JOURNAL OF APPLIED SPORT PSYCHOLOGY, 15: 223–238, 2003

ISSN: 1041-3200 print / 1533-1571 online
DOI:10.1080/10413200390213344

Taylor & Francis

Anxiety versus Fundamental Emotions as Predictors of Perceived Functionality of Pre-Competitive Emotional States, Threat, and Challenge in Individual Sports

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The objectives of this study were to examine the contribution of anxiety and fundamental emotions to perceived emotion functionality and evaluate the informational value of anxiety measures used in sport versus measures of fundamental emotions in terms of appraisal. A battery of questionnaires comprising the somatic and cognitive subscale of the Competitive State Anxiety Inventory-2 (CSAI-2), the State Anxiety Inventory, the Differential Emotions Scale–IV, a perceived functionality of emotions single item, and two items assessing challenge and threat appraisals was administered to 202 athletes competing in individual sports in the United Kingdom. They were tested on recalled pre-competitive emotions experienced before their best and worst competition ever and momentary emotions experienced one hour before an actual competition. In general, measures of fundamental emotions with clear approach or avoidance action tendencies were better predictors of emotion functionality than anxiety measures. Results also suggested that the CSAI-2 does not convey clear information about an athlete's appraisal of a competition. Measures of negative and positive fundamental emotions with clear action tendencies were better indicators of athletes' appraisal patterns. It was concluded that assessment of athletes' emotional state should not be exclusively based on anxiety measures but should encompass or be replaced with measures of emotions conveying unambiguous information about the athlete-competition relationship.

The study of discrete emotions in sport is theoretically and practically important for two main reasons. First, they are thought to objectively and/or subjectively affect athletic performance (Hanin, 1999; Lane & Terry, 2000). Second, they convey fundamental information on the athlete-environment relationship (Lazarus, 1999) in terms of subjective importance attributed to the event, perceived ability to cope with it, and action tendency associated with it (e.g., approach, avoidance, reflective self-focused, or interacting externally focused behavior; Frijda, 1986; Green & Sedikines, 1999). This information is crucial to understand athletes' behavior, plan and implement performance-enhancement programs, and promote athletes' psychological well-being.

Received 6 February 2002; accepted 12 September 2002.
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I thank Mr. Anthony Barnett and Dr. Stephanie J. Hanrahan for their helpful comments during the preparation of this manuscript.
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Unfortunately, research on competition-related emotions has, until recently, been limited to the, by definition, threat-related emotion of anxiety using instruments that are believed to confound anxiety with other emotions (Burton & Naylor, 1997; Jones, 1995; Shek, 1988). And, although a considerable amount of current literature has pointed to the need to study a wider range of emotions (Hanin, 1999), there is still a strong tendency, especially in the applied setting, to focus on anxiety only. The present paper explores some potential pitfalls associated with over-reliance on anxiety measures.

The current literature suggests three sources of potential problems associated with the exclusive reliance on anxiety measures as indicators of athletes' emotional state. The first relates to the fact that athletes' emotional experience cannot be thoroughly and accurately described in terms of presence or lack of anxiety symptoms. Athletes' subjective responses to competition are dynamic and complex states, most often encompassing more than one emotion (Frijda, 1986; Lane & Terry, 2000) associated with specific types of appraisal (harm, challenge, or threat; Lazarus, 1999) and action tendencies (approach, avoidance, self- or externally focused attention; Frijda, 1986) and moderated by various situational (e.g., type of sport) and personal factors (e.g., personality traits; Cerin, Szabo, Hunt, & Williams, 2000).

The second reason why it seems inappropriate to use anxiety as the exclusive marker of psychological response to competition pertains to its conceptually problematic nature. Although some theorists view anxiety as a basic unitary emotion triggered by stimuli perceived to be threatening, characterized by avoidance tendencies and clearly distinguishable from challenge-related emotions (Lazarus, 1999), others surmise that anxiety is a secondary, complex, and variable emotional state that can be typified by both approach and avoidance tendencies (e.g., Izard, 1991; Plutchik, 1994). For instance, differential emotions theorists (DET; Izard, 1991) view anxiety as a set or pattern of fundamental emotions. It is defined as an unstable and variable combination of fear and two or more of the fundamental emotions of anger, shame, guilt, shyness, self-hostility, and interest-excitement. Fear or sense of threat is considered to be an essential component of anxiety, while other fundamental emotions are postulated to be variable elements.

Neuropsychological research indirectly supports the DET's conceptualization of anxiety (e.g., Gray, 1994; LeDoux, 1995). For instance, Gray's (1994) neuropsychological model postulates the existence of a behavioral inhibition system which is thought to be linked with anxiety and is activated by conditioned stimuli associated with punishment, termination or omission of reward, novel stimuli, and innate fear stimuli. The behavior elicited by these stimuli consists of behavioral inhibition, risk assessment, and increase in the level of arousal and attention. As anxiolytic drugs have been shown to affect the activity of the behavioral inhibition system, it is at this level of the hierarchy that neuropsychologists locate anxiety (Gray & McNaughton, 1996). These findings imply that anxiety should not be considered a phenomenologically unitary emotion. It may result from the perception of potential aversive stimuli that need to be confronted. But it is also associated with conditions of mixed reward and non-reward, and exposure to novel stimuli. Consequently, it can be subjectively perceived as a state of fear/apprehension or a mixed affective state of concurrent or alternating feelings of fear, apprehension, hope and pleasurable anticipation, or a state of alertness and interest.

