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Emotion self-regulation and athletic performance: An application of the IZOF model

Claudio Robazza [a,*], Melinda Pellizzari [b], Yuri Hanin [c]

[a] *Dipartimento di Scienze Mediche e Chirurgiche, Polo 40 Semeiotica Medica, Via Ospedale Civile, 105, Padova 35128, Italy*

[b] *Associazione Italiana Psicologia dello Sport, Italy*

[c] *Research Institute for Olympic Sports, Jyväskylä, Finland*

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Abstract

Objectives: To examine the effects of multimodal and individualised self-regulation strategies upon emotions and bodily symptoms of athletes' psychobiosocial state and performance, within the Individual Zones of Optimal Functioning (IZOF) framework.

Design: A multiple baseline single-subject design.

Method: Eight male high-level Italian athletes (four goalkeeper roller-skating hockey players and four gymnasts) participated in the study. Procedures involved: (a) recall of idiosyncratic emotions and autonomic symptoms associated with best and worst performances; (b) identification of spontaneous idiosyncratic psychological preparation procedures; (c) monitoring of precompetitive emotions across a competitive season; (d) implementation of an individual multimodal self-regulation programme; and (e) a social validation interview.

Results: Preliminary empirical support was provided for the effectiveness of a mental training strategy to optimise precompetitive psychobiosocial states and to improve competition performance. Findings also supported the in/out-of-zone notion applied to perceived emotions and bodily symptoms.

Conclusions: Further research is needed to replicate and extend study findings, explore additional concepts incorporated in the recent developments of the IZOF-psychobiosocial model, and develop effective intervention strategies.

Keywords: IZOF model; Emotions; Mental training; Gymnastics; Hockey

* Corresponding author: Tel. and fax: +1-39-422-261338.
E-mail address: c.robazza@tin.it (C. Robazza).

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Much of the work in applied sport psychology is based on experiential knowledge, and practitioners sometimes have difficulty building effective mental training programmes for individual athletes and teams. Hence, there is a clear need in the practice of sport psychology for theory/model-driven mental training and self-regulation programmes based on research evidence (Annesi, 1998; Gould & Udry, 1994; Hardy, Jones, & Gould, 1996; Morgan, 1997). Research evidence, in the rapidly growing area of performance enhancement through emotion regulation, is particularly important. Unfortunately, 'most of the interventions in applied sport psychology are based upon unverified hypotheses and unsubstantiated pedagogical principles, rather than on scientific evidence' (Morgan, 1997: 5). Such evidence, however, even if available, may be sometimes difficult to apply when a sport psychologist employs a nomothetic research model emphasising general principles of behaviour derived from the study of groups. Moreover, group-oriented interventions may underestimate or ignore the phenomenology of performance-related subjective experiences reflecting an athlete's perspective (Dale, 1996). Therefore, an idiographic (individual-oriented) approach to the development and application of emotion self-regulation programme holds promise, especially in field setting of high achievement sport.

Our intervention study used the Individual Zones of Optimal Functioning (IZOF) model (Hanin, 1980, 1986, 1997, 2000b, 2000c) as a conceptual framework and methodological tool to examine the effectiveness of an individual-oriented emotion self-regulation programme for highly skilled and experienced athletes. Space limitations preclude a detailed review of extant literature featuring the IZOF model and relevant empirical research. Therefore, the readers are referred to recent reviews highlighting the application of the model to anxiety research (Hanin, 1995; Jokela & Hanin, 1999; Raglin & Hanin, 2000) and positive and negative emotions (Hanin, 1997, 2000b; Robazza, Bortoli, Zadro, & Nougier, 1998b). Additionally, several constructive critiques of the IZOF model are also available (Cerin, Szabo, Hunt, & Williams, 2000; Gould & Tuffey, 1996; Kamata, Tenenbaum, & Hanin, 2002; Landers & Arent, 2001; Lazarus, 2000; Morgan, 1997; Williams & Krane, 2001; Woodman & Hardy, 2001; Zaichkowsky & Baltzell, 2001). The sections below provide a brief overview of selected aspects of the IZOF model bearing directly on the development of individualised emotion self-regulation programmees.

The IZOF model

The IZOF model, developed in the naturalistic setting of elite sport, holds that emotion is a component of the psychobiosocial state conceptualised as a situational, multi-modal and dynamic manifestation of the total human functioning (Hanin, 1997, 2000b). Five basic dimensions (form, content, intensity, time, and context) are used to describe individually optimal and dysfunctional structure and dynamics of performance related emotional experiences. The model provides the functional explanation of the dynamics of the emotion-performance relationships based on a detailed description of athletes' idiosyncratic subjective experiences. This is especially important because the practitioners assisting athletes in emotion self-regulation usually face three issues: (a) identifying emotional states related to individually successful and poor performances; (b) understanding emotion–performance relationships; and (c) selecting person- and task-relevant techniques of self-regulation (Gould & Udry, 1994; Hanin, 1993, 1997; Murphy & Jowdy, 1992). Compelling empirical evidence in support of the IZOF model provides several tentative guidelines of how to deal with these three issues.

Identifying optimal and dysfunctional emotional states

It is crucial for any intervention programme to realise that each athlete has individually optimal emotion intensity (high, moderate or low) (Hanin, 1980, 1986). Moreover, each athlete has a specific constellation (Hanin, 1993, 1995, 1997, 2000b) or a 'recipe' (Gould & Udry, 1994) of individually optimal and dysfunctional emotion content described by athlete-generated idiosyncratic markers. Finally, idiosyncratic emotion content and intensity are different in practices and competitions and vary across pre-, mid-, and post-event performance situations (Hanin & Stambulova, 2002; Syrjä, Hanin, & Pesonen, 1995).

Individualised assessment procedures to qualitatively and quantitatively identify optimal and dysfunctional emotions include semi-structured interviews (Orlick, 2000), self-report scales, individualised emotion (Hanin, 2000a) and performance (Jones, 1993) profiling, metaphor-generation method (Hanin & Stambulova, 2002), and narratives (Sparkes & Silvennoinen, 1999). This study used individualised emotion profiling with athlete-selected markers to assess emotion and bodily symptoms as two of the most relevant modalities in an emotion-self regulation programme (Williams & Krane, 2001; Zaichkowsky & Takenaka, 1993). Athletes own self-regulation strategies during best performances were also identified.

Prediction of emotion–performance relationships

The IZOF model makes several empirically supported individual-oriented predictions of emotion–performance relationships. Firstly, there is a high degree of interindividual variability in the intensity and content of idiosyncratic optimal and dysfunctional emotions accompanying individually successful and poor performances. Secondly, a high probability of individually successful performance is expected when combined maximum enhancing and minimum impairing effects (in the zone condition) are observed. In contrast, a high probability of poor performance is expected when low enhancing and high inhibitory effects (out of the zone condition) are observed (Hanin, 1997, 2000c; Kamata, Tenenbaum & Hanin, 2002). Additionally, separate and interactive effects of emotions enhancing and impairing sporting activity should be considered. From the applied perspective, the in–out notion suggests that to enhance performance it is necessary that an athlete is: aware of his or her optimal and dysfunctional zones; able to distinguish optimal from less than optimal states; and able to enter and stay in the optimal zone during performance. Finally, the notion of bi-directionality focuses on the dynamics of emotion effect upon performance and performance impact on emotions, suggesting that pre-event emotions can affect performance and on-going performance affects mid-event and post-event emotions. Therefore, emotion self-regulation should consider potentially beneficial and detrimental effects of performance dynamics upon emotional states.

The zones reflect individual differences in athletes' ability to recruit and utilise efficiently available resources. Therefore, the explanation of the functional impact of emotions upon performance in the IZOF model is based on the notion of resources matching. Optimal pleasant and unpleasant emotions reflect availability of resources and their effective recruitment and utilisation by producing energising (enhanced effort) and organising (enhanced skill) effects. In contrast, dysfunctional unpleasant and pleasant emotions reflect a lack of resources or their inefficient recruitment and utilization resulting in dis-energising and dis-organising effects of emotions upon performance.

The IZOF-based interventions

There are numerous techniques of emotion self-regulation in the practice of sport psychology (Gould & Udry, 1994; Williams & Harris, 2001; Zaichkowsky & Baltzell, 2001). In our study, the effort was made first to identify and further develop the athletes' own self-regulation techniques that they used prior to their best competitions rather than simply to suggest existing strategies not matching their experiences or resources. This option was related to the fact that sometimes in the practice of sport psychology mental skills suggested by researchers are not as effective as performers' own skills (Murphy & Jowdy, 1992).

As mentioned earlier, the major emphasis in the IZOF model so far has been on the description, prediction, and explanation of emotion–performance relationships. The model has several practical implications for individualised interventions; however, their effectiveness has not been empirically tested so far. Specifically, based on extensive studies of precompetition anxiety and observations of elite athletes, Hanin (1980, 1986) proposed a tentative programme for optimisation of precompetition anxiety. This intervention, used in applied work with elite rowers and weightlifters (Hanin, 1980) included: establishing retrospectively optimal anxiety zones; assessing actual anxiety 5–7 days prior to competition; measuring anticipated (expected) prestart anxiety and attitudes and mind-sets towards competition; comparing anticipated actual anxiety with pre-established zones; and reducing or increasing anxiety to help athletes enter and stay in their optimal zones.

