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Meijen, Carla, Jones, Marc V., McCarthy, Paul J., Sheffield, David and Allen, Mark S. (2012) *Cognitive and affective components of challenge and threat states*. *Journal of Sports Sciences*, 31 (8). pp. 847-855. ISSN 1466-447X.

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1 Running head: CHALLENGE AND THREAT STATES

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5 Cognitive and affective components of challenge and threat states

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15 *Keywords:* emotions, self-efficacy, achievement goals, control

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Link to publisher version DOI <http://dx.doi.org/10.1080/02640414.2012.753157>

## Abstract

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We explored the cognitive and affective components of the Theory of Challenge and Threat States in Athletes (TCTSA) using a cross-sectional design. One hundred and seventy-seven collegiate athletes indicated how they typically approached an important competition on measures of self-efficacy, perceived control, achievement goals, emotional states and interpretation of emotional states. Participants also indicated to what extent they typically perceived the important competition as a challenge and /or a threat. The results suggest that a perception of challenge was not predicted by any of the cognitive components. A perception of threat was positively predicted by avoidance goals and negatively predicted by self-efficacy and approach goals. Both challenge and threat had a positive relationship with anxiety. Practical implications of this study are that an avoidance orientation appeared to be related to potentially negative constructs such as anxiety, threat and dejection. The findings may suggest that practitioners and researchers should focus on reducing an avoidance orientation, however the results should be treated with caution in applied settings, as this study did not examine how the combination of constructs exactly influences sport performance. The results provided partial support for the TCTSA with stronger support for proposed relationships with threat rather than challenge states.

## 1 Introduction

2 Sports competition is an example of a motivated performance situation in which an  
3 individual must exert effort to attain a goal, or goals, that are self-relevant (Seery, 2011). One  
4 approach to explaining how individuals respond in such situations is by considering whether  
5 the situation is perceived as a challenge or a threat. The notion that athletes might perceive  
6 competition as a challenge or a threat has been considered in organised sport (Anshel &  
7 Wells, 2000; Campbell & Jones, 2002; Cerin, 2003; Skinner & Brewer, 2004). The Theory of  
8 Challenge and Threat States in Athletes (TCTSA; Jones, Meijen, McCarthy, & Sheffield,  
9 2009) explains why sport competitions are often perceived as a challenge or a threat, what  
10 physiological and emotional responses ensue, and in turn, how sport performance might be  
11 affected. The TCTSA provides the theoretical framework for this study.

12 The TCTSA was developed on principles outlined in the biopsychosocial model of  
13 challenge and threat (Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996), along with  
14 the model of adaptive approaches to competition (Skinner & Brewer, 2004) and the control  
15 model of debilitating and facilitative competitive state anxiety (Jones, 1995). A challenge  
16 state is experienced when an individual perceives they have sufficient resources to meet  
17 situational demands and a threat state is experienced when an individual perceives they have  
18 insufficient resources to meet situational demands (Blascovich & Mendes, 2000; Blascovich  
19 & Tomaka, 1996). Challenge states are proposed to be associated with adaptive  
20 cardiovascular responses (i.e., decreased vascular resistance and increased cardiac output),  
21 positive emotions, increased energy levels and dedication, whereas threat states are  
22 associated with maladaptive cardiovascular responses (i.e., increased vascular resistance and  
23 no changes or a slight increase in cardiac output), negative emotions, reduced effort and  
24 energy levels (Blascovich, Seery, Mugridge, Norris, & Weisbuch, 2004; Skinner & Brewer,  
25 2004). The transactional theory of stress (Lazarus & Folkman, 1984) also outlines that

1 challenge appraisals have a positive connotation and threat appraisals a negative connotation.  
2 Lazarus and colleagues consider challenge and threat appraisals to be part of the appraisal  
3 process (Lazarus & Folkman, 1984). The biopsychosocial model and the TCTSA, however,  
4 conceptualise challenge and threat as states that are the *result* of the appraisal process (Jones,  
5 et al., 2009; Seery, 2011). Thus, to clarify, the demands of the situation might not differ for  
6 challenge and threat states in the TCTSA, instead it is the evaluation of the available  
7 resources in relation to the demand that leads to a challenge or a threat state. The TCTSA  
8 adds to existing literature by specifying these resources.