In the sport arena, the view that anxiety is a complex and variable emotional state rather a unitary emotion may help partially explain why there is a substantial inter- and intra-individual variation in perceived functionality (whether an emotion is perceived to help or hinder performance) of similar intensity levels of competitive anxiety (Cerin et al., 2000). Recent studies on the perceived functionality of competitive anxiety (Jones & Hanton, 2001) and relationship between mood and athletic performance (Lane & Terry, 2000) have indicated that anxiety patterns characterized by the presence of fear and/or sadness, guilt, shyness, self-hostility, and discouragement, in which avoidance and reflective (self-focused attention) action tendencies dominate, may subjectively and/or objectively hinder performance. In contrast, anxiety patterns characterized by the presence of mild to moderate threat-related affects (fear) and enjoyment, interest/excitement, or externally-directed anger, in which approach and interactive (externally-focused attention) action tendencies prevail, might subjectively and/or objectively help performance. These hypotheses imply that, because anxiety operationalized as a unitary emotion does not convey enough information about an athlete's prevailing action tendency and appraisal of the competitive situation, the predictive validity of anxiety inventories with respect to perceived or actual effect on athletic performance is bound to be inferior to that of multiple-emotion instruments gauging emotional states associated with clearer action tendencies (e.g., sadness and interest). One of the main aims of this study was to examine this issue.

The third set of problems arising from exclusive reliance on anxiety measures pertains to the questionable diagnostic validity of two of the most frequently used anxiety measures in sport, the Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Burton, Vealey, Bump, & Smith, 1990) and the State Anxiety Inventory (SAI; Spielberger, Gorusch, & Luschene, 1970). It has been contended that some of items of the CSAI-2 (e.g., "I am concerned about this competition") describe subjective states that can be understood as symptoms of debilitating states characterized by avoidance tendencies (fear of failure, threat and harm appraisals) or as symptoms of facilitating states indicating preparedness for competition and characterized by a prevalence of approach tendencies (excitement, challenge appraisals; Burton & Naylor, 1997). Additionally, the modified version of the CSAI-2 (Jones & Swain, 1992), which was constructed to overcome the above problem and was meant to gauge both intensity and perceived functionality of competitive anxiety, is also believed to confound challenge-related emotional states such as excitement with "facilitative" anxiety (anxiety symptoms perceived to help performance; Jones & Hanton, 2001). However, to date, no research has directly analyzed whether and to what extent the CSAI-2 differentiates threat from challenge situations.

With respect to the SAI, it has been shown that it may confound anxiety with depression (Bieling, Antony, & Swinson, 1998) and that, despite producing one single score, it gauges at least two (anxiety absence and anxiety presence) or three orthogonal emotional factors (anxiety presence, calmness and happiness; Shek, 1988). There is no doubt that these problems render the interpretation of scores on this particular anxiety measure difficult. However, because the score on the SAI is based on the difference between threat-related emotions and non-threat related emotions, it is contended that it may differentiate approach from avoidance action tendencies and threat from challenge appraisals better than the CSAI-2.

In summary, the wide use of anxiety measures in sport settings coupled with the potential problems related to the concept and operationalization of competitive anxiety point to the need to explore the informational value of anxiety measures in terms of appraisal of, and action tendency associated with, a competitive situation. Although anxiety may be a complex and variable emotion, theorists concur that an emotional state can be categorized as "anxiety" only if it involves an element of perceived threat. If there is no perceived (potential) threat, there is no anxiety. In other words, if there is no fear or threat-related emotion, there is no anxiety. Because mixed emotional states are a frequent phenomenon, to ascertain whether the CSAI-2 confounds positive excitement with anxiety and evaluate the informational value of the SAI in terms of appraisal, the relationships between challenge and threat and these two anxiety measures were examined. The second main goal of this study was to examine and compare the contribution of anxiety and fundamental emotions to athletes' perceived functionality of pre-competitive emotional states. It was hypothesized that measures of emotions characterized by a clear action tendency would be better predictors of athletes' perceived functionality of emotional states than anxiety scales based on a unitary conceptualization of anxiety.

METHOD

Participants

As type of sport (individual versus team) appears to moderate the quality, intensity, and subjective preference of competition-related emotions (Cerin et al., 2000), the present study was limited to athletes competing in individual sports. One hundred and thirteen male and 89 female athletes competing at regional or national level agreed to participate in the study. The sample was composed of 88 Tae Kwon Do practitioners (39 males, 49 females), 37 karate practitioners (29 males, 8 females), 38 table tennis players (30 males, 8 females), 16 swimmers (7 males, 9 females), 12 triathletes (7 males, 5 females), nine female gymnasts, and two cyclists (1 male, 1 female). The participants were assessed on recalled pre-competitive emotions experienced before their best and worst competition ever and on their momentary pre-competitive states one hour before an actual competition using a battery of questionnaires. Momentary data from karate, Tae Kwon Do, cycling, gymnastics, and triathlon were based on one major national competition, whereas data from swimming and table tennis were based on two regional competitions during the 2000 season. All participants but one completed the two retrospective and one momentary assessments. All athletes were competing at the highest level of competition relative to their skills. The mean age of the participants was 24.44 years (*SD* = 7.25). They had been, on average, training in their sport for 8.87 years (*SD* = 6.31).

Materials

Demographic Questionnaire

Demographic information was obtained through a short questionnaire assessing age, years of training experience, and level of participation.