Later, based on empirical research into positive and negative emotions and performance, Hanin (1997, 2000c) proposed the seven principles as guidelines for individualised emotion regulation. These included the principle of multimodality, multizone, multidirection, multifunction, multistage, multitask, and multi-method. Annesi's (1998) intervention study with three skilled tennis players was one of the first well-documented intervention investigations examining the efficacy of the selected principles of the IZOF model. Annesi identified the optimal zones using the Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Burton, Vealey, Bump, & Smith, 1990) and taught athletes to enter their zones to enhance their performance during the season. However, his study was limited to the assessments of precompetition anxiety using the CSAI-2 and to the application of researcher-generated regulation strategies. Our study aimed to address these concerns by going beyond anxiety and assessing positive and negative emotions and somatic symptoms using athlete-generated idiosyncratic descriptors. Moreover, whenever it was possible, we tried to activate the usage of self-regulation strategies the athletes already successfully used in their best performances and in coping with difficult performance situations. Recently, Robazza and associates (Robazza, Bortoli, Zadro & Nougier, 1998b; Robazza, Bortoli, & Nougier, 1999, 2000b, 2002) used the proposed principles in monitoring emotional states of top Italian track and field athletes and archers. Anecdotal evidence suggested that the IZOF-based approach was instrumental in enhancing athletes' awareness and ability to consistently optimise their emotional states and athletic performance. However, several practical and procedural aspects of the application of the IZOF model in self-regulation warrant additional research in a field setting.

The purpose of the study

This study aimed to develop an individualised emotion self-regulation programme based on the IZOF model and research evidence. Our primary purpose was to examine whether and how highly skilled and experienced athletes could be helped to deliberately enter and stay in their optimal zones and how it affected their performance during the competitive season. Based on several theoretical formulations and earlier evidence in sport practice, we hypothesised that athletes would be able to: (a) identify their highly idiosyncratic optimal and dysfunctional emotional states; (b) deliberately enter (and stay) in the optimal zones using their own self-regulation strategies; and (c) perform more consistently and even better than before while being in the zone than when out of the zone.

Method

Participants

Experienced athletes from two sports were chosen for the study in order to establish the efficacy of the intervention by replicating findings across two sport disciplines. The participants were eight male high-level athletes from the northeast of Italy, four goalkeeper roller-skating hockey players (H1, H2, H3, and H4), aged 20–29 years, and four gymnasts (G1, G2, G3, and G4), aged 17–22 years. Their competitive experience ranged from 9 to 20 years. The athletes competed repeatedly in top-level Italian national tournaments with about 10–15 competitions during the regular season. None of the participants had experience of a structured psychological skills training programme, although they reported having knowledge of the potential benefits of using mental skills. The research purpose was explained at the practice sites to sport managers, coaches, and athletes. Informed consent was then obtained from participants, and parents of the 17-year-old gymnast. Anonymity and confidentiality in reporting study results were assured.

Experimental design

A multiple baseline single-subject design (Bates, 1996; Reboussin & Morgan, 1996) was employed to examine the effect of the mental skills training programme upon performance. Several authors (e.g. Bryan, 1987; Hanton & Jones, 1999; Hrycaiko & Martin, 1996) have advocated the advantages of this research design in sport psychology. Single-subject designs are appropriate for applied research in that they permit a continuous monitoring of individual's responses throughout the duration of the study, and allow the implementation of procedures which best address individual needs across the intervention. The potential problem of low external validity for results generalisation may be minimised by replicating the results in further studies.

Intervention in a single-subject design usually starts when baseline-dependent variables are stable or in a direction opposite of that predicted for the treatment. However, time constraints and the length of time required to develop individualised self-regulation strategies precluded the possibility to start intervention after having achieved a stable baseline. The treatment was introduced to hockey players H1, H2, and H3 after competitions 3, 5, and 7 (staggered baseline), respectively. Data were collected for players H1, H2, and H3 across 10, 12, and 14 competitions, respectively, to provide participants with a same duration of mental training intervention. Similarly, gymnasts G1, G2, and G3 underwent treatment after competitions 3, 4, and 5, collecting data for 7, 8, and 9 competitions, respectively. For each performer, precompetition data were gathered prior to treatment and during treatment. Thus, during the intervention phase hockey players received treatment throughout seven data collections, while gymnasts underwent treatment across four data collections. The different schedule of data collection between hockey players and gymnasts was determined by the relatively low number of gymnastic competitions during the season. A hockey player and a gymnast, selected at random, acted as controls without receiving the intervention programme. Data were collected across nine and 10 competitions, respectively. The control participants were presented with the intervention purposes and procedures; they were offered the possibility to undertake the mental training programme at the completion of the study. One of them decided to undergo the programme and he was provided with the individualised intervention at the end of the study.

Measures

An idiographic step-wise emotion scaling procedure, mainly based on Hanin's (1997, 2000a) IZOF-emotion model, was employed using two stimulus lists. A first list of 64 emotion descriptors was derived by translating emotions used by Hanin and Syrjä (1995a, 1995b) with athletic samples. It was presented to the athletes to help them recognise or generate idiosyncratic emotion descriptors associated with prestart recalled optimal and recalled poor performances. The list of adjectives had been used in studies with different Italian athletic samples (D'Urso, Petrosso, & Robazza, 2002; Robazza, Bortoli, Nocini, Moser & Arslan, 2000a; Robazza, Bortoli & Nougier, 1998a, 1998b, 2002). Hanin & Syrjä (1995a, 1995b) had participants identify facilitating or inhibiting idiosyncratic items from two lists, one of positive and one of negative emotion descriptors. In this study, similar to the investigations of Robazza and colleagues, a single list was used with positive and negative items randomly arranged, with the aim of prompting athletes to decide on their own pleasant (positive) or unpleasant (negative) descriptor characteristics. Participants could generate new items deemed to be more representative of their own emotional experiences than those listed. A second list of 45 physiological states was also used to allow the athlete to identify physiological symptom descriptors concomitant to performance emotions. The item list has been developed by Bortoli and Robazza (2002; Robazza & Bortoli, 2003) in studies with Italian referees and athletes. The list included the somatic anxiety items of the CSAI-2 (Martens, Burton, Vealey, Bump & Smith, 1990) and the Sport Anxiety Scale (SAS; Smith, Smoll, & Schutz, 1990).

Intensity of each emotion and physiological descriptors related to recalled optimal and poor performances were rated using a Borg Category Ratio scale (CR-10; see Borg, 2001, and Hanin, 2000a: 306). This scale has been used successfully in psychological studies of exercise capacity, exertion, and pain (Borg, 2001) and for investigation of emotions (Hanin, 2000a, 2000c). The slightly modified verbal anchors of the scale were 0, nothing al all; 0.5, very, very little; 1, very little; 2, little; 3, moderate; 5, much; 7, very much; 10, very, very much; 11, maximum possible (no verbal anchors were used for 4, 6, 8 and 9). Single item scores may therefore range from 0 to 11.

Reliability of precompetition recall was established for anxiety and then for emotions. Precompetitive recalled anxiety and current anxiety were reported correlating 0.60 to 0.80 (Hanin, 1986; Raglin & Turner, 1993; for a review, see Annesi, 1997, and for a meta-analysis see Jokela & Hanin, 1999). Higher reliability ($r > 0.95$) was reported for track and field athletes, contrasting current anxiety with recalled anxiety 2 days after the competition (Harger & Raglin, 1994). Significant correlations were also yielded between anticipated anxiety, from 24 h to 2–3 weeks before the event, and current anxiety (Hanin, 1986; Raglin, Morgan, & Wise, 1990; Salminen, Liukkonen, Hanin, & Hyvönen, 1995). Hanin and Syrjä (1996) established the intraindividual reliability of idiosyncratic affect scales in high-level soccer players. Mean intraindividual Cronbach alphas ranged from 0.54 to 0.90 in the four affect scales (facilitating-positive, facilitating-negative, inhibiting-positive, and inhibiting-negative). Moreover, recall and prediction accuracy were examined. Findings revealed significant correspondences between recalled and actual scores, and between predicted and actual scores in 76.5 and 70.6% of the players, respectively. In summary, research findings support the notion that athletes are able to accurately predict and recall precompetition emotions.

Procedure

Prior to the beginning of the competitive season, each athlete was individually contacted to participate on a volunteer basis in a mental training project. Participants were presented with information about research goals and assessment procedures. Athletes were also advised that they could withdraw from the investigation at any time. The investigation comprised five phases with the aim to: (a) identify preperformance content of optimal–dysfunctional emotions with a recall procedure; (b) scrutinise their own spontaneously developed psychological preparation procedures; (c) monitor precompetitive emotions; (d) develop an individual multimodal self-regulation programme; and (e) examine the actual adoption of psychological self-regulation procedures (social validation). The control participants were involved in the procedures of preperformance emotions identification (first phase) and precompetitive emotions monitoring (third phase); their self-regulation strategies were not examined and intervention was not implemented.

Emotion profiling

Athletes were met individually and provided with information regarding the concepts of idiosyncratic precompetition emotions and bodily reactions, and their effects upon performance. It was also explained that emotions and bodily reactions would be perceived pleasant or unpleasant, no matter whether beneficial or harmful. Emphasis was placed on the recognition of individual performance-related emotions as an important step to gaining awareness and control of bodily states affecting performance. Performers were thereafter asked to identify emotions and physiological states associated with recalled best and recalled worst performances. They were presented with the two lists of positive-negative affect and physiological symptom descriptors to facilitate the identification of idiosyncratic items. Generation of new descriptors was sought to better match the idiosyncratic competitive experience. Specifically, athletes were asked to select up to five emotions and up to five symptoms concomitant to emotions for each of the four emotion content categories, facilitating-pleasant, facilitating-unpleasant, inhibiting-unpleasant, and inhibiting-pleasant. Therefore, a total of 20 emotions and 20 bodily symptoms could have been selected. Each item was then reconsidered to be rated in intensity on the CR-10 scale. Participants were asked, ‘What is the intensity of this emotion (or bodily symptom) when related to best (or worst) performance?' Recalled optimal-dysfunctional emotion content and intensities were thus identified to serve as individualised criteria and guidelines for athletes' self-regulation.