9         The cognitive resources in the TCTSA are self-efficacy, perceived control, and  
10 achievement goals. Self-efficacy refers to an individual's judgement of capability to perform  
11 a task successfully (Bandura, 1997). Self-efficacy is a key aspect of the cognitive aspect as  
12 the belief to perform a task contributes to the perception of being able to cope with the  
13 demands of the situation (Lazarus, 1999). High levels of self-efficacy can increase the  
14 available coping options that can help individuals perceive a motivated performance situation  
15 as a challenge (Williams, Cumming, & Balanos, 2010). In addition, for self-efficacy to  
16 develop individuals must perceive that they are in control (Bandura, 1997) and, as such,  
17 control also forms a central component of the resource appraisals outlined in the TCTSA.  
18 Individuals can perceive a situation as within (controllable) or outside personal control  
19 (uncontrollable). This influences their perception of the situation as a challenge or a threat.  
20 When someone believes that an important situation is controllable, he/she is motivated to use  
21 'personal efficacy' most, which in turn increases the chances for success. If a situation is  
22 approached as uncontrollable, the likelihood of failure increases, as the individual is more  
23 likely to use personal efficacy to a lower extent (Bandura & Wood, 1989). The TCTSA  
24 proposes that high levels of perceived control are related to a challenge state and low levels  
25 of perceived control are related to a threat state (Jones et al., 2009).

1           The TCTSA uses the 2 x 2 model of achievement goals (Elliot & McGregor, 2001) to  
2 explain how achievement goals play a role in challenge and threat states. The 2 x 2 model has  
3 four types of achievement goals: mastery-approach goals (MAp) that focus on the attainment  
4 of task or self-referenced target; mastery-avoidance goals (MAv) that reflect a motivation  
5 focusing on avoiding task incompetence; performance-approach goals (PAp) that reflect a  
6 motivation to attain normative competence; and performance-avoidance goals (PAv) that  
7 reflect the motivation to avoid normative competence. Based on research in academic  
8 (McGregor & Elliot, 2002) and athletic settings (Adie, Duda, & Ntoumanis, 2008), the  
9 TCTSA contends that approach goals are related to a challenge state and avoidance goals to a  
10 threat state.

11           The TCTSA outlines for the affective component that positive emotions are normally,  
12 but not exclusively, related to a challenge response, whereas negative emotions are normally,  
13 but not exclusively, associated with a threat response. The notion that positive emotions are  
14 related to challenge appraisals and negative emotions are related to threat appraisals has been  
15 previously proposed in sport (Skinner & Brewer, 2004). However, because some high  
16 intensity emotions with a negative valence, like anger or anxiety, can serve motivational  
17 functions, they can occur in a challenge state (Mendes, McCoy, Major, & Blascovich, 2008).  
18 The interpretation of emotions as facilitative (helpful) or debilitating (unhelpful) to  
19 performance also plays a role in challenge and threat states. How an individual interprets  
20 emotions directs their behaviour (Lazarus, 1999, 2000) and although emotions are often  
21 defined as being positive or negative in terms of valence, this does not mean that a negative  
22 emotion only influences performance negatively, or that a positive emotion only influences  
23 performance positively (Hanton, Neil, & Mellalieu, 2008; Jones & Uphill, 2004; Mellalieu,  
24 Hanton, & Fletcher, 2006). Consistent with Jones' (1995) control model of debilitating and  
25 facilitative anxiety, the TCTSA proposed that athletes can experience negative emotions in a

1 challenge state but these are interpreted as helpful to performance provided the athlete feels  
2 in control and believes the goal can be achieved (Jones et al., 2009).

3 In summary, the TCTSA specifies the resource appraisals comprising challenge and  
4 threat states and proposes how these resource appraisals relate to emotional responses  
5 (intensity and interpretation). This relation has not yet been examined (Jones et al., 2009) and  
6 testing this part of the TCTSA was the focus of the present study. Specifically, it was  
7 hypothesised that a challenge state would be characterised by increased self-efficacy,  
8 perceived control, approach goals, positive emotions and a facilitative interpretation of  
9 emotions just before an important competition. It was further hypothesised that a threat state  
10 would be characterised by decreased levels of self-efficacy, lower perceived control,  
11 avoidance goals, more negative emotions and a more debilitating interpretation of emotions  
12 just before an important competition.

## 13 Method

### 14 Participants and Procedure

15 One hundred and seventy seven collegiate level athletes (121 males, 55 females, 1  
16 gender not disclosed) between the ages of 18 and 52 years (mean age 22.50 years,  $SD = 6.32$ )  
17 took part in the study. Thirty-nine participants were involved in individual sports and 138  
18 participants were involved in team sports. These sports included football ( $n = 73$ ); basketball  
19 ( $n = 16$ ); cricket ( $n = 14$ ); rugby, netball (both  $n = 9$ ); martial arts and hockey (both  $n = 7$ ).  
20 Participants competed at levels ranging from international to recreational level with an  
21 average of 10.13 ( $s = 6.04$ ) years competitive experience. The participants played their main  
22 sport an average of 6.18 ( $s = 4.86$ ) hours per week.