Pre-Competitive Emotions Self-Evaluation Questionnaire (PESQ)

A retrospective (using the past tense) and momentary (using the present tense) version of a battery comprising the somatic and cognitive subscale of the CSAI-2, the SAI, the Differential Emotions Scale-IV (DES-IV; Izard, Libero, Putam, & Haynes, 1993), an item gauging perceived "threat," and an item assessing "challenge" was constructed. To account for potential effects of the sequence of presentation of the items on the participants' responses, the items of the battery were randomized so that each participant was given the same set of questionnaires but with the items presented in a different order. For consistency, although the CSAI-2 and SAI are originally rated on a 4-point Likert-type scale, with the anchors *not at all, somewhat, moderately so, and very much so*, all responses were recorded on the original 5-point Likert-type scale of the state version of the DES-IV defined by the anchors *not at all, slightly, moderately, considerably, and very strongly*. This procedure has been previously successfully used by Izard and associates to investigate the structure of secondary emotions such as anxiety and depression (Izard, 1991). The items "I feel jittery" and "I feel nervous" appearing in both the SAI and the somatic subscale of the CSAI-2, were included only once in the PESQ.

The CSAI-2 (Martens et al., 1990) was used to measure the cognitive and somatic components of competitive anxiety. Possible intensity scores on each subscale ranged from 9 to 45. Although the psychometric validity of the CSAI-2 has been demonstrated by several researchers (e.g., Martens et al., 1990), others have argued that this instrument may confound motivation and positive excitement with anxiety (Burton & Naylor, 1997; Jones, 1995; Jones & Hanton, 2001; Lane, Sewell, Terry, Bartram, & Nesti, 1999).

The SAI (Spielberger et al., 1970) consists of 20 self-statements that ask the respondents to describe how they feel or felt at a particular moment. High scores on this measure indicate a high level of state anxiety, whereas low scores reflect states of calmness and serenity. The inventory has been extensively used in clinical and research settings, has good reliability and validity (Spielberger et al., 1970), but has also been criticized as confounding more than one emotional state (Shek, 1988). Possible intensity scores on this inventory ranged from 20 to 100.

The DES-IV (Izard et al., 1993) is a self-report instrument designed for the use and assessment of an individual's experience of fundamental emotions and patterns of complex emotions as conceptualized by the DET. To keep the DES scales as emotion-specific as possible, their item content was derived from cross-cultural research on emotion expression labeling (Izard et al., 1993). The DES-IV represents a modified version of the DES-III, an inventory adapted for a maximum range of ages and educational levels. It comprises 12 3-item subscales gauging the emotions of interest/excitement, enjoyment, surprise, sadness, anger, disgust, contempt, fear, guilt, shame, shyness, and self-hostility. Several studies have contributed evidence for the construct validity of the DES scales, including the scales of the latest version of the inventory (Izard et al., 1993). The possible intensity scores on each subscale of the DES-IV ranged from 3 to 15.

In the absence of a published psychometrically validated inventory measuring threat and challenge appraisals in sport and similarly to previous research on appraisal (Campbell & Jones, 2000; Pakenham, 1999), two items assessing athletes' appraisal of the competitive events, also rated on a 5-point Likert-type scale, were developed and added to the above questionnaire. These were "I feel/felt like the competition is/was a threat" and "I feel/felt like the competition is/was a challenge."

Perceived Functionality of Pre-Competitive Emotional States Item

Similarly to the anxiety direction scales of the modified version of the CSAI-2 (Jones & Swain, 1992), perceived functionality of athletes' pre-competitive emotional state was measured with a single 7-point item scale ranging from -3 *(very harmful to performance)* to +3 *(very helpful to performance)* with the midpoint "0" denoting *"unimportant to performance."* The participants were given the following instructions: "Using the rating scale below, circle the number representing how much you consider (considered) your overall emotional state at the very moment (before your best/worst performance) as being harmful or helpful in relation to your forthcoming performance."

Design and Procedure

To determine and compare the contribution of discrete fundamental emotions and anxiety, as measured by the DES-IV, SAI, and CSAI-2, to athletes' perceived functionality of pre-competitive emotional states, intra- and inter-individual differences in debilitative and facilitative patterns of emotions were analyzed. Intra-individual differences were examined by assessing athletes on recalled emotions before their best and worst competition ever. This was done after a regular training session, 5 to 7 days before a competition, in which the participants were briefed about the procedures of the study and informed consent was obtained.

It was thought that the assessment of recalled pre-competitive emotions experienced before the worst and best competitions would maximize the chances of getting a substantial number of athletes reporting functional patterns of emotions on one assessment (best competition) and, at the same time, dysfunctional emotional patterns on the other assessment (worst competition). To establish intra-individual differences between functional and dysfunctional pre-competitive emotional patterns, retrospective self-reports from athletes who exhibited a facilitative emotional pattern on their best competition and a debilitative pattern on their worst competition were analyzed.

As it has been shown that recalled pre-competitive emotions are liable to memory distortions (Cerin, Szabo, & Williams, 2001), athletes were also tested in presence of the experimenter on how they were feeling approximately one hour before an actual competition. Completion of the questionnaire took approximately 10 to 15 minutes and was not perceived by the participants to affect their psychological preparation. Because a more balanced distribution of facilitative and debilitative emotional states was expected before the actual competition than prior to the recalled best and worst competitions, only momentary self-reports were used for the analysis of inter-individual differences between facilitative and debilitative patterns of emotions. Momentary self-reports were also used to test and compare the discriminative validity of the CSAI-2, SAI, and DES-IV in relation to challenge and threat appraisals.

Data Analyses

Analysis of data was divided into two main phases. The first phase aimed at exploring the relationships between measures of anxiety and fundamental emotions and perceived functionality of pre-competitive emotional states. This set of analyses provided information on what emotions are generally viewed by athletes competing in individual sports as having an impact (if any) on their performance. At the same time, it compared the predictive validity of the CSAI-2, SAI, and DES-IV scales with regard to perceived functionality of pre-competitive emotional state.