Spontaneous psychological preparation procedures

Before implementing psychological techniques it is important to analyse the demands of a specific sport (Taylor, 1995) and how performers act spontaneously. Expert performers of different sports, compared to lower level athletes, are usually more effective in spontaneously adopting a combination of idiosyncratic mental preparation strategies and skills to deal with competition demands. These strategies include arousal control, imagery, self-talk, concentration, anxiety control, and consistent precompetition routines (Gould, Eklund, & Jackson, 1992a, 1992b, 1993; Mahoney, Gabriel, & Perkins, 1987; Orlick & Partington, 1988). Therefore, a second session took place with each participant before the competitive season with the aim to examine 'self-made' mental preparation procedures already developed. Each athlete was presented with his emotion and somatic symptom descriptors previously identified, and asked to describe in detail the thoughts, emotions, and behaviours occurring prior to and during best performance and then prior to and during worst performance. Personal procedures for best achievements and usual reactions to difficulties and mistakes were also addressed. The discussion took into account preparatory routines and behaviours associated with goal setting, imagery, focussing, self-talk, arousal regulation, and emotion control. Spontaneous psychological and behavioural preparation procedures were identified to gain information necessary for the development of most effective individualised self-regulation strategies. Finally, athletes were asked to reconsider their emotion profiles to make sure that descriptors were fully representative of their precompetitive experience. No changes in content or intensity of the previously identified items occurred.

Precompetition emotion monitoring

As explained in the Experimental Design section, a precompetitive monitoring was conducted with hockey players and gymnasts over the competitive season, collecting data from 10 to 14 events and from seven to nine events, respectively. Assessments were conducted within the 45 min preceding the competition. Using the 'how you feel right now' instruction, athletes were requested to score their emotions on the Borg CR-10 scale. Participants were provided with a form for each competition containing personal affect items. They were instructed to score each item before competition and to evaluate performance retrospectively in the same scale immediately after competition. Self-referenced performance evaluation was conducted using the Borg CR-10 scale ranging 0 to 11 points (see Measures section) in order to facilitate the athlete's assessment by adopting a same scale of measure for emotions and performance. Hockey players were required to evaluate their performance associated with the first of the two halves of the game, whereas gymnasts were asked to evaluate their performance related to the first of the six events in competition. The retrospective assessment was restricted to portions of competition in an attempt to focus on the link between prestart emotions and performance, and limit the effects of other potentially intervening variables (e.g. game duration, events occurring during competitions, and outcomes) that may moderate the predictive power of precompetitive emotions. A self-referenced performance evaluation was considered appropriate. Indeed, objective measures or final results may not account for factors that are not easy to quantify, such as the opponent's ability (D'Urso, Petrosso & Robazza, 2002; Gould, Tuffey, Hardy, & Lochbaum, 1993; Terry, 1995). Evaluations of hockey players by their coaches on the Borg CR-10 scale, and final scores ranging 0 to 10 given to gymnasts by jury members were also collected after events. Each athlete was contacted by telephone the day before competition and reminded about the scoring procedure.

Multimodal self-regulation programme

The mental skills intervention was implemented into the programme at the appropriate time in the base-line (see Experimental Design section). Participants were provided with psychological skills training during individual meetings on a regular basis, once a week, for 2 h. With each participant, 10 meetings were scheduled across the treatment phase to have performers develop and apply self-regulation strategies. Athletes were informed that mental training procedures would be beneficial in improving self-regulation skills, with the purpose of reaching a preperformance state as near as possible their own optimal states. The individualised treatment was proposed following suggestions provided by several authors (Boutcher, 1990; Hall, 2001; Hanin, 2000c; Hanin & Stambulova, 2002; Schmid, Peper, & Wilson, 2001; Taylor & Wilson, 2002; Vealey & Greenleaf, 2001; Williams & Harris, 2001). Table 1 contains the self-regulation procedures adopted. Treatment comprised several phases and evolved at different rates within and across sessions depending on the participant's progress. At first, each athlete was required to accomplish a retrospective analysis of his functional or dysfunctional precompetitive states. In particular, the participant was asked, 'What are your thoughts, emotions, and somatic reactions occurring prior to your best (worst) events over the last season? What are the intensities of these emotions and somatic reactions?' The idiosyncratic emotion content and intensity profile related to best and worst performances, identified in the first meeting pretreatment, was instrumental in facilitating recall and discussion of individual precompetition mental states. Athletes were then instructed to pay attention to their current mental states before actual competition, and to contrast current conditions with recalled optimal-dysfunctional states with the help of their emotion profile. The general objective of this phase was to improve individual awareness of content and intensity of preperformance emotions and bodily symptoms, and their facilitating-inhibiting functional effects.

In a second stage, the athlete was asked to examine in detail effective personal strategies spontaneously employed to achieve precompetition optimal states. A question was, 'What are the routines, behaviours, and mental procedures you find most effective to recover your optimal precompetition emotions and you are able to apply?' Another question was, 'What are the routines, behaviours, and mental procedures you find most effective to regulate (increase or decrease) the intensity of your optimal precompetition emotions?' Ineffective strategies were also scrutinised to increase awareness of functional and less than functional procedures while facing competitive demands. Participants were then encouraged to draw attention to their current behaviour and emotional state before actual competition, and to apply their effective strategies. The goal of this phase was to enable performers achieve optimal conditions by applying their effective self-regulation procedures and dismissing ineffective habits.

In a last phase, suggestions were provided to improve, refine, and expand spontaneous self-regulation strategies taking into account preparatory routines and the skills of goal setting, imagery, focussing, self-talk, arousal regulation, and emotion control as proposed by several authors

Table 1
Pre-competition self-regulation procedures

Purposes			Procedures
Recover (remove)	Facilitating (inhibiting) emotions	Pre-competition routines	Equipment preparation, mental preparation (Boutcher, 1990; Taylor & Wilson, 2002)
		Imagery	Rehearsal of successful execution and competition mastery (Hall, 2001; Vealey & Greenleaf, 2001)
		Self-talk	Control of negative self-statements, reframing, action-oriented thoughts (Williams & Leffingwell, 2002; Zinsser, Bunker, & Williams, 2001)
		Self-assessment	Self-evaluation of emotion content and intensity (Hanin, 2000a)
	Facilitating (inhibiting) bodily symptoms	Pre-competition routines	Physical and technical warm-up (Boutcher, 1990; Taylor & Wilson, 2002)
			Relaxation and energising techniques (Williams & Harris, 2001)
		Self-assessment	Self-evaluation of symptom content and intensity (Hanin, 2000a)
Increase	Facilitating emotions	Imagery	Rehearsal of successful execution and competition mastery (Hall, 2001; Vealey & Greenleaf, 2001)
		Self-talk	Control of negative self-statements, reframing, action-oriented thoughts (Williams & Leffingwell, 2002; Zinsser, Bunker, & Williams, 2001)
		Use of metaphors	Energising metaphors (Hanin & Stambulova, 2002)
	Facilitating bodily symptoms	Energising techniques	Thoracic breathing, muscular tension, energising thoughts, imagery (Williams & Harris, 2001)
		Use of metaphors	Energising metaphors (Hanin & Stambulova, 2002)

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Table 1 (*continued*)

Purposes			Procedures
Decrease	Facilitating emotions	Goal setting	Challenging, attainable, realistic, specific goals (Burton, Naylor, & Holliday, 2001; Gould, 2001)
		Focussing	Thought stopping, goal focussing, task execution cues, re-focussing after mistakes (Schmid, Peper, & Wilson, 2001)
		Use of metaphors	De-energising metaphors (Hanin & Stambulova, 2002)
	Facilitating bodily symptoms	Relaxation techniques	Diaphragmatic breathing, muscular relaxation, relaxing thoughts, imagery rehearsal (Williams & Harris, 2001)
		Use of metaphors	De-energising metaphors (Hanin & Stambulova, 2002)

(see Table 1). At every meeting the athletes were encouraged to achieve an optimal content and intensity of emotions and physiological symptoms by consistently applying self-regulation prior to practice and competition. The beneficial effect of techniques matching individual needs was stressed. For example, an athlete might rehearse successful execution to recover an optimal content of emotions and bodily symptoms, and then employ realistic goals, task specific imagery, somatic relaxation, and de-energising metaphors to lower intensities of emotions and symptoms. Another athlete might focus on preparatory routines to recover facilitating states, and then use challenging goals, mastery imagery, positive self-talk, and energising metaphors and procedures to enhance emotion and autonomic symptom intensities. At the end of the third stage, athletes were expected to be able to reach their optimal precompetition states by systematically using spontaneous or learnt self-regulation procedures. In summary, the intervention was intended to enable athletes to: (a) improve awareness of how different contents and intensities of precompetition emotions and somatic symptoms may exert facilitating or inhibiting functional effects; (b) apply spontaneous self-regulation procedures to recover and modulate optimal precompetition emotions and somatic symptoms; and (c) improve, refine, and expand the individual self-regulation procedures to be consistently applied before competition.