23 Participants were recruited from three university sites, using non-probability  
24 convenience sampling. That is, participants were asked during undergraduate classes if they  
25 were willing to take part in the study and this allowed us to get responses from collegiate

1 athletes who were available and willing to take part (Stevens, 1996). Institutional ethical  
2 approval was obtained prior to data collection and all of the participants volunteered to take  
3 part in this study and provided written informed consent before completion of questionnaires  
4 in a lecture theatre or seminar room. Participants completed the questionnaires in relation to  
5 how they typically feel just before an important competition.

## 6 **Measures**

7 **Self-efficacy.** A sport specific questionnaire developed by Coffee and Rees (2008)  
8 was used to measure self-efficacy ( $\alpha = .75$ ). Participants were instructed to indicate with  
9 reference to how they typically feel before an important competition, to what extent they felt  
10 confident that they could cope with a range of statements. They rated six statements on a  
11 five-point scale, 1 represented (not at all) and 5 (completely). An example statement is  
12 “mobilise all your resources for this performance”.

13 **Perceived control.** Perceived control was measured using three items based on  
14 Bonetti and Johnston’s (2008) perceived control measure, Ajzen’s (1991) perceived  
15 behavioural control protocol and Conner and Sparks’ (1996) locus of control protocol. Locus  
16 of control was measured using a single item, “Do you think it is entirely up to you whether  
17 you perform to the best of your abilities” rated on a five point scale ranging from 1 (strongly  
18 disagree) to 5 (strongly agree). Perceived behavioural control was measured using two items:  
19 “How much control do you feel you have over whether you perform to the best of your  
20 abilities” - ranging from 1 (no control at all) to 5 (complete control), and “How difficult will  
21 it be for you to perform to the best of your abilities?” - ranging from 1 (extremely difficult) to  
22 5 (not at all difficult). The perceived behavioural control items were in line with the  
23 theoretical framework of control (Skinner, 1996) where perceived control relates to the  
24 individual’s belief about how much control is available. The internal consistency coefficient  
25 of the perceived control measure in this study was  $\alpha = .55$ . Deleting any of the three items did



1 not improve the internal consistency of the scale. To further explore the scale, a principal  
2 components analysis was conducted. All three items were significantly correlated, with  
3 correlation coefficients between  $r = .22$  to  $.40$ . The Kaiser-Meyer-Olkin measure was  $.59$   
4 suggesting acceptable reliability (Kaiser, 1974). Bartlett's test of sphericity was significant,  
5  $\chi^2(3) = 42.64, p < .001$ . The communalities of the three items were all above  $.30$ , indicating  
6 that each item shared some common variance with the other two items. A principal  
7 components analysis extracted one component. Therefore it was decided to retain the scale  
8 for further analysis.

9       **Achievement goals.** Achievement goals were measured using the 12-item  
10 Achievement Goal Questionnaire for Sport (AGQ-S; Conroy, Elliot, & Hofer, 2003). The  
11 participants indicated the extent to which items were true of them in relation to how they feel  
12 just before an important competition, on a scale ranging from 1 (not at all true) to 7 (very  
13 true). In line with the TCTSA, the scores for M<sub>A</sub>p and P<sub>A</sub>p were summed for an overall  
14 score for approach goals, and M<sub>A</sub>v and P<sub>A</sub>v were summed up for an overall score for  
15 avoidance goals. The internal consistency reliability coefficient was  $\alpha = .70$  for approach  
16 goals and  $\alpha = .84$  for avoidance goals.

17       **Emotions.** Emotions were measured using the 22-item Sport Emotion Questionnaire  
18 (SEQ; Jones, Lane, Bray, Uphill, & Catlin, 2005). The SEQ identifies five emotions: anger;  
19 anxiety; dejection; happiness; and excitement. The participants were asked to indicate on a  
20 scale ranging from 0 (not at all) to 4 (extremely), how they feel just before an important  
21 competition ( $\alpha = .84$  for anxiety,  $\alpha = .92$  for dejection,  $\alpha = .66$  for excitement,  $\alpha = .82$  for  
22 anger, and  $\alpha = .86$  for happiness). Dejection and anger had low mean scores (see Table 1),  
23 and these subscales were not used in further analyses as many participants did not report  
24 experiencing these two emotions ( $n = 110$  for dejection,  $n = 78$  for anger). Interpretation of  
25 emotional state was measured using a single item, "how helpful do you feel your emotional

1 state is for your performance?”, rated on a five point scale (0 = not at all helpful to 4 =  
2 extremely helpful). This measure was chosen as the prediction for interpretation of emotional  
3 state reflected the athletes’ interpretation of their overall emotional state. Only 107 (60.5%)  
4 of the participants completed the interpretation of emotional state question, as the result of an  
5 administrative error in which the scale was not included in half of the questionnaire booklets.