For this scope, intra-individual differences on the DES-IV scales, SAI, and CSAI-2 between retrospective reports of athletes who exhibited a facilitative emotional pattern on their best competition and a debilitative pattern on their worst competition were analyzed using *t* tests for dependent samples. A corrected probability level of .003 was adopted due to multiple testing. Differences in effect sizes (Cohen's *d* for dependent and independent samples) were analyzed using a meta-analytic procedure comparing effect size estimates outlined by Rosenthal (1991). Facilitative patterns of emotions were considered those perceived as being helpful to performance (scores ranging from +1 to +3 on the "perceived functionality of emotional state item"), whereas debilitative patterns of emotions were defined as those that were judged to be harmful to performance (scores ranging form -3 to -1 on the "perceived functionality of emotional state item").

Inter-individual differences on the DES-IV, SAI, and CSAI-2 between individuals who thought that their pre-competitive emotional state had a positive effect on their performance and individuals who thought that their emotional state was debilitative were analyzed with *t* tests for independent samples using data related to the momentary assessments of pre-competitive emotions. The participants were classified into a "facilitative" and "debilitative" group using the earlier described criterion. *T* test based on separate variances was employed if a significant difference between group variances was detected. Similarly to the previous analysis, a corrected probability level of .003 was adopted due to multiple testing.

Hierarchical regressions were performed to analyze and compare the explanatory value of fundamental emotions and anxiety in relation to athletes' perceived functionality of pre-competitive emotional states. Specifically, the aim of these analyses was to test the hypothesis that fundamental emotions with a clear action tendency would be better predictors of perceived functionality of emotional states than anxiety, anxiety being characterized by both avoidance and approach tendencies. These analyses were performed using data from momentary self-reports. To avoid multicollinearity and shrinkage problems, the 15 emotional scales were reduced to a subset of emotional factors. Principal component analysis with oblimin rotation was carried out. Only factors with eigenvalues greater than 1 were retained (Kaiser, 1960).

Two hierarchical regression analyses were performed. In the first regression, anxiety-related factor(s) were assigned first entry and other fundamental emotion factors were assigned second entry, while, in the second hierarchical regression, this order was reversed. The first regression aimed at testing the predictive validity of anxiety (as it is currently measured) in relations to perceived functionality of emotional state and evaluating whether other fundamental emotions significantly added to the explanation of perceived functionality over and above anxiety. In contrast, the second hierarchical regression tested the predictive validity of fundamental emotions with clearer action tendencies in relation to perceived functionality and evaluated whether anxiety significantly added to the explanation of perceived functionality over and above fundamental emotions.

In the second phase of the data analyses, the relationships between threat and challenge appraisals and anxiety-like emotional states were examined and compared with those between threat and challenge appraisals and fundamental emotions. For this scope, correlational analysis between measures of threat- (anxiety and fear) and challenge-related (interest-excitement) emotions and "threat" and "challenge" appraisals was performed on data from retrospective and momentary assessments. Additionally, a canonical correlation analysis was carried out with the threat and challenge appraisal items as criteria and the emotional factors extracted from the earlier described principal component analysis as explanatory variables. This analysis used data from momentary assessments and was meant to explore further the relationship between appraisals and emotion factors.

RESULTS

Internal consistency for the SAI, DES-IV subscales, and somatic and cognitive subscales of the CSAI-2 were calculated for each retrospective and momentary assessment. Results showed that internal consistency for the DES-contempt subscale was undermined by the item "I felt/feel like I was/am better than somebody." Exclusion of this item improved the internal consistency of the scale from alpha values of .55, .56, and .68, to .82, .84, and .85. The other scales exhibited an acceptable degree of internal consistency ranging from .70 to .94 (M = .83).

Significance Testing of Intra-Individual Differences on Emotion Measures in Relation to Perceived Functionality of Pre-Competitive Emotional States

One hundred and three out of 202 athletes exhibited a subjectively facilitative pattern of emotions before their best competition and a debilitative pattern of emotions before their worst competition. Eleven athletes exhibited a neutral emotional state in both occasions. Five athletes reported a debilitative pattern of emotions on their best competition and a neutral or facilitative pattern of emotions on their worst competition. Eighty-three participants reported facilitative emotional states on their best competition but not debilitative on their worst competition or debilitative emotional states on their worst competition but not facilitative on their best competition.

Results showed that recalled facilitative emotional states experienced before the best competition significantly differed in all measured emotions from recalled debilitative emotional states experienced before the worst competition, except for anger, contempt, and disgust (Table 1). When compared to recalled facilitative emotional states, debilitative patterns of emotions

Table 1
Intra-Individual Differences in Pre-Competitive Emotions in Athletes with a Subjectively Facilitative Emotional Pattern before Their Best Competition and a Debilitative Emotional Pattern before Their Worst Competition (*p* = .003; *n* = 103)