Social validation interview

A personal interview was conducted after the conclusion of the study with the athletes who underwent intervention. The purposes of the interview were to investigate the participants' perception of the individualised multimodal self-regulation programme usefulness, the level of satisfaction with the results produced by applying the procedure, the extent of application of the programme, and whether participants perceived any performance improvement. Examples of specific questions are, 'Did you apply your self-regulation programme consistently in practice and competition? Did you find difficulties in applying the programme? Did you perceive performance improvements or other benefits as a consequence of self-regulation? Do you intend to continue to apply self-regulation strategies?'

Results

Idiosyncratic emotion and bodily descriptors

Table 2 reports content and intensity of emotion and somatic symptom descriptors of each performer. The athletes identified a total of 67 emotion labels and 55 physiological symptom labels across facilitating-inhibiting and pleasant-unpleasant content categories. Regarding emotion descriptors, 19 were facilitating-pleasant, 15 facilitating-unpleasant, 16 inhibiting-unpleasant, and 16 inhibiting-pleasant; 34 items were included in one content category, 14 items in two categories and one item (tense) in three categories. Reversals in the functional impact were shown for 13 items, since six descriptors (e.g. afraid, insecure, and unconfident) perceived unpleasant and seven descriptors (e.g. calm, focused, and secure) perceived pleasant were also experienced as either facilitating or inhibiting. Reversals in the hedonic preference was shown in one item (determined)

Table 2
Content and intensity of emotion and bodily symptom descriptors

Participants	Facilitating-Pleasant		Facilitating-Unpleasant		Inhibiting-Unpleasant		Inhibiting-Pleasant	
	Emotions	Symptoms	Emotions	Symptoms	Emotions	Symptoms	Emotions	Symptoms
H1	Calm (5)	Energetic movements (5)	Agitated (3)	Loose legs (2)	Unfocused (5)	Cold feet (5)	Joyful (5)	Relaxed muscles (5)
	Focused (11)	Muscular tension (3)	Tired (3)	Physical exhaustion (3)	Insecure (1)	Slow movements (3)	Secure (10)	Feeling fresh (5)
	Capable (11)		Scared (4)		Unconfident (3)		Relaxed (7)	
H2	Cheerful (5)	Relaxed muscles (4)	Nervous (0.5)	Heart rate perception (0.5)	Unfocused (5)	Stiff movements (5)	Superior (7)	
	Relaxed (6)	Smooth movements (5)	Tense (2)	Sweaty and cold hands (1)			Self-assured (7)	
	Tranquil (7)		Afraid (0.5)	Yawns (1)				
	Certain (4)							
	Vivacious (7)							
H3	Secure (7)	Arm muscles relaxed (5)	Frightened (1)	Sweaty hands (3)	Afraid (10)	Loose legs (5)	Happy (7)	Stomach tension (5)
	Aggressive (10)	Energetic movements (7)	Afraid (5)	Stomach tension (5)	Distracted (10)	Sweating (7)	Proud (5)	Feeling thirsty (7)
	Tranquil (11)	Not thirsty (6)	Doubtful (3)	Nervous tic (3)	Frightened (10)	Slow movements (7)	Joyful (7)	
H4	Secure (5)	Muscular tension (5)	Indifferent (5)	Sweaty hands (5)	Insecure (5)	Relaxed muscles (4)	Free (7)	Regular heart rate (5)
	Motivated (7)	Sharp movements (6)	Determined (5)	Muscular tension (5)	Unmotivated (6)	Physical exhaustion (5)	Calm (7)	Relaxed muscles (6)
	Determined (7)	Feeling fresh (5)	Hostile (5)	Sharp movements (5)	Undetermined (3)	Slow movements (2)	Cheerful (5)	Feeling hungry (6)

(*continued on next page*)

experienced facilitating-pleasant and unpleasant. Finally, one item (tense) was reversed in functional impact, as well as hedonic preference.

With reference to physiological symptom descriptors, 16 were facilitating-pleasant, 17 facilitating-unpleasant, 13 inhibiting-unpleasant, and nine inhibiting-pleasant; 24 items were included in

Table 2 (*continued*)

Participants	Facilitating-Pleasant		Facilitating-Unpleasant		Inhibiting-Unpleasant		Inhibiting-Pleasant	
	Emotions	Symptoms	Emotions	Symptoms	Emotions	Symptoms	Emotions	Symptoms
G1	Energetic (11)	Regular breathing (7)	Agitated (2)	Dry mouth (3)	Stressed (7)	Loose legs (5)	Focused (11)	Slow movements (3)
	Reactive (11)	Arm muscles relaxed (4)	Unconfident (2)	Feeling thirsty (1)	Tense (5)	Heart rate perception (6)	Courageous (5)	Yawns (5)
	Determined (6)	Face muscles relaxed (5)			Annoyed (5)	Stiff movements (6)	Confident (7)	
G2	Energetic (5)	Arm muscles relaxed (4)	Tense (1)	Leg muscles tensed (0.5)	Unconfident (6)	Nervous tic (9)	Secure (10)	Relaxed muscles (10)
	Happy (3)	Heart rate perception (8)	Afraid (3)	Sweating (1)	Nervous (8)	Cold feet (10)	Serene (10)	Over energetic (8)
	Serene (6)		Agitated (2)		Distracted (9)	Irregular heart rate (8)	Proud (6)	
G3	Secure (11)	Smooth movements (11)	Troubled (0.5)	Muscular tension (4)	Afraid (5)	Physical exhaustion (11)	Calm (10)	Feeling fresh (5)
	Active (11)	Warm body (3)	Worried (0.5)		Agitated (5)		Relaxed (10)	Relaxed muscles (8)
	Energetic (11)				Discouraged (10)			
G4	Tranquil (5)	Muscular suppleness (7)	Insecure (3)	Stomach ache (2)	Depressed (5)	Physical pain (5)	Secure (5)	Relaxed muscles (5)
	Charged (7)	Lightness (11)	Agitated (2)	Muscular tiredness (2)	Raged (3)	Tiredness (5)	Exited (5)	Slow movements (5)
	Secure (3)	Lack of pain (10)	Afraid (2)	Need to urinate (1)		Sweaty hands (3)	Tense (5)	Feeling fresh (5)
	Rested (5)	Sweating (3)						
	Focused (6)							

In parentheses, the intensity of facilitating-pleasant and facilitating-unpleasant descriptors is related to recalled best performance; the intensity of inhibiting-unpleasant and inhibiting-pleasant descriptors is related to recalled worst performance.

one content category, 11 items in two categories and three items in three categories. Reversals in the functional impact were revealed for five items, since four descriptors (e.g. loose legs, and sweaty hands) perceived unpleasant and one descriptor (feeling fresh) perceived pleasant were also experienced as either facilitating or inhibiting. Reversals in the hedonic preference were shown for three items, with two items (muscular tension, and sharp movements) experienced facilitating-pleasant and unpleasant, and one item (slow movements) perceived inhibiting-pleasant and unpleasant. Finally, six items (e.g. heart-rate perception, relaxed muscles, and sweating) were reversed in functional impact, as well as hedonic preference.

As can be seen, interindividual differences were apparent for both emotion and bodily descriptors, since low content and intensity overlap emerged. These data support the basic assumptions of the IZOF model and highlight the need to identify idiosyncratic optimal and dysfunctional patterns of emotions and somatic symptoms, against which to compare current states, before implementing an intervention programme.

Zone predictions

According to the IZOF model predictions, good performance was expected when precompetition emotion intensities were near best (and far from worst) performance emotion intensities. On the other hand, poor performance was predicted when precompetition emotion intensities were far from best (and near worst) performance emotion intensities. To test these assumptions, best and worst performances with related optimal and dysfunctional emotion intensities were identified across competitions based on retrospective performance evaluations of athletes and the hockey coach or gymnastic jury. Best and worst achievements derived from athletes' evaluations were the same as the coach's evaluations or jury scores.

Similar to the procedure employed by Robazza, Bortoli and Nougier (2002), two intraindividual difference scores were calculated for each emotion and physiological symptom descriptors across all assessments: (a) between current and best performance intensity; and (b) between current and worst performance intensity. Hence, current preperformance descriptor intensities of several events were contrasted with current best and worst preperformance descriptor intensities. Recalled optimal and dysfunctional item intensities, which were used as reference for athletes' self-regulation, were not considered for analyses because initial intensities identified by recall are tentative and require further validation and refinement to improve reliability (Hanin, 2000c). Scores were analysed in terms of absolute values, given that the focus of the IZOF model is on magnitude rather than on direction of difference scores. Afterwards, difference scores of emotion and physiological symptom descriptors pertaining to a same content category (facilitating-pleasant, facilitating-unpleasant, inhibiting-unpleasant, and inhibiting-pleasant) were averaged, thus resulting in eight mean scores (four emotions and four symptoms) for each competition. Finally, intraindividual correlations were calculated between mean difference scores and self-referenced performance evaluation scores. Negative coefficients were expected when correlating difference scores of current and optimal performance descriptor intensities with performance scores, whereas positive coefficients were predicted correlating difference scores of current and poor performance descriptor intensities with performance scores. Indeed, decreased differences of current precompetition item intensities from best performance should be related to increased performance (negative relationship). Conversely, decreased differences of current precompetition item intensities to worst performance should be related to decreased performance (positive relationship).