6 **Challenge and threat appraisals.** To provide a measure of whether competition is  
7 typically viewed as a challenge or as a threat participants were asked to imagine that they are  
8 about to take part in the most important competition of the season and to indicate on a 5-point  
9 scale ranging from 0 (not at all) to 4 (extremely) on two items: “how threatened do you feel  
10 by this” and “how challenged do you feel by this”. Similar single item measures of challenge  
11 and threat have been used in the literature (e.g., Tomaka, Blascovich, Kibler, & Ernst, 1997).

12 **Manipulation check.** To verify if participants were able to imagine if they were just  
13 about to take part in an important competition, they were asked to indicate how able they  
14 were to complete the task that was asked of them by ticking one out of three options (Jones &  
15 Uphill, 2004): option one “I was able to complete the questionnaire as if I was just about to  
16 compete in an important competition accurately”; option two “I was able to complete the  
17 questionnaire as if I was just about to compete in an important competition with some degree  
18 of accuracy”; or option three “I was unable to complete the questionnaire as if I was just  
19 about to compete in an important competition with any degree of accuracy”. Participants who  
20 ticked option three were removed from data analysis ( $n = 3$ ). A further two participants failed  
21 to indicate how able they were to recall the competition and were also removed from further  
22 data analysis. This left 172 participants in the analyses for the cognitive resources and  
23 affective responses.

24 **Data analysis**

1           To examine the predictive value of the cognitive resources (self-efficacy, control,  
2 approach and avoidance goals) on challenge and threat appraisals, we conducted two linear  
3 regression analyses with either challenge appraisal or threat appraisal as the outcome  
4 (criterion) variable. Next, to examine the predictive value of the cognitive components on  
5 emotions, we conducted three hierarchical regression analyses with the emotions (anxiety,  
6 excitement, and happiness) as the outcome variables. For this analysis, self-efficacy, control,  
7 avoidance and approach goals were entered in Step 1, and challenge appraisal and threat  
8 appraisal were entered in Step 2, whereas the TCTSA proposes that a challenge state is  
9 related to approach goals and a threat state to avoidance goals, it does not suggest that  
10 avoidance goals are linked to challenge states nor that approach goals are linked to threat  
11 states. Jones et al., (2009) noted that research on achievement goals and challenge and threat  
12 states was in its early stages, and so we took the opportunity to examine the role of avoidance  
13 goals in challenge states and approach goals in threat states. Finally, interpretation of  
14 emotional state was measured by a three step hierarchical regression analysis. Emotions  
15 (anxiety, excitement, and happiness) were entered in Step 1 to control for the emotional  
16 response, self-efficacy, control, avoidance and approach goals were entered in Step 2, and  
17 challenge appraisal and threat appraisal were entered in Step 3. The Durbin Watson statistic  
18 was close to the recommended value of 2 (Field, 2009) and collinearity diagnostics showed  
19 that variance inflation factors (VIF) were below 10.00 (Field, 2009) for all analyses.

20

## Results

### 21 Preliminary Analysis

22           Descriptive statistics and correlation coefficients for the cognitive resources and  
23 emotional responses are presented in Table 1. The data were screened for outliers and normal  
24 distribution. Most of the variables were normally distributed, except for the variable  
25 dejection. The non-normal distribution of dejection could be explained by the low variability

1 in the scores for this emotion, most participants ( $n = 110$ ) reported that they did not  
2 experience dejection. The data show that challenge appraisals were positively correlated with  
3 threat appraisals and anxiety; threat appraisals were positively correlated with challenge  
4 appraisals, anxiety, dejection, anger, and avoidance goals and negatively correlated with self-  
5 efficacy. Interpretation of emotional state was positively correlated with self-efficacy and  
6 negatively correlated with avoidance goals.

7

8 \*\*\*INSERT TABLE 1 NEAR HERE\*\*\*

9

10 **Cognitive Resources**

11 The results for the linear regression revealed that the cognitive variables self-efficacy,  
12 control, approach goals and avoidance goals did not significantly predict challenge appraisal  
13 ( $R^2 = .02, p = .54$ ). In contrast, cognitive variables predicted threat appraisal ( $R^2 = .16, p <$   
14  $.001$ ); avoidance goals was the only significant predictor of threat appraisal ( $\beta = .36, p <$   
15  $.001$ ). Self-efficacy ( $\beta = -.15, p = .06$ ) and approach goals ( $\beta = -.16, p = .06$ ) were nearing  
16 significance.

