feedback, the present research empowers coaches to replace controlling behaviours by more positive ones, thereby offering a specific and accessible way to improve coaching. It should also help them stop delaying or avoiding change-oriented feedback, a type of feedback that is essential for their athletes' improvements.

In the past decade, numerous researches have highlighted the crucial role of the quality of the coach–athlete relationship for athletes' optimal functioning (e.g. Jowett, 2005; Lafrenière et al., 2011; Lyle, 2002). Giving feedback is an inherent part of the coach–athlete relationship such that change-oriented feedback should have a profound impact on this relationship. Depending on the way that it is given, change-oriented feedback could contribute to build trust and healthy communication between coaches and athletes, which have been identified as central factors to successful relationships (Jowett & Cockerill, 2003), but it could also be interpreted as dominance and as a lack of respect, which could be detrimental to a healthy

relationship (Blanchard, Amiot, Perreault, Vallerand, & Provencher, 2009; Burke, 2001; Jowett, 2003; Jowett & Cockerill, 2003). Although future research is still needed to investigate the specific impact of feedback quality on the coach–athlete relationship, the present study suggests that giving an autonomy-supportive change-oriented feedback, i.e., a feedback that is empathic, paired with tips and choices of solutions, given in a considerate tone of voice, free from person-related statements and based on clear and attainable objectives known to athletes, could help maximize the positive impact that coaches can have on athletes' lives.

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