Scale (theoretical range)	Facilitative *M*	Facilitative *SD*	Debilitative *M*	Debilitative *SD*	*t*	*p*	*d*
DES – interest (3–15)	10.99	2.26	6.73	2.63	14.39	<.001	1.73
DES – sadness (3–15)	3.30	.87	6.48	3.08	–10.78	<.001	–1.30
DES – enjoyment (3–15)	7.78	2.50	4.94	2.20	10.22	<.001	1.19
DES – self-hostility (3–15)	3.32	.92	5.34	2.71	– 7.70	<.001	–0.95
SAI (20–100)	55.82	9.67	67.02	14.43	– 7.18	<.001	–0.91
DES – guilt (3–15)	3.47	1.22	5.40	2.81	– 6.70	<.001	–0.88
DES – fear (3–15)	5.11	2.43	7.46	4.01	– 6.43	<.001	–0.68
DES – shame (3–15)	4.60	2.53	6.25	3.38	– 5.77	<.001	–0.54
CSAI-2 – cognitive (9–45)	22.59	6.40	27.43	9.42	– 5.05	<.001	–0.59
CSAI-2 – somatic (9–45)	23.76	6.87	28.23	8.68	– 4.84	<.001	–0.57
DES – surprise (3–15)	5.23	3.09	3.89	1.70	4.69	<.001	0.51
DES – shyness (3–15)	3.80	1.88	5.00	2.71	– 4.22	<.001	–0.51
DES – disgust (3–15)	3.47	1.28	4.15	2.14	– 2.96	.004	–0.38
DES – anger (3–15)	3.97	1.77	4.36	2.42	– 1.43	.157	–0.18
DES – contempt (2–10)	2.81	1.79	2.63	1.40	0.81	.418	0.11

were characterized by higher levels of anxiety, fear, guilt, self-hostility, sadness, shame, and shyness. They were also typified by lower levels of interest, enjoyment, and surprise. In both competitive situations negative emotions were relatively low in intensity, reaching mean values of 4 to 6 (corresponding to absence or slight presence of a specific emotion) on a scale ranging from 3 to 15 before the worst competition. Anxiety and fear were the most elevated negative emotions (slight to moderate presence) prior to both best and worst competitions. Recalled facilitative patterns of emotions were characterized by a moderate or considerable presence of interest and enjoyment, whereas debilitative emotional states were characterized by low levels of enjoyment and low to moderate levels of interest.

The highest effect sizes (ES) were observed for the emotions of interest, sadness, and enjoyment. Statistical comparison of the absolute value of the ES (Cohen's *d* for dependent samples; Dunlap, Cortina, Vaslow, & Burke, 1996) for anxiety measures and fundamental emotion measures with ES higher than those of anxiety measures showed that the anxiety subscales of the CSAI-2 had significantly lower effect sizes than the DES subscales for interest, sadness, and enjoyment, lowest $z = 1.92$, $p < .05$. The ES for the SAI did not significantly differ from those for cognitive and somatic anxiety, highest $z = 1.12$, $p > .05$, sadness, enjoyment, and self-hostility, highest $z = 1.21$, $p > .05$ but it was lower that the ES for interest, $z = 1.70$, $p < .05$.

Significance Testing of Inter-Individual Differences on Emotion Measures in Relation to Perceived Functionality of Pre-Competitive Emotional States

Forty-four participants experienced a debilitative pattern of pre-competitive emotions one hour before an actual competition, 125 athletes experienced a facilitative pattern and 33 participants reported that their emotional state would not affect their performance. Results showed that debilitative patterns of emotions were characterized by higher levels of anxiety, fear, guilt, self-hostility, sadness, shame, and shyness, and lower levels of enjoyment and interest (Table 2). No significant inter-individual differences were observed for the emotions of surprise, contempt, disgust, anger, and cognitive anxiety. The SAI was the measure that exhibited the greatest difference, followed by the DES subscales for fear, interest, sadness, self-hostility, guilt, and enjoyment. The effect sizes (ES) of these measures were not significantly different, highest $z = 1.27$, $p > .05$. The somatic subscale of the CSAI-2 had a significantly lower ES than the SAI, $z = 2.84$, $p < .01$, while the cognitive subscale had a significantly lower ES than the SAI, $z = 3.35$; $p < .01$ and the DES fear scale, $z = 1.98$, $p < .05$.

Comparative Analysis of the Explanatory Value of Fundamental Emotions and Anxiety in Relation to Athletes' Perceived Functionality of Pre-Competitive Emotional States

Prior to performing hierarchical regression analyses, the 15 emotional scales were reduced to a smaller number of emotional factors using principal component analysis. Four oblique factors were extracted (Table 3). A first factor (Negative Emotions), encompassing self-hostil-

Table 2
Inter-Individual Differences Between Facilitative and Debilitative Patterns of Pre-Competitive Emotions (p = .003)

Scale (theoretical range)	Facilitative (n = 125)		Debilitative (n = 44)		t	p	d
	M	*SD*	*M*	*SD*			
SAI (20–100)	54.91	10.82	67.84	9.08	–7.09	<.001	–1.25
DES – fear (3–15)	5.02	1.93	7.84	2.96	–5.91	<.001	–1.04
DES – interest (3–15)	10.36	2.94	7.70	2.79	5.21	<.001	0.92
DES – sadness (3–15)	3.35	1.32	5.18	2.26	–5.07	<.001	–0.89
DES – self-hostility (3–15)	3.12	.68	5.09	2.60	–4.92	<.001	–0.87
DES – guilt (3–15)	3.40	1.24	5.18	2.37	–4.77	<.001	–0.84
DES – enjoyment (3–15)	7.31	2.64	5.16	2.52	4.71	<.001	0.83
DES – shyness (3–15)	3.38	1.04	4.52	1.96	–3.68	<.001	–0.65
CSAI-2 – somatic (9–45)	23.18	6.44	27.41	6.99	–3.67	<.001	–0.65
DES – shame (3–15)	4.10	1.83	5.61	2.97	–3.19	.002	–0.56
CSAI-2 – cognitive (9–45)	21.75	5.47	25.82	8.60	–2.93	.004	–0.52
DES – anger (3–15)	3.32	.89	5.16	3.22	–3.74	.005	–0.66
DES – disgust (3–15)	3.15	.65	4.48	3.02	–2.89	.005	–0.51
DES – surprise (3–15)	4.01	1.58	4.73	2.51	–1.78	.077	–0.31
DES – contempt (2–10)	2.57	1.25	2.80	2.04	– .70	.485	–0.12