17 Challenge and threat appraisal were positively correlated, therefore the cognitive  
18 resource model was re-run with challenge appraisal or threat appraisal entered in Step 1 (see  
19 Table 2) to partial out the effects of challenge appraisal on threat appraisal and vice versa.  
20 After entering challenge appraisal at Step 1, self-efficacy ( $\beta = -.14, p = .05$ ), approach goals  
21 ( $\beta = -.20, p < .001$ ) and avoidance goals ( $\beta = .38, p < .001$ ) predicted threat appraisal in the  
22 expected ways ( $\Delta R^2 = .17, p < .001$ ). After entering threat appraisal at Step 1, there was an  
23 improvement of the fit of the model, with approach goals ( $\beta = .20, p = .02$ ) and avoidance  
24 goals ( $\beta = -.22, p = .01$ ) predicting challenge appraisal in the expected direction. Step 2

1 approached significance ( $\Delta R^2 = .05, p = .06$ ); no single predictor added at Step 2 was  
2 significant.

3

4

\*\*\*INSERT TABLE 2 NEAR HERE\*\*\*

5

## 6 **Affective Responses**

7         The results for the hierarchical regression analysis for anxiety showed a significant  
8 effect at Step 1 ( $R^2 = .25, p < .001$ ), with self-efficacy ( $\beta = -.22, p = .005$ ) and avoidance  
9 goals ( $\beta = .41, p < .001$ ) as significant predictor variables. The addition of challenge and  
10 threat appraisals at Step 2 showed a significant improvement in model fit,  $\Delta R^2 = .11, p <$   
11  $.001$ , for challenge appraisal ( $\beta = .18, p = .01$ ), and for threat appraisal ( $\beta = .25, p = .002$ ).

12         Excitement was positively predicted by both self-efficacy ( $\beta = .17, p = .03$ ) and  
13 approach goals ( $\beta = .23, p = .01$ ), and negatively predicted by avoidance goals ( $\beta = -.18, p =$   
14  $.03$ ). These components accounted for 11.7% of the variance in excitement. The addition of  
15 challenge and threat appraisals was not significant. For happiness, cognitive variables  
16 accounted for 6.2% explained variance although no significant beta weights were observed  
17 for any of the cognitive variables. The addition of challenge appraisal and threat appraisal at  
18 Step 2 did not result in a significant improvement in model fit.

19         Avoidance goals predicted both threat appraisal and anxiety, and threat appraisal  
20 predicted anxiety, therefore the data pointed to a possible mediating effect. Mediation  
21 analysis was performed using protocols outlined by Baron and Kenny (1986) and Kenny,  
22 Kashy, and Bolger (1998). This involved three steps; in the first step the outcome variable  
23 (anxiety) was regressed on the predictor variable (avoidance) and in the second step the  
24 mediator variable (threat appraisal) was regressed on the predictor variable (avoidance). Both  
25 of these steps were significant, which is a requirement for mediation to occur. In the third

1 step, the outcome variable (anxiety) was regressed on both the predictor (avoidance) and  
2 mediator (threat appraisal) variables. When there is a full mediation effect, the association  
3 between avoidance and anxiety would be non-significant (Baron & Kenny, 1986). Although  
4 this relation was not attenuated to non-significance, the relation between the predictor and  
5 outcome was smaller with the mediator (threat appraisal) included in the model ( $B = .22$  vs.  $B$   
6  $= .30$ ). This change in beta-weight was significant (Sobel's  $z = 3.60$ ,  $p < .001$ ) suggesting  
7 partial mediation. Threat appraisal partially mediates the relationship between anxiety and  
8 avoidance goals.

9 Interpretation of emotional state was measured by a three step hierarchical regression  
10 analysis using a subsample of 107 participants. No significant effects were observed at Step 1  
11 ( $R^2 = .06$ ,  $p = .19$ ) or Step 2 ( $\Delta R^2 = .07$ ,  $p = .21$ ). However, the addition of challenge and  
12 threat appraisal at Step 3 revealed a significant effect ( $\Delta R^2 = .09$ ,  $p = .02$ ), threat appraisal  
13 positively predicted the interpretation of emotional state ( $\beta = .32$ ,  $p = .01$ ) as well as self-  
14 efficacy ( $\beta = .25$ ,  $p = .04$ ). Participants who reported feeling more threatened by an important  
15 competition indicated that their emotional state was more helpful for their performance.