Relatively few correlations[1] were significant because of the small number of assessments. Yet, 109 (87%) correlations related to emotions ($n = 59$, 92%) and symptoms ($n = 50$, 81%) were in the predicted direction, whether negative or positive, with 58 (46%) coefficients higher than 0.50. In addition, almost all correlations (61 out of 64) of emotion and symptom (total) content categories were in the predicted direction, with 34 (53%) coefficients higher than 0.50. Finally, the number of emotion correlations in the predicted direction (current–best, $n = 30$; current–worst, $n = 29$) was not different from the number of symptom correlations (current–best, $n = 22$; current–worst, $n = 28$), $\chi(1) = 0.51$, ns. Thus, findings provide support to the zone notion for both emotion and symptom descriptors.

Correlations between raw scores of current emotions and symptoms with performance scores were also computed. Correlating raw data (instead of difference scores) with performance scores do not allow individual fluctuations related to effective and ineffective zones to be taken into account. Thus, according to the IZOF model, raw data analysis should be less powerful than analysis of difference scores in predicting performance. This prediction was upheld across emotion and symptom content categories, with a higher number of difference score correlations (87%) in the predicted direction, compared to the number of raw score correlations (62%) one would expect to be greater than zero for facilitating descriptors and performance, and <0 for inhibiting descriptors and performance. The lower number of raw data correlations concerned both emotions (from 92 to 66%) and symptoms (from 81 to 58%).

Intervention effects

The individualised self-regulation procedures were implemented to adjust athletes' emotion intensities nearer best performance and more distant from worst performance. Hence, athletes during treatment were expected to reduce difference scores between current and optimal performance intensity and augment difference scores between current and poor performance intensity. As a result of this effect, improved performance would be revealed. Mean difference scores of emotion and physiological symptom descriptors pertaining to a same content category were computed across pre- and during-treatment conditions. To examine the effects of self-regulation, the number of item content categories with current intensity getting nearer best performance intensity during treatment was calculated, as well as the number of item content categories with current intensity getting farther from worst performance intensity during treatment. A percentage of change was also derived by contrasting the number of item content categories having intensity change in the predicted direction against the total number of item content categories. The experimental athletes identified items pertaining to four emotion-content categories (a total of 24 for the six participants) and four symptom-content categories, with the exception of an athlete who did not identify any inhibiting-pleasant bodily symptoms (thus, a total of 23 symptom-content categories across experimental participants resulted). Most of the difference scores of emotion and symptom items in the

[1] Intraindividual correlations, self-referenced performance evaluation mean scores, and mean difference scores of current emotions from best-worst performances pre- and during-treatment are available from the first author.

four content categories were in the predicted direction as a consequence of self-regulation. In particular, according to prediction, changes resulting from self-regulation were found in the experimental participants for 18 (75%) out of 24 emotion and 18 (78%) out of 23 symptom mean difference scores from best performance, and 16 (67%) out of 24 emotion and 15 (65%) out of 23 symptom mean difference scores from worst performance. Emotion and symptom (total) mean difference scores from best performance and from worst performance were in the predicted direction for 19 (79%) and 18 (75%) content categories, respectively. This pattern of modifications was not apparent in the two control participants over first and last competitions.

To test treatment effects, paired-samples *t*-test analyses were also conducted on the mean difference scores of emotions and symptoms from best and worst performances, and on performance scores. Alpha level was set 0.05. A more stringent alpha level, to avoid type I errors, was not deemed necessary since planned comparisons were based on clear hypotheses, and randomly occurring type I errors should not always be in the same direction. For each participant, scores were obtained by averaging data across content categories. Significant results emerged contrasting pre- with during-treatment data of mean difference scores of current symptoms from best performance symptoms, $t(5) = 2.87$, $P < 0.04$, eta - squared = 0.62, whereas mean difference scores of current emotions from best performance emotions approached significance, $t(5) = 2.39$, $P = 0.06$, eta - squared = 0.53. A series of *t*-test analysis was further performed taking into account each emotion and symptom content category separately. Pre- to during-treatment significant results were reached on four out of eight emotion-symptom content categories, specifically, on mean difference scores of: (a) current facilitating-pleasant symptoms from worst performance, $t(5) = 2.57$, $P = 0.05$, eta - squared = 0.57; (b) current inhibiting-unpleasant emotions from best performance, $t(5) = 2.54$, $P = 0.05$, eta - squared = 0.56; (c) current inhibiting-pleasant symptoms from best performance, $t(4) = 3.65$, $P = 0.02$, eta - squared = 0.77; and (d) current inhibiting-pleasant emotions from worst performance, $t(5) = 2.63$, $P < 0.05$, eta - squared = 0.58. Finally, performance data yielded significant results from pre- to during-treatment, $t(5) = 3.31$, $P = 0.02$, eta - squared = 0.69.

A graphical analysis for each participant was accomplished plotting time series emotion difference scores and performance data. Figs. 1 and 2 depict the effects of treatment on emotion and bodily symptom difference scores from best performance (Fig. 1) and worst performance (Fig. 2). Fig. 3 illustrates the effects of intervention on performance. In accordance with treatment purposes, five participants (H1, H3, G1, G2, and G3) reduced their difference scores between current and optimal performance intensity from about 26 to 34% (Fig. 1). Four participants (H3, G1, G2, and G3) enhanced their difference scores between current and worst performance intensity from about 32 to 46% (Fig. 2). Those athletes who modified their psychophysical pattern from pre- to during-treatment (H1, H3, G1, G2, and G3) also improved their performance from approximately 13 to 48%. Participant G3 showed the largest changes in the sample on both emotions and autonomic symptoms, and in performance. On the other hand, participant H2 did not modify his psychophysical pattern of emotions in the predicted direction and his performance was largely unchanged. Interestingly, the psychophysical pattern of the control athlete H4 worsened from first to last competition (see Figs. 1 and 2) and his performance dropped (see Fig. 3); likewise the psychophysical pattern of control athlete G4 worsened slightly as did his performance.

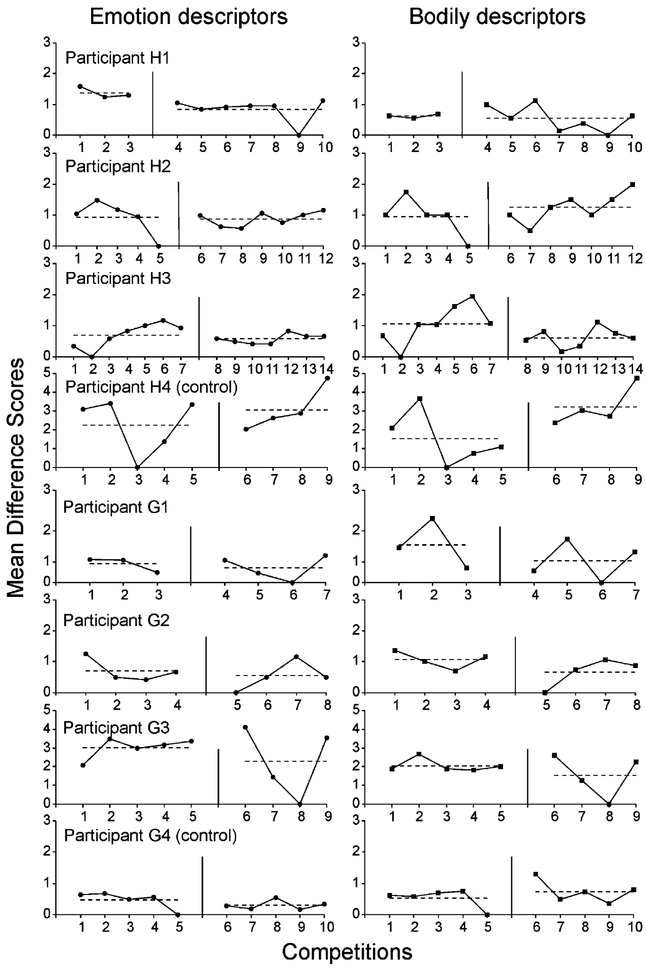

Fig. 1. Pre- and during-treatment emotion and bodily mean difference scores from best performance of athletes across competitions.

Social validation

Upon completing the study, each participant was individually interviewed. All experimental athletes reported that they were interested in the study in which they had taken part. Five of them evaluated the individualised multimodal self-regulation programme as being effective in optimising prestart mental states, and affirmed that psychological strategies were applied systematically in training and competition. They also perceived they had improved their performance and wished to participate in further psychological treatments. They did not report any disturbance caused by precompetition data collection. On the contrary, they perceived prestart assessments beneficial for becoming aware of psychological conditions and eliciting mental states that facilitate performance.