Table 3
Oblique Factor Pattern Matrix Resulting From Analysis of Momentary Emotion Measures

	Factor			
Emotion measure	**Negative Emotions**	**Anxiety-Fear**	**Hostility**	**Interest-Enjoyment**
DES – guilt	.88			
DES – shyness	.87			
DES – self-hostility	.82			
DES – shame	.75			
DES – surprise	.60			
DES – sadness	.58			
CSAI-2 somatic		.96		
SAI		.77		–.42
DES – fear		.73		
CSAI-2 cognitive		.72		
DES – disgust			.91	
DES – contempt			.89	
DES – anger			.88	
DES – enjoyment				.84
DES – interest				.83

Note. Only loadings exceeding .40 are shown.

ity, guilt, shame, sadness, shyness, and surprise, explained 27.95% of the total variance in the 15 original variables. Anxiety scales and fear formed a second factor (Anxiety-Fear) which explained 20.42% of the total variance. Anger, contempt, and disgust formed a third factor (Hostility) explaining 19.07% of the total variance. Enjoyment and interest grouped together on one factor (Interest-Enjoyment), accounting for 12.24% of the total variance. The Anxiety-Fear factor showed a positive low correlation with Hostility (.17) and Negative Emotions (.27). The latter also correlated with Hostility (.31). All other between-factor correlations approached 0.

Hierarchical regression analyses were performed with perceived functionality of emotional states as criterion and the extracted emotional factors as explanatory variables. Because some of the variables were not normally distributed, these analyses were performed on untransformed and transformed data. Regression analyses of transformed and untransformed data yielded virtually identical results. Consequently, only results based on untransformed data were reported.

The first hierarchical regression showed that the Anxiety-Fear factor was a significant predictor of perceived functionality. Higher anxiety intensity was associated with lower perceived functionality. However, Anxiety-Fear predicted only 7% of the variance of perceived functionality. Inclusion of the fundamental emotion factors of Negative Emotions, Hostility, and Interest-Enjoyment significantly added to the explanation of the criterion variance, accounting for 22.9% more variance than the Anxiety-Fear factor. After all four emotional predictors were entered in the regression equation, Interest-Enjoyment and Negative Emotions were the only significant predictors of perceived functionality of pre-competitive emotions (Table 4).

Table 4
Summary of Hierarchical Regression Analyses of Emotional Factors as Predictors of Perceived Functionality of Momentary Emotional States (N = 201)

Predictor	β	R	R^2	R^2change	Adjusted R^2	F-to-enter (df)
Regression 1						
Step 1						
Anxiety-Fear	–.27*	.27	.07	.07*	.07	15.86 (1, 200)
Step 2						
Anxiety-Fear	–.06	.55	.30	.23*	.29	21.54 (3, 197)
Neg. Emotions	–.27*					
Hostility	–.07					
Interest-Enjoy.	.40*					
Regression 2						
Step 1						
Neg. Emotions	–.29*	.55	.30	.30*	.29	28.21 (3, 198)
Hostility	–.07					
Interest-Enjoy.	.41*					
Step 2						
Neg. Emotions	–.27*	.55	.30	.00	.29	0.83 (1, 197)
Hostility	–.07					
Interest-Enjoy.	.40*					
Anxiety-Fear	–.06					

*p < .01

When controlling for Negative Emotions and Interest-Enjoyment, Hostility and Anxiety-Fear did not contribute to the explanation of emotion functionality.

The second hierarchical regression, in which emotional factors other than Anxiety-Fear were assigned first entry, showed that they explained 29.9% of the criterion variance. Again, Negative Emotions and Interest-Enjoyment were significant predictors of perceived emotion functionality. The addition of Anxiety-Fear to the regression equation did not add to the explanation of the criterion over and above the emotional factors entered in the previous step. Overall, these results support the contention that emotions associated with a clear approach or avoidance action tendency are better predictors of perceived functionality of emotional states than anxiety, as it is currently measured. Finally, perceived functionality was not significantly correlated with threat (r_s = –.04, p > .05) but showed a moderate positive correlation with challenge (r_s = .38, p < .05).

Relationship Between Appraisals of Threat and Challenge and Treat- and Challenge-Related Emotion Measures and Emotional Factors

Analysis of momentary measurements of appraisal showed that 51.24% of the participants exhibited a mixed pattern of appraisal, 42.29% perceived the competition as a source of challenge but no threat, 3.48% thought that the competition was a source of threat but no challenge, and 2.99% reported that the event was neither challenging nor threatening.

Correlational analysis of threat- and challenge-related appraisals and corresponding measures of emotions was performed using Spearman rank correlation due to the fact that the distributions of most variables based on retrospective assessments were significantly skewed. Results showed that interest-excitement, as measured by the DES, was consistently positively correlated with challenge and was not associated with threat appraisal (Table 5). In contrast, anxiety as measured by the SAI and fear as measured by the DES were positively correlated with threat and uncorrelated with challenge. The somatic and cognitive subscales of the CSAI-2 were positively correlated with both threat and challenge. *Z* tests showed that somatic anxiety showed a consistently stronger correlation with threat than challenge. In contrast, cognitive anxiety exhibited a stronger correlation with threat than challenge only in debilitative emotional states.