### 16 **Challenge and Threat Patterns**

17 A 2x2 multivariate analysis of variance (MANOVA) was performed to explore how  
18 patterns of response on challenge and threat appraisals (high challenge/high threat, high  
19 challenge/high threat, low challenge/low threat) relate to the cognitive and affective  
20 variables. Only four participants (2%) scored high on threat and low on challenge and this  
21 pattern was left out of the MANOVA. A separate one-way ANOVA was conducted for  
22 interpretation of emotional state because fewer participants completed this item. The results  
23 for the MANOVA showed a main effect for group (challenge/threat pattern), Wilks  $\lambda = .770$ ,  
24  $F(14, 274) = 2.74$ ,  $p = .001$ ,  $\eta_p^2 = .12$ . Univariate tests using Bonferroni correction showed  
25 that there was a significant difference between the challenge and threat patterns in terms of

1 self-efficacy,  $F(2, 143) = 3.58, p = .03, \eta_p^2 = .05$ , avoidance goals,  $F(2, 143) = 4.34, p = .02,$   
 2  $\eta_p^2 = .06$ , and anxiety,  $F(2, 143) = 14.39, p < .001, \eta_p^2 = .17$ . The high challenge/low threat  
 3 group scored higher on self-efficacy ( $M = 3.79, SD = .55$ ) than the high challenge/high threat  
 4 group ( $M = 3.48, SD = .68, p = .03$ ). For avoidance goals, the high challenge/low threat group  
 5 scored lower ( $M = 3.90, SD = 1.29$ ) than the high challenge/high threat group ( $M = 4.64, SD$   
 6  $= 1.20, p = .01$ ). For anxiety, the high challenge/high threat group reported higher scores ( $M$   
 7  $= 2.45, SD = .86$ ) than the low challenge/low threat group ( $M = 1.52, SD = .76, p < .001$ ) and  
 8 the high challenge/low threat group ( $M = 1.74, SD = .77, p < .001$ ). There were no significant  
 9 differences between the challenge and threat patterns and control,  $F(2, 143) = 1.90, p = .15,$   
 10  $\eta_p^2 = .03$ , approach goals,  $F(2, 143) = 0.19, p = .83, \eta_p^2 = .003$ , excitement,  $F(2, 143) =$   
 11  $0.26, p = .77, \eta_p^2 = .004$ , happiness,  $F(2, 143) = 0.01, p = .99, \eta_p^2 = .00$ , and interpretation of  
 12 emotional state,  $F(2, 94) = 3.00, p = .06, \eta_p^2 = .06$ .

### 13 Discussion

14 We examined relations among self-efficacy, perceived control, approach and  
 15 avoidance goals, emotions, interpretation of emotions and challenge and threat appraisals  
 16 before competing in an important competition. In this sample of collegiate level athletes the  
 17 results supported some, but not all, of the predictions made by the TCTSA. Threat appraisal  
 18 was positively predicted by avoidance goals and negatively predicted by self-efficacy and  
 19 approach goals. Anxiety was negatively predicted by self-efficacy and positively predicted by  
 20 avoidance goals, and positively predicted by both challenge and threat appraisals. Excitement  
 21 was positively predicted by self-efficacy and approach goals, and negatively predicted by  
 22 avoidance goals. This finding suggests that, for collegiate athletes, the pattern predicted by  
 23 the TCTSA (control excepted) is only observed when athletes are in a threat state.  
 24 Collectively, the results provide partial support for theory (TCTSA) and accord with previous

1 research demonstrating the association between cognitive components of challenge and threat  
2 states and emotions (Elliot & McGregor, 2001; Sideridis, 2008).

3         The cognitive components of challenge and threat states were associated with  
4 emotions. Consistent with similar investigations (Elliot & McGregor, 2001; Sideridis, 2008),  
5 results showed that mastery avoidance goals positively predicted anxiety. Thus, the athletes  
6 who reported greater anxiety before competitions reported higher avoidance goals compared  
7 to those who had lower levels of anxiety before competition. This suggests that anxious  
8 individuals are less engaged in competition (Elliot, Cury, Fryer, & Huguet, 2006), for  
9 example, an anxious basketball player does not demand the ball as often as his team-mates.  
10 This effect was partially mediated by threat appraisal, thus avoidance goals could influence  
11 anxiety directly, but also indirectly, through their appraisals of the situation as a threat. In  
12 addition, the results showed that there was a positive association between approach goals and  
13 interpretation of emotional state and a negative association between avoidance goals and  
14 interpretation of emotional state. Thus, those who perceived their emotional state as  
15 beneficial to performance reported more approach goals and fewer avoidance goals. This  
16 finding is in line with the predictions made by the TCTSA.