Participant H2, for whom the intervention was not effective, stated that although he agreed to

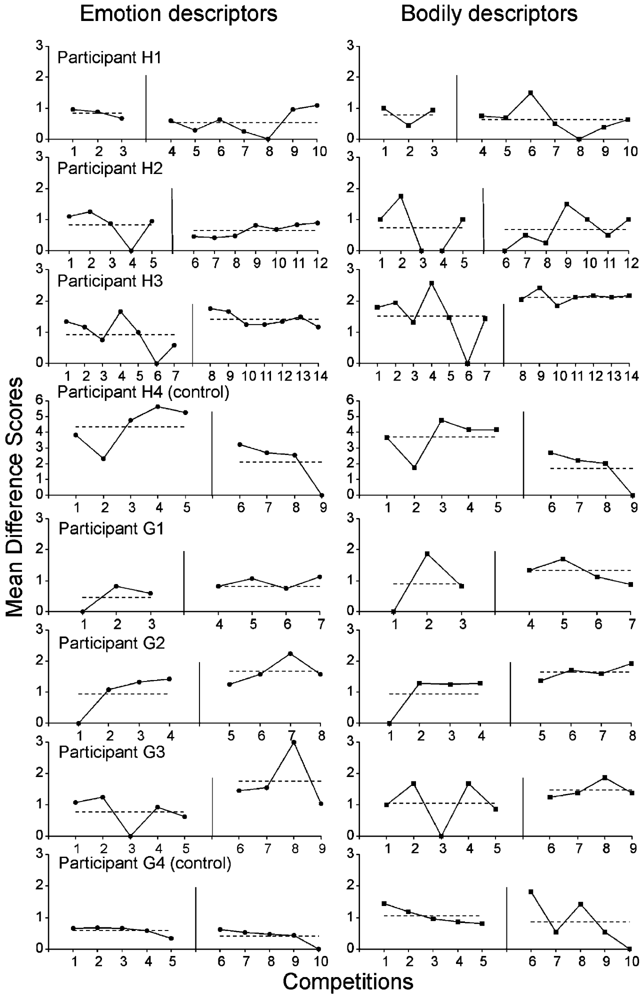

Fig. 2. Pre- and during-treatment emotion and bodily mean difference scores from worst performance of athletes across competitions.

take part in the study he did not place much interest in or commitment to mental procedures. He was not really convinced about the practical benefits of a mental training programme, being instead more involved in improving technical and tactical skills. Despite the researcher's attempts to foster involvement, personalise the intervention, and prevent dissatisfaction, what emerged from the interview confirmed the general feeling of low commitment that was apparent during the weekly intervention meetings. Conversely, participant G3, to whom the treatment was most effective, displayed a high level of belief, energy, and dedication in applying mental training procedures consistently, thus reaching satisfying results.

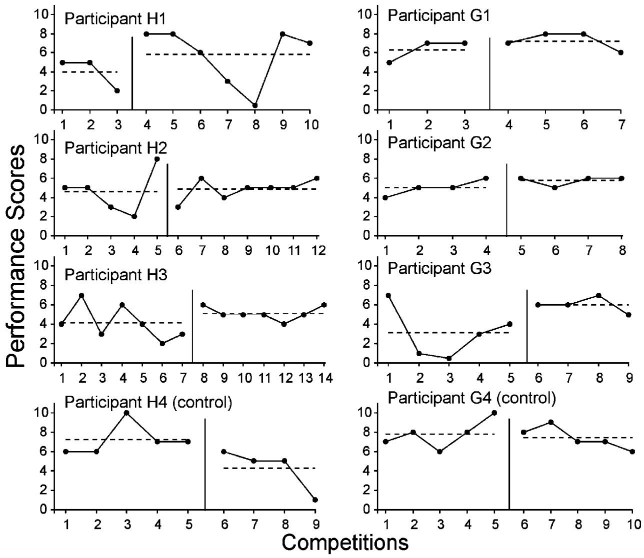

Fig. 3. Pre- and during-treatment self-referenced performance scores of athletes across competitions.

Discussion

Several researchers in discussing the IZOF model applications place emphasis on the importance of assisting athletes to enter their zones of optimal functioning (e.g. Cox, 2002; Morgan, 2002; Taylor & Wilson, 2002; Weinberg & Gould, 1999). Their arguments might seem rather speculative, although grounded on a sound theoretical perspective and empirical evidence of an indirect nature. Previous findings have revealed differentiation between effective and ineffective performances or discrimination between successful and less successful performers, according to the in/out-of-zone predictions (Prapavessis & Grove, 1991; Robazza, Bortoli, Zadro & Nougier, 1998b, 2002). However, with the exception of the Annesi's (1998) IZOF-anxiety study and the present investigation, previous research did not examine directly the effects of manipulating emotions in assisting athletes to enter their optimal zones. Similar to Annesi's (1998) study, an individualised multimodal treatment was adopted based upon the matching or specific-effect hypothesis to raise or lower intensity of the two selected (emotion and somatic) modalities. However, Annesi's treatment presented two limitations, namely, it was designed to match the fixed content of cognitive and somatic components of anxiety and self-confidence, and it was based upon individualised but still research-generated procedures. These issues were addressed in the present study by matching idiosyncratic content and intensity of emotion and somatic modalities, and implementing athlete-generated, self-regulation procedures. The programme was intended to help participants become more aware and acceptant (Hanin, 1997, 2000c) of the content (facilitating-inhibiting, pleasant-unpleasant) and intensities of emotions and bodily symptoms. Once awareness was attained, athletes were trained to improve, refine, and expand their own routines and psychological skills to recover emotions and symptoms associated with best performance, and to either increase or decrease their levels.

Hitherto applied to anxiety management, the matching hypothesis states that an anxiety technique should be matched to a particular anxiety problem. For example, physical relaxation or other somatic techniques should be applied to reduce somatic anxiety, whereas cognitive restructuring or other cognitive approaches are preferable in dealing with cognitive anxiety (Maynard & Cotton, 1993; Maynard, MacDonald, & Warwick-Evans, 1997). The matching principle was applied to young tennis players by Annesi (1998) not only to lower, but also to raise the cognitive and somatic components of anxiety, as well as self-confidence. The same notion was applied in this study to increase or decrease the levels of emotional and bodily states matching participants' needs. Yet, to respond to participants' requirements it was necessary to apply mixed cognitive-somatic strategies to all cases as deemed more appropriate than procedures targeting a single cognitive or somatic dimension. This is in accordance with Williams and Harris' (2001) contention that stress-management interventions should integrate physical and cognitive techniques, since anxiety problems often manifest themselves both cognitively and somatically. Thus, although the intervention was initially inspired by the matching hypothesis applied to emotions and autonomic symptoms, it was not possible to analyse the differential effects of cognitive and somatic techniques since both were applied to help athletes reach their individual optimal zones. In other words, the matching hypothesis emerging from anxiety research seems to be limited to cognitive and somatic components of anxiety state. In contrast, the IZOF model suggests a wider range of modalities (the form dimension) including cognitive, emotional, motivational, bodily, motor-behavioural, performance-operational, and communicative components of performance state (Hanin, 2000c). Study findings suggest that these components could be targeted by self-regulation interventions. Indeed, emotion descriptors identified by athletes incorporated also non-emotion modalities, such as those included in the terms 'motivated,' 'determined,' and 'focussed'. Another limitation of the matching hypothesis that emerged in this study is its narrow definition of the expected effect on just one selected modality. For example, physical relaxation does not only reduce somatic tension, but also may affect an athlete's focus of attention and the content of automatic thoughts. Similarly, cognitive restructuring modifies cognitions but also emotions, motivations, and motor behaviour. These assumptions concur well with the recent findings which revealed that athlete-generated emotion descriptors are often associated with other closely interrelated components of the psychobiosocial state (cognitive, motivational, etc.) perceived by the athlete as an entity (Hanin & Stambulova, 2002). Thus, selection of only cognitive and somatic components may be a conceptual limitation; on the other hand selected intervention strategies used by the athletes usually affect not one selected component only but also other modalities of their performance states.

Findings revealed that the treatment was quite effective in adjusting the patterns of both emotions and symptoms as intended. In fact, five out of six experimental participants modified their precompetition psychobiosocial states towards patterns related to best performance in the predicted direction after intervention (four of them also got more distant from worst performance), and their performance improved (see Figs. 1–3). Interestingly, the hockey player (H2) who did not modify his psychobiosocial states as expected, apparently because of a general disengagement from the self-regulation programme, also failed to improve performance. Hence, according to the IZOF predictions, this player who was not able to improve his pregame states was neither able to achieve better game outcomes. On the other hand, the athlete (G3) who displayed the largest improvements in the group on both emotions and autonomic symptoms also showed best achievements. Worth noting are also the psychophysical patterns and performances of control participants.

The control athlete H4 worsened markedly from first to last competition. His psychophysical pattern went further away from best states and closer to worst states and, accordingly, his performance dropped. In addition, the control athlete G4 displayed a small worsening in psychophysical pattern, as well as in performance across assessments. Overall, findings concerning the pattern of psychophysical states of experimental and control athletes are in agreement with predictions derived from the in/out-of-zone notion of the IZOF model. Of course, further research is needed to examine the distinct effects of cognitive and somatic treatments towards emotions, symptoms, and other components of the psychobiosocial state, and also to substantiate the preliminary findings of this study across different sports and levels of performer's proficiency. In addition, future research should explore the dynamics of psychobiosocial states over time. Getting into the optimal zone pre-event does not guarantee that athletes will stay in the zone until the task is completed, even though in a soccer study (Syrjä, Hanin & Pesonen, 1995) it was revealed that those players who were in the zone prior to the game stayed in the zone more often than those who were out of the zone prior to the game. Staying in the zone may be a serious problem for competitors especially in long duration events. Future studies should also implement follow-up assessments to examine whether beneficial effects towards emotions and performance are maintained after treatment, and ascertain whether athletes continue to apply self-regulation procedures over time.