Canonical correlation analysis resulted in two significant canonical variates (Rc1 = .65, $p < .001$; Rc2 = .48; $p < .001$), accounting for 42.38% and 23.14% of the variance, respectively. As the redundancy index has been shown to provide a more accurate measure of the proportion of variance in the variables in one set that is reproducible from the variables in the other set (Thompson, 1984), a redundancy index was calculated for each canonical variate. Redundancy indices for the dependent set showed that the first canonical variate accounted for 24.1% of the variance and the second variate accounted for 10.0% of the variance. The first variate represented a dimension of combined challenge (standardized canonical loading = .77) and threat (.74), which was positively correlated with the emotion factors of Anxiety-Fear (.77) and Interest-Enjoyment (.40). The second variate represented a state of higher challenge (.67) and low threat (-.64) which was positively correlated with Interest-Enjoyment (.76) and negatively correlated with Negative Emotions (-.66), Anxiety-Fear (-.61), and Hostility (-.44).

DISCUSSION

The main purpose of this study was to examine the information conveyed by two of the most commonly used measures of state anxiety in sport, the CSAI-2 and the SAI, in terms of appraisal of a forthcoming competition and perceived functionality in relation to performance. The information provided by these two anxiety measures was compared to that of measures of

Table 5
Spearman Rank Correlations Between Threat- and Challenge-Related Measures of Emotions and Threat and Challenge Appraisals

	Recalled facilitative emotional states (n = 149)		Recalled debilitative emotional states (n = 139)		Momentary emotional states (n = 201)	
Scale	**Threat**	**Challenge**	**Threat**	**Challenge**	**Threat**	**Challenge**
CSAI-2 cognitive	.26*	.23*	[a].67*	.49*	.49*	.38*
CSAI-2 somatic	[a].45*	.22*	[b].68*	.23*	[a].48*	.30*
SAI	.44*	.05	.70*	.06	.47*	.13
DES – fear	.39*	.12	.74*	.03	.39*	.04
DES – interest	.13	.39*	.15	.60*	.13	.55*

[a] Correlation with threat significantly greater than correlation with challenge ($p < .05$).
[b] Correlation with threat significantly greater than correlation with challenge ($p < .01$).
$*p < .01$.

fundamental emotions, specifically the DES-IV. In defining anxiety, the differential emotions theory's assumption that anxiety is a complex emotion potentially encompassing both approach or avoidance tendency was adopted (Izard, 1991). It was hypothesized that, because of its complex nature, (measures of) anxiety would provide less clear information about the way athletes appraise a competitive situation and show a weaker association with perceived functionality than measures of fundamental emotions typified by clear action tendencies.

The present findings lend substantial support to the above contentions. With respect to perceived functionality of momentary pre-competitive emotional states, the fundamental emotion factors of interest-enjoyment and negative emotions (sadness, guilt, self-hostility, shame, shyness, and surprise) explained 30% of the perceived functionality variance and were better predictors than anxiety-fear (encompassing the SAI, CSAI-2 and fear). Analysis of the intra-individual differences on each emotion scale between recalled debilitative and facilitative emotional states showed that interest-excitement exhibited a stronger association with perceived functionality than all of the anxiety scales (Table 1). Moreover, sadness and enjoyment differentiated between functional and dysfunctional emotional states better than somatic and cognitive competitive anxiety did. These differences were not as clear cut at inter-individual level of variation (Table 2). Single measures of fundamental emotions discriminated between functional and dysfunctional states as well as anxiety measures did. However, the SAI tended to be a better marker of perceived functionality than the CSAI-2. As stated in the introduction and confirmed by the present study (Table 3), the SAI gauges fear-like emotional states as well as positive affect. As such, it is bound to provide more information about action tendencies and cognitive appraisals related to a stressful situation than the cognitive and somatic subscales of the CSAI-2.

The somewhat dissimilar patterns of intra- and inter-individual differences between facilitative and debilitative emotional states highlight the importance of taking into account both levels of variations. However, from a practical viewpoint, intra-individual analyses are considered to be more important because they provide more direct information on what emotions should be targeted in psychological intervention programs, avoiding the confounding effects of trait inter-individual differences (Hanin, 1999). In contrast, inter-individual analyses may be more appropriate for the identification of inter-sport differences in patterns of optimal emotional states.

Whether the above patterns of functional and dysfunctional emotions are typical of the sports examined in this study or can be generalized to other athletic disciplines has yet to be determined. In fact, 61.88% of the sample consisted of athletes competing in individual contact sports, in which anxiety might be relatively consistently high across situations (as it was) due to the always present risk of physical injuries. Hence, in the present study, anxiety might have not emerged as one of the top important affective phenomena in determining perceived functionality as it may have in individual not contact sports. Further research is needed to elucidate these issues and cross-validate the findings.

However, for the examined sample, the findings support the contention that subjectively debilitative emotional states would be characterized by the presence of emotions associated with avoidance tendencies, and increased self-focus, whereas facilitative emotional patterns would be characterized by emotions motivating approach behavior (Cerin et al., 2000; Jones & Hanton, 2001). They also found partial support for the hypothesis that anxiety measures would be less predictive of perceived functionality of pre-competitive emotional stated than fundamental emotions with clear avoidance or approach action tendencies (Cerin et al., 2000).

These findings indicate that, in an effort to predict sport performance and help athletes reach their optimal emotional states, it is recommended not to exclusively rely on measures of threat-related affective phenomena. In fact, in the present study, the emotions of interest-excitement and enjoyment and the negative emotions of sadness, guilt, and self-hostility in general appeared to be more significant emotional states to the athletes than anxiety or fear (Tables 1 and 4). And although what athletes think about the effect of a particular emotion on their performance may not correspond to the objective reality, it is imperative to help athletes gain self-confidence through programs aimed at the management of emotions that they regard as being important.