17         How athletes perceive an upcoming sport competition and their available resources,  
18 such as self-efficacy and achievement goals, plays an important role in determining anxiety  
19 responses. The present study shows that perceived available resources also predict other  
20 emotional states such as excitement and happiness. For happiness, the combination of self-  
21 efficacy, goal orientations, and control contributed more than the constructs separately, which  
22 provides support for the combination of cognitive variables as outlined by the TCTSA. Also,  
23 the higher a participant scored on threat appraisal, the more helpful they interpreted their  
24 emotional state to be. This is important given the strong associations shown between  
25 emotional interpretation and sport performance (Swain & Jones, 1996). The finding that



1 threat appraisal was positively related to interpretation of emotional states, however, is  
2 inconsistent with our initial hypothesis and previous work. Skinner and Brewer (2004)  
3 proposed that a beneficial interpretation of emotional state is related to a challenge; however  
4 mild or weak levels of emotions, specifically anxiety (Carver, 1996), were not associated  
5 with a strong interpretation of emotional state as beneficial or harmful for performance. It is  
6 possible that the low intensity of some of the emotional responses in this study contributed to  
7 these findings and therefore we encourage researchers to externally validate these findings in  
8 more competitive environments where emotional responses may be greater. Also, participants  
9 could have interpreted the scale measuring interpretation of emotional state in terms of  
10 helpfulness only and this might have excluded the perception that the emotional state can also  
11 be considered as harmful for performance. Furthermore, because we asked participants how  
12 they felt in general in sport competition, we may have assessed an individual's disposition to  
13 perceive a motivated performance situation as a challenge or a threat rather than assessing  
14 actual appraisals in competition, with the latter being more sensitive to the demands of the  
15 situation (cf. Roesch & Rowley, 2005). By collecting data in competitive situations, the  
16 relationship between demand and resource appraisals can be fully elucidated.

17         There are at least three possible reasons why the TCTSA was not fully supported in  
18 this sample. First, the control measure posed problems because of its low internal consistency  
19 and, although it was included in main analyses, it did not predict responses in either challenge  
20 or threat states. Therefore, we cannot be entirely confident that control does not play a role in  
21 challenge and threat states. In addition, participants could have drawn on previous  
22 experiences when imagining how they typically feel before an important competition,  
23 therefore attribution theory might have influenced the findings for control. For successful  
24 performance self-efficacy and controllability were not associated, whereas for less successful  
25 performance self-efficacy and controllability were positively related (Coffee & Rees, 2008).

1 When recalling a successful performance, controllable or uncontrollable causes of this  
2 successful performance showed to have little influence on subsequent self-efficacy beliefs  
3 (Coffee & Rees, 2008). This appears to partially explain why the patterns predicted by the  
4 TCTSA were only observed in a threat state. Second, the scenarios envisaged by the  
5 collegiate athletes may not have sufficient demand characteristics to generate strong  
6 psychological responses similar to those normally experienced pre-competition. This is  
7 perhaps best evidenced by scores around the mid-range for the emotional responses to the  
8 scenario, although we did assess participants' perceptions of their ability to complete the  
9 questionnaires accurately and this manipulation check has been used successfully in past  
10 research (Jones & Uphill, 2004).

11 Third, athletes typically reported the upcoming competition to be challenging, and not  
12 very threatening. Most participants displayed a pattern where they scored high in challenge  
13 and low in threat. In a setting where it can be expected that athletes normally describe  
14 upcoming competitions as a challenge rather than a threat, the use of the words challenging  
15 and threatening in the self-report measures may not accurately reflect how athletes  
16 psychologically describe competition. Cerin (2003) has shown that participants can  
17 cognitively appraise an upcoming competition as both a challenge and a threat, rather than  
18 appraising an upcoming competition as one or the other. This finding suggests that the  
19 dichotomous approach proposed by the TCTSA, at least for the self-reported appraisals of  
20 challenge and threat, is too simplistic in a sport setting, particularly considering the findings  
21 that challenge and threat appraisal were positively related in the present study. Further  
22 exploration of challenge and threat patterns showed that the high challenge/high threat pattern  
23 scored higher on anxiety than the low challenge/low threat and high challenge/low threat  
24 pattern and the high challenge/low threat pattern reported higher self-efficacy and less  
25 avoidance goals than the high challenge/high threat pattern. The findings for the challenge

1 and threat patterns illustrate that challenge and threat do not appear to be opposite ends of a  
2 continuum, as the different patterns appear to elucidate distinct responses.