Additional findings of the study were related to the in/out-of-zone notion applied to bodily symptoms. Results suggest the viability of applying the zone concept to symptoms together with emotions. As discussed, both emotion and symptom patterns across assessments of experimental and control participants generally supported the predictions of functional facilitating or inhibiting effects. This was reflected in the high number of correlations in the predicted direction between: (a) emotion and symptom difference scores from best and worst performances; and (b) performance scores. Furthermore, the number of emotion correlations in the predicted direction was not significantly different to the number of somatic symptom correlations. Previous studies demonstrated the feasibility of incorporating affect-related autonomic symptom descriptors in the idiosyncratic assessment of emotions (Bortoli & Robazza, 2002; Robazza & Bortoli, 2003). Moreover, according to Bortoli and Robazza's findings, functional and hedonic reversals for both emotion and symptom items were revealed; in fact, the same idiosyncratic descriptors were experienced facilitating or inhibiting (functional reversal), and pleasant or unpleasant (hedonic reversal). This extension is theoretically sound because autonomic responses are an integral part of an emotional experience and an important component of psychobiosocial state (Hanin, 1997, 2000b). For example, Spielberger (1972) described state anxiety as an emotional reaction characterised by feelings of tension, apprehension, and heightened autonomic system activity (e.g. increased heart rate and blood pressure). Consistent with this assumption, Martens, Burton, Vealey, Bump and Smith (1990) and Smith, Smoll and Schutz (1990) incorporated cognitive anxiety and somatic anxiety scales in their anxiety inventories (the CSAI-2, and the SAS, respectively). In addition, both cognitive and somatic components have been acknowledged as main factors of emotions within different theoretical perspectives of the mainstream psychology (e.g. Apter, 1984; Cacioppo, Berntson, & Klein, 1992; Lazarus, 1991, 2000; Schachter & Singer, 1962) and exercise and sport settings (e.g. Kerr, 1997; Raedeke & Stein, 1994). It is worth noting that anxiety research generated two components (cognitive and somatic) of a performance-related state. On the other hand, the IZOF model proposing several components is more comprehensive, thus enabling researchers to account for a broader range of emotions and states. The limitation of a two-dimensional conceptualisation is also reflected in the difficulty to apply the notions of cognitive and somatic to emotions other than anxiety. Although cognitive anxiety and somatic anxiety are conventional and historically well 'established' terms, it could be argued that these are just two components of any psychobiosocial state.

References

Annesi, J. J. (1997). Three-dimensional state anxiety recall: Implications for Individual Zones of Optimal Functioning research and application. *The Sport Psychologist*, *11*, 43–52.

Annesi, J. J. (1998). Applications of the Individual Zones of Optimal Functioning model for the multimodal treatment of precompetitive anxiety. *The Sport Psychologist*, *12*, 300–316.

Apter, M. J. (1984). Reversal theory and personality: A review. *Journal of Research in Personality*, *18*, 265–288.

Bates, B. T. (1996). Single-subject methodology: An alternative approach. *Medicine and Science in Sports and Exercise*, *28*, 631–638.

Borg, G. (2001). Borg's range model and scales. *International Journal of Sport Psychology*, *32*, 110–126.

Bortoli, L., & Robazza, C. (2002). Idiosyncratic performance affect in volleyball referees: An extension of the IZOF-emotion model profiling. *Journal of Sport Behavior*, *25*, 115–133.

Boutcher, S. H. (1990). The role of performance routines in sport. In G. Jones, & L. Hardy (Eds.), *Stress and performance in sport* (pp. 231–245). New York: John Wiley & Sons.

Bryan, A. J. (1987). Single-subject designs for evaluation of sport psychology interventions. *The Sport Psychologist*, *1*, 283–292.

Burton, D., Naylor, S., & Holliday, B. (2001). Goal setting in sport: Investigating the goal effectiveness paradox. In R. N. Singer, H. A. Hausenblas, & C. M. Janelle (Eds.), *Handbook of sport psychology, 2nd edn* (pp. 497–528). New York, NY: John Wiley & Sons.

Cacioppo, J. T., Berntson, G. G., & Klein, D. J. (1992). What is an emotion? The role of somatovisceral afference, with special emphasis on somatovisceral 'illusions'. *Review of Personality and Social Psychology*, *14*, 63–98.

Cerin, E., Szabo, A., Hunt, N., & Williams, C. (2000). Temporal patterning of competitive emotions: A critical review. *Journal of Sports Sciences*, *18*, 605–626.

Cox, R. H. (2002). *Sport psychology: Concepts and applications, 5th edn*. Dubuque, IA: McGraw-Hill.

Dale, G. A. (1996). Existential phenomenology: Emphasizing the experience of the athlete in sport psychology research. *The Sport Psychologist*, *10*, 307–321.

D'Urso, V., Petrosso, A., & Robazza, C. (2002). Emotions, perceived qualities, and performance of rugby players: A comparison of the IZOF model and performance profiling. *The Sport Psychologist*, *16*, 173–199.

Gould, D. (2001). Goal setting for peak performance. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance, 4th edn* (pp. 190–205). Mountain View, CA: Mayfield.

Gould, D., Eklund, R. C., & Jackson, S. A. (1992a). 1988 U.S. Olympic wrestling excellence: I. Mental preparation, precompetitive cognition, and affect. *The Sport Psychologist*, *6*, 358–382.

Gould, D., Eklund, R. C., & Jackson, S. A. (1992b). 1989 U.S. Olympic wrestling excellence: II. Thoughts and affect occurring during competition. *The Sport Psychologist*, *6*, 383–402.

Gould, D., Eklund, R. C., & Jackson, S. A. (1993). Coping strategies used by U.S. Olympic wrestlers. *Research Quarterly for Exercise and Sport*, *64*, 83–93.

Gould, D., & Tuffey, S. (1996). Zones of Optimal Functioning research: A review and critique. *Anxiety, Stress and Coping*, *9*, 53–68.

Gould, D., Tuffey, S., Hardy, L., & Lochbaum, M. (1993). Multidimensional state anxiety and middle distance running performance: An exploratory examination of Hanin's (1980) zones of optimal functioning hypothesis. *Journal of Applied Sport Psychology*, *5*, 85–95.

Gould, D., & Udry, E. (1994). Psychological skills for enhancing performance: Arousal regulation strategies. *Medicine and Science in Sports and Exercise*, *26*, 478–485.

Hall, C. R. (2001). Imagery in sport and exercise. In R. N. Singer, H. A. Hausenblas, & C. M. Janelle (Eds.), *Handbook of sport psychology, 2nd edn* (pp. 529–549). New York, NY: John Wiley & Sons.

Hanin, Y. L. (1980). A study of anxiety in sports. In W. F. Straub (Ed.), *Sport psychology: An analysis of athlete behavior* (pp. 236–249). Ithaca, NY: Mouvement.

Hanin, Y. L. (1986). State-trait anxiety research on sports in the USSR. In C. D. Spielberger, & R. Diaz-Guerrero (Eds.), *Cross cultural anxiety*, *Vol. 3* (pp. 45–64). Washington: Hemisphere.

Hanin, Y. L. (1993). *Optimal performance emotions in top athletes*. In S. Serpa, J. Alves, V. Ferreira, & A. Paula-Brito (Eds.), Proceedings of the 8th World Congress of Sport Psychology. (pp. 229–232). Lisbon, Portugal: International Society of Sport Psychology.

Hanin, Y. L. (1995). Individual zones of optimal functioning (IZOF) model: An idiographic approach to performance anxiety. In K. Henschen, & W. Straub (Eds.), *Sport psychology: An analysis of athlete behaviour* (pp. 103–119). Longmeadow, MA: Movement Publications.

Hanin, Y. L. (1997). Emotions and athletic performance: Individual Zones of Optimal Functioning model. *European Yearbook of Sport Psychology*, *1*, 29–72.

Hanin, Y. L. (2000a). IZOF-based emotions-profiling: Step-wise procedures and forms. In Y. L. Hanin (Ed.), *Emotions in sport* (pp. 303–313). Champaign, IL: Human Kinetics.

Hanin, Y. L. (2000b). Individual zones of optimal functioning (IZOF) model: Emotion–performance relationships in sport. In Y. L. Hanin (Ed.), *Emotions in sport* (pp. 65–89). Champaign, IL: Human Kinetics.

Hanin, Y. L. (2000c). Successful and poor performance and emotions. In Y. L. Hanin (Ed.), *Emotions in sport* (pp. 157–187). Champaign, IL: Human Kinetics.

Hanin, Y., & Stambulova, N. (2002). Metaphoric description of performance states: An application of the IZOF model. *The Sport Psychologist*, *16*, 396–415.

Hanin, Y., & Syrjä, P. (1995a). Performance affect in junior ice hockey players: An application of the individual zones of optimal functioning model. *The Sport Psychologist*, *9*, 169–187.

Hanin, Y., & Syrjä, P. (1995b). Performance affect in soccer players: An application of the IZOF model. *International Journal of Sports Medicine*, *16*, 260–265.

Hanin, Y., & Syrjä, P. (1996). Predicted, actual, and recalled affect in Olympic-level soccer players: Idiographic assessments on individualized scales. *Journal of Sport and Exercise Psychology*, *18*, 325–335.

Hanton, S., & Jones, G. (1999). The effects of a multimodal intervention program on performers: II. Training the butterflies to fly in formation. *The Sport Psychologist*, *13*, 22–41.

Hardy, L., Jones, G., & Gould, D. (1996). *Understanding psychological preparation for sport: Theory and practice of elite performers*. Chichester: Wiley & Sons.

Harger, G. J., & Raglin, J. S. (1994). Correspondence between actual and recalled precompetition anxiety in collegiate track and field athletes. *Journal of Sport and Exercise Psychology*, *16*, 206–211.

Hrycaiko, D., & Martin, G. L. (1996). Applied research studies with single-subject designs: Why so few? *Journal of Applied Sport Psychology*, *8*, 183–199.

Jokela, M., & Hanin, Y. L. (1999). Does the Individual Zones of Optimal Functioning model discriminate between successful and less successful athletes? A meta-analysis. *Journal of Sports Sciences*, *17*, 873–887.