Finally, it is important to note that this study showed that even nominally small changes in low intensity levels of negative emotions may make a significant difference in whether a pre-competitive emotional state will be perceived as facilitative or debilitative to performance. In the present study, negative fundamental emotions other than fear and anger were very low in intensity in both facilitative and debilitative patterns of emotions, which is consistent with previous research findings (Cerin et al., 2001; Lane & Terry, 2000). However, most of the differences in intensity of these emotions between facilitative and debilitative states were significant (Tables 1 and 2). Similarly, Lane and Terry (2000) have shown that even a small degree of depression as measured by the POMS can have a detrimental effect on performance. These findings indicate that in assessing athletes emotional state it is necessary to check for the presence of even low levels of negative emotions associated with increased self-focus and avoidance behavior (e.g., sadness, shame, and self-hostility), although, overall, they might not appear to be characteristic of athletes' pre-competitive emotional experience.

The study of emotions in sport is valuable because it is thought to convey information about the athlete-competition relationship and appraisal of the competitive situation. Sport psychologists need to be aware of the information that can be drawn from the analysis of the emotional profile of an athlete based on specific emotion scales. Consequently, this study aimed at testing the construct validity of anxiety measures in the form of relationship with threat appraisals and comparing the clarity of information about appraisal of the competition conveyed by different threat- and challenge-related scales. As noted earlier, two sources of problems associated with the exclusive use of anxiety measures have been identified. The first source of problems pertains to the construct validity of current anxiety measures. The second source of problems is associated with the potential ambiguous information conveyed by anxiety, if measured with single score unidimensional scales. In fact, anxiety has been defined here as a complex threat-related emotional state which may motivate both approach and avoidance behavior (Izard, 1991). As such, it is expected to be invariably associated with threat and to be variably and to a lesser extent associated with challenge appraisals, especially in athletes experiencing facilitative patterns of emotions (Cerin et al., 2000).

The CSAI-2 has been suspected to confound anxiety with positive excitement (Jones, 1995). If this was true it should be associated with both threat and challenge appraisals, regardless of the degree of perceived functionality. Correlational analysis showed that the somatic and anxiety subscales of the CSAI-2 were positively correlated with both threat and challenge (Table 5). However, while the somatic subscale showed a consistently higher correlation with threat, the cognitive subscale showed a higher correlation with threat only in debilitative emotional states. In conformity with previous suggestions (Lane et al., 1999), these findings imply that the cognitive subscale of the CSAI-2 may indeed in certain instances confound anxiety with positive excitement. On the other hand, if adopting Cerin et al.'s (2000) concept of competitive anxiety, these results also indicate that the somatic subscale of the CSAI-2 may be a valid measure of anxiety. However, it does not provide clear information of whether and to what extent an athlete perceives a competition as a threat or a challenge.

As noted earlier, the SAI has been shown to gauge two orthogonal emotion factors: anxiety and calmness-enjoyment. And because the score on the SAI is defined as the difference between these two factors, it was hypothesized that it would convey clearer information about appraisal than the CSAI-2. The findings from this study support this contention. The SAI was invariably positively correlated with threat but not with challenge (Table 5) and loaded on both an anxiety-fear and interest-enjoyment factor (Table 3). Therefore, although it may not be a "proper" measure of anxiety, it seems to convey clear information about whether an athlete appraises competition as a source of threat.

With respect to athletes' appraisals of a competitive event, results showed that, for this sample, athletic competition was most often associated with both threat and challenge. A mixed pattern of appraisal was exhibited by 51.24% of the participants. These ambivalent appraisals were generally accompanied by interest-enjoyment and anxiety-fear, expressed as a composite result of all threat-related measures used in this study. A considerable percentage of athletes associated competition only with challenge (42.29%). Unmixed challenge appraisals were associated with lower levels of negative emotions (expressed as a composite measure of guilt, shame, shyness, self-hostility, sadness, and surprise) and anxiety-fear, and higher levels of interest-enjoyment. It is also important to note that challenge but not threat was positive correlated with perceived functionality of emotional state and challenge and threat were not correlated. These finding suggest that interventions aimed at managing challenge appraisal (e.g., cognitive restructuring) and the emotions associated with it (e.g., emotion induction techniques) may prove more effective in helping athletes improve their pre-competitive emotional states than programs exclusively focused on threat reduction.

In conclusion, the present study suggests that sport psychologists should avoid basing the assessment of athletes' pre-competitive emotional state exclusively on measures of anxiety, the affective phenomenon thought to be the most obvious psychological consequence of an impending competition. Exclusive reliance on the currently available anxiety measures is not recommended for two main reasons. First, there are other emotions that seem to be perceived as more important in determining perceived functionality of pre-competitive emotional states. Second, measures of anxiety provide insufficient or ambiguous information about the athlete-competition relationship and the way the competition is appraised.

It is acknowledged that the retrospective nature of intra-individual measurements of emotional states, the absence of an analysis of the sources of threat and challenge associated with the use of single-item measures, and the structure of the examined sample are limitations of the present study. Additionally, the present study did not analyze the self-confidence subscale of the CSAI-2, the reason being that most emotion theorists agree that self-confidence is a positive non-emotional state (Lazarus, 1999; Plutchik, 1994). The existing literature indicates that this subscale might have significantly contributed to the differentiation of threat and challenge appraisals (Jones, 1995). Future research needs to overcome these limitations and extend the study to other types of sport.

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