3 In addition to the methodological limitations noted earlier, the present study did not  
4 explore the cardiovascular activation associated with challenge and threat states. This forms a  
5 key part of the biopsychosocial model and latterly the TCTSA. In future researchers should  
6 include measures of cardiovascular reactivity and self-report measures to outline the nature of  
7 challenge and threat states in an athletic setting. Furthermore, the question of whether  
8 challenge and threat appraisals reflect a particular style, or rather fluctuate as demand  
9 characteristics and resource appraisals change, could be explored. In addition, as task  
10 engagement could be an issue, in future researchers could examine the relation between  
11 perceived effort and challenge and threat states. These latter demands were not assessed in  
12 the present study and it has been proposed that challenge and threat states may reflect  
13 changes in demand rather than simply changes in resource appraisals (Wright & Kirby,  
14 2003).

15 Practical implications of the present study are that an avoidance orientation relates to  
16 potentially negative constructs such as anxiety, threat appraisal, and dejection. In addition,  
17 the findings of the present study provide some insight into the associations between cognitive  
18 resources and affective responses of challenge and threat states of how athletes *typically*  
19 respond to an upcoming competition. However, practitioners should be cautious using the  
20 findings of the present study for applied practice as it is not clear how the combination of  
21 constructs influence sport performance.

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Table 1: Summary of Means, Standard Deviation, and Correlations for Scores on Self-efficacy, Control, Approach Goals, Avoidance Goals, Emotions, Interpretation of Emotions and Challenge and Threat Appraisals

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Self efficacy	3.70	0.59	--														
2 Control	3.69	0.62	.31***	--													
3 Approach	5.36	0.89	.21**	.13	--												
4 Avoidance	4.25	1.34	-.09	-.09	.42***	--											
5 MAP	6.22	0.71	.29***	.22**	.57***	-.04	--										
6 MAV	4.74	1.48	-.24**	-.12	.25**	.82***	.04	--									
7 PAP	4.50	1.50	.12	.06	.92***	.52***	.20*	.28***	--								
8 PAV	3.75	1.71	.06	-.04	.44***	.86***	-.10	.41***	.57***	--							
9 Anxiety	1.93	0.87	-.27**	-.11	.13	.47***	-.02	.53***	.16*	.27**	--						
10 Anger	0.48	0.77	-.09	.03	.00	.22	-.19*	.14	.09	.23**	.23**	--					
11 Excitement	2.85	0.67	.26**	.12	.19*	-.14	.27*	-.15	.09	-.08	.03	.04	--				
12 Dejection	0.27	0.61	-.18*	.08	-.02	-.25**	-.18*	.24**	.06	.19*	.32***	.74***	-.04	--			
13 Happiness	2.26	0.98	-.20*	.19*	.03	-.13	.14	-.15	-.03	-.07	-.12	.16*	.55***	.21**	--		
14 Interpretation emotional state	3.05	0.86	.25**	.12	.07	-.20*	.26**	-.11	-.04	-.21*	-.09	-.01	.15	-.09	.18	--	
15 Challenge appraisal	3.05	0.93	-.01	-.06	.10	.02	.15	.09	.05	-.04	.29***	-.11	.05	-.04	-.05	.16	--
16 Threat appraisal	1.72	1.14	-.23**	-.15	-.02	.34***	-.19*	.42***	.06	.17*	.47***	.17*	-.07	.17*	-.07	.12	.33***

Note. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . MAP = mastery-approach goals, MAV = mastery-avoidance goals, PAP = performance-approach goals, PAV = performance-avoidance goals.

Table 2: *Regression Analyses for Self-efficacy, Control, Approach Goals and Avoidance Goals Predicting Challenge Appraisal and Threat Appraisal*

	Challenge			Threat		
	<i>B</i>	<i>SE b</i>	<i>B</i>	<i>B</i>	<i>SE b</i>	<i>B</i>
Step 1						
Challenge or Threat	0.28	0.06	.33*	0.40	0.09	.33*
Step 2						
Challenge or Threat	0.34	0.07	.41	0.42	0.08	.35*
Self-efficacy	0.06	0.13	.04	-0.27	0.14	-.14
Control	-0.09	0.12	-.06	-0.05	0.13	-.03
Approach	0.21	0.09	.20	-0.26	0.10	-.20*
Avoidance	-0.15	0.06	-.22	0.32	0.06	.38*

*Note.* Challenge  $R^2 = .11$ ,  $p < .001$  for Step 1,  $\Delta R^2 = .05$ ,  $p = .06$  for Step 2. Threat  $R^2 = .11$ ,  $p < .001$  for Step 1,  $\Delta R^2 = .17$ ,  $p < .001$  for Step 2.

\*  $p < .001$