Jones, G. (1993). The role of performance profiling in cognitive behavioural interventions in sport. *The Sport Psychologist*, *7*, 160–172.

Kamata, A., Tenenbaum, G., & Hanin, Y. L. (2002). Individual zone of optimal functioning (IZOF): A probabilistic conceptualisation. *Journal of Sport and Exercise Psychology*, *24*, 189–208.

Kerr, J. H. (1997). *Motivation and emotion in sport: Reversal theory*. East Sussex, UK: Psychology Press, Taylor & Francis.

Landers, D. M., & Arent, S. M. (2001). Arousal-performance relationships. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance, 4th edn* (pp. 206–228). Mountain View, CA: Mayfield.

Lazarus, R. S. (1991). Progress on a cognitive-motivational-relational theory of emotion. *American Psychologist*, *46*, 819–834.

Lazarus, R. S. (2000). How emotions influence performance in competitive sports. *The Sport Psychologist*, *14*, 229–252.

Mahoney, M. J., Gabriel, T. J., & Perkins, T. S. (1987). Psychological skills and exceptional athletic performance. *The Sport Psychologist*, *1*, 181–199.

Martens, R., Burton, D., Vealey, R. S., Bump, L. A., & Smith, D. E. (1990). Development and validation of the Competitive State Anxiety Inventory-2. In R. Martens, R. S. Vealey, & D. Burton (Eds.), *Competitive anxiety in sport (Part III)*. Champaign, IL: Human Kinetics.

Maynard, I. W., & Cotton, P. C. J. (1993). An investigation of two stress-management techniques in a field setting. *The Sport Psychologist*, *7*, 375–387.

Maynard, I. W., MacDonald, A. L., & Warwick-Evans, L. (1997). Anxiety in novice rock climbers: A further test of the matching hypothesis in a field setting. *International Journal of Sport Psychology*, *28*, 67–78.

Morgan, W. P. (1997). Mind games: The psychology of sport. In D. Lamb, & R. Murray (Eds.), *Recent advances in the science and medicine of sports* (pp. 1–31). Carmel, IN: Benchmark Press.

Morgan, W. P. (2002). Hypnosis in sport and exercise psychology. In J. L. Van Raalte, & B. W. Brewer (Eds.), *Exploring sport and exercise psychology, 2nd edn* (pp. 151–181). Washington, DC: American Psychological Association.

Murphy, S. M., & Jowdy, D. P. (1992). Imagery and mental practice. In T. S. Horn (Ed.), *Advances in sport psychology* (pp. 221–250). Champaign, IL: Human Kinetics.

Orlick, T. (2000). *In pursuit of excellence, 3rd edn*. Champaign, IL: Human Kinetics.

Orlick, T., & Partington, J. (1988). Mental links to excellence. *The Sport Psychologist*, *2*, 105–130.

Prapavessis, H., & Grove, J. R. (1991). Precompetitive emotions and shooting performance: The mental health and zone of optimal function models. *The Sport Psychologist*, *5*, 223–234.

Raedeke, T. D., & Stein, G. L. (1994). Felt arousal, thoughts/feelings, and ski performance. *The Sport Psychologist*, *8*, 360–375.

Raglin, J. S., & Hanin, Y. L. (2000). Competitive anxiety. In Y. L. Hanin (Ed.), *Emotions in sport* (pp. 93–111). Champaign, IL: Human Kinetics.

Raglin, J. S., Morgan, W. P., & Wise, K. J. (1990). Pre-competition anxiety and performance in female high school swimmers: A test of optimal function theory. *International Journal of Sports Medicine*, *11*, 171–175.

Raglin, J. S., & Turner, P. E. (1993). Anxiety and performance in track and field athletes: A comparison of the inverted-U hypothesis with zone of optimal function theory. *Personality and Individual Differences*, *14*, 163–171.

Reboussin, D. M., & Morgan, T. M. (1996). Statistical considerations in the use and analysis of single-subject designs. *Medicine and Science in Sports and Exercise*, *28*, 639–644.

Robazza, C., & Bortoli, L. (2003). Intensity, idiosyncratic content and functional impact of performance-related emotions in athletes. *Journal of Sports Sciences*, *21*, 171–189.

Robazza, C., Bortoli, L., & Nougier, V. (1998a). Performance-related emotions in skilled athletes: Hedonic tone and functional impact. *Perceptual and Motor Skills*, *87*, 547–564.

Robazza, C., Bortoli, L., Zadro, I., & Nougier, V. (1998b). Emotions in track and field athletes: A test of the individual zones of optimal functioning model. *European Yearbook of Sport Psychology*, *2*, 94–123.

Robazza, C., Bortoli, L., & Nougier, V. (1999). Emotions, heart rate, and performance in archery: A case study. *Journal of Sports Medicine and Physical Fitness*, *39*, 169–176.

Robazza, C., Bortoli, L., Nocini, F., Moser, G., & Arslan, C. (2000a). Normative and idiosyncratic measures of positive and negative affect in sport. *Psychology of Sport and Exercise*, *1*, 103–116.

Robazza, C., Bortoli, L., & Nougier, V. (2000b). Performance emotions in an elite archer: A case study. *Journal of Sport Behavior*, *23*, 144–163.

Robazza, C., Bortoli, L., & Nougier, V. (2002). Monitoring of precompetition affect in elite Italian archers during the world championships. *International Journal of Sport Psychology*, *33*, 72–97.

Salminen, S., Liukkonen, J., Hanin, Y., & Hyvönen, A. (1995). Anxiety and athletic performance of Finnish athletes: Application of the zone of optimal functioning model. *Personality and Individual Differences*, *19*, 725–729.

Schachter, S., & Singer, J. E. (1962). Cognitive, social, and physiological determinants of emotional state. *Psychological Review*, *69*, 379–399.

Schmid, A., Peper, E., & Wilson, W. E. (2001). Strategies for training concentration. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance, 4th edn* (pp. 333–346). Mountain View, CA: Mayfield.

Smith, R. E., Smoll, F. L., & Schutz, R. W. (1990). Measurement and correlates of sport-specific cognitive and somatic trait anxiety: The Sport Anxiety Scale. *Anxiety Research*, *2*, 263–280.

Sparkes, A.C., & Silvennoinen, M. (Eds.). (1999). *Talking bodies. Men's narratives of the body in sport*. Jyväskylä, Finland: Sophi, University of Jyväskylä.

Spielberger, C. D. (1972). Anxiety as an emotional state. In C. D. Spielberger (Ed.), *Anxiety: Current trends in theory and research, Vol. 1* (pp. 23–49). New York: Academic Press.

Syrjä, P., Hanin, Y., & Pesonen, T. (1995). *Emotion and performance relationship in soccer players*. In R. Vanfraechem-

Raway, & Y. Vanden Auweele (Eds.), Proceedings of the 9th European Congress on Sport Psychology. (pp. 191–198). Brussels, Belgium: FEPSAC/Belgian Federation of Sport Psychology.

Taylor, J. (1995). A conceptual model for integration athletes' needs and sport demands in the development of competitive mental preparation strategies. *The Sport Psychologist*, *9*, 339–357.

Taylor, J., & Wilson, G. S. (2002). Intensity regulation and sport performance. In J. L. Van Raalte, & B. W. Brewer (Eds.), *Exploring sport and exercise psychology, 2nd edn* (pp. 99–130). Washington, DC: American Psychological Association.

Terry, P. (1995). The efficacy of mood state profiling with elite performers: A review and synthesis. *The Sport Psychologist*, *9*, 309–324.

Vealey, R. S., & Greenleaf, C. A. (2001). Seeing is believing: Understanding and using imagery in sport. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance, 4th edn* (pp. 247–283). Mountain View, CA: Mayfield.

Weinberg, R. S., & Gould, D. (1999). *Foundations of sport and exercise psychology, 2nd edn*. Champaign, IL: Human Kinetics.

Williams, J. M., & Harris, D. V. (2001). Relaxation and energizing techniques for regulation of arousal. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance, 4th edn* (pp. 229–246). Mountain View, CA: Mayfield.

Williams, J. M., & Krane, V. (2001). Psychological characteristics of peak performance. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance, 4th edn* (pp. 162–178). Mountain View, CA: Mayfield.

Williams, J. M., & Leffingwell, T. R. (2002). Cognitive strategies in sport and exercise psychology. In J. L. Van Raalte, & B. W. Brewer (Eds.), *Exploring sport and exercise psychology, 2nd edn* (pp. 75–98). Washington, DC: American Psychological Association.

Woodman, T., & Hardy, L. (2001). Stress and anxiety. In R. N. Singer, H. A. Hausenblas, & C. M. Janelle (Eds.), *Handbook of sport psychology, 2nd edn* (pp. 290–318). New York, NY: John Wiley & Sons.

Zaichkowsky, L. D., & Baltzell, A. (2001). Arousal and performance. In R. N. Singer, H. A. Hausenblas, & C. M. Janelle (Eds.), *Handbook of sport psychology, 2nd edn* (pp. 319–339). New York, NY: John Wiley & Sons.

Zaichkowsky, L., & Takenaka, K. (1993). Optimizing arousal level. In R. N. Singer, M. Murphey, & L. K. Tennant (Eds.), *Handbook of research on sport psychology* (pp. 511–527). New York: MacMillan.

Zinsser, N., Bunker, L., & Williams, J. M. (2001). Cognitive techniques for building confidence and enhancing performance. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance, 4th edn* (pp. 284–311). Mountain View, CA: Mayfield.