Mood and Anxiety Scores Predict Winning and Losing Performances in Tennis

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Abstract

Psychological measures have previously been shown to be predictive of sport performance across a range of sports. The present study assessed the capacity of pre-competition mood and anxiety scores to predict tennis results. A sample of 92 social-competitive tennis players (49 men and 43 women, mean 39.7 years, range 19-62) completed the Brunel Mood Scale (BRUMS) and the revised Competitive State Anxiety Inventory-2 (CSAI-2R) prior to weekly competitions, producing a dataset of 567 matches. Discriminant function analysis showed that the outcome of matches could be correctly classified with 60% accuracy ($p < .01$). Consistent with theoretical predictions, low scores for confusion, depression, tension, anger, and cognitive anxiety, and high scores for self-confidence were significant predictors of winning performances. Using the two measures independently, the BRUMS provided 56.8% correct classifications ($p < .01$) and the CSAI-2R provided 58.7% ($p < .01$). Notably, a much higher proportion of winners (78.5%) than losers (38.3%) were correctly classified from mood scores, suggesting greater potential for predicting winning performances from positive moods than losing performances from negative moods. Results were generally consistent with Morgan's mental health model and Martens' multidimensional anxiety theory, and can be used to inform interventions applied by sport psychologists with tennis players.

Introduction

A very substantial body of research has investigated relationships between measures of psychological states and performance in sport competitions. Although significant relationships have been identified between pre-competition anxiety responses and performance (see Craft, Magyar, Becker, & Feltz, 2003) and between pre-competition mood responses and performance (see Beedie, Terry, & Lane, 2000), the specific characteristics of these relationships are still to be explicated fully.

Multidimensional anxiety theory (Martens, Vealey, & Burton, 1990), which predicts that cognitive anxiety debilitates performance, self-confidence facilitates performance and somatic anxiety shows an inverted-U relationship with performance, has provided the theoretical basis for much of the research into anxiety-performance relationships. However, it has also been proposed that the effects of cognitive and somatic anxiety on performance are interactive rather than discrete, with cognitive anxiety facilitating or debilitating performance depending on an athlete's degree of physiological arousal (Edwards & Hardy, 1996; Hardy, 1990).

With regard to relationships between mood responses and performance, Morgan's (1985) mental health model posits that a mood profile high on vigour, and low on anger, confusion, depression, fatigue, and tension (i.e., a profile indicative of mental health) will be associated with superior athletic performance. Although the model has been extremely influential in guiding research efforts, subsequent summaries of the research evidence (e.g., Terry, 1995) have emphasized the complexities of mood-performance relationships and theoretical advances have highlighted the interactive effects of different mood components upon performance (Lane & Terry, 2000).

Type of sport has frequently been identified as a variable that influences the relationship between psychological states and performance. Generally, it has been shown that pre-competition mindset has a greater impact on performance in individual sports than in team sports. For example, the effectiveness of anxiety and mood measures in predicting successful and unsuccessful performances has been shown to be very high in individual sports, such as karate (93%; Terry & Slade, 1995) compared to team sports, such as hockey (65%; Terry & Youngs, 1996). To date, the sport of tennis has received only limited attention in this research context, although Terry, Cox, Lane, & Karageorghis (1996) found that anxiety and mood scores produced 72% correct classification of match outcome among nationally-ranked junior players in the United Kingdom, and Covassin and Pero (2004) found general support for the propositions of multidimensional anxiety theory and the mental health model in their investigation of college tennis players in the United States.

There have been many calls for a greater focus on intra-individual studies rather than the more common cross-sectional designs (Hanin, 1997; Hassmén, Raglin, & Lundqvist, 2004). Hanin, for example, suggested that equivocal findings regarding the link between pre-competitive affective states and performance may be due to individual differences among cross-sectional samples. To address this issue, Lane and Chappell (2001) conducted a study examining mood-performance relationships for 11 basketball players at the World University Games competition, to compare results of cross-sectional and intra-individual analyses. Cross-sectional results indicated that pre-performance mood explained about 9% of performance variance. When intra-individual relationships between mood and performance were examined, it was shown that performance was significantly related to mood for about half of the group, explaining 40% of variance, whereas mood and performance were unrelated for the remainder of the participants.

Similarly, an investigation of mood-performance relationship among two large groups of junior swimmers (N = 354 and 348, respectively) by Terry, Janover, & Diment (2004) showed that pre-race mood scores accounted for 24% of performance variance in both samples, using cross-sectional analyses. When intra-individual analyses were conducted on 24 swimmers, however, pre-race mood responses explained between 1% and 86% of performance variance. In summary, there is growing evidence to support the proposition that mood-performance relationships are highly individualized, varying significantly from athlete to athlete.

The purpose of the present study was to investigate, among a group of tennis players, relationships between measures of pre-match anxiety and mood responses and subsequent performance, from both cross-sectional and intra-individual perspectives.

Method

Participants

Ninety-two social-competitive tennis players from Sydney's Northern Suburbs, with ages ranging from 19 to 62 years (M = 39.7, SD = 9.8 yr.; male = 49, female = 43) participated in the study. Participants competed in a weekly competition for between 5 and 12 weeks, completing the CSAI-2R shortly before each match played. Players were entered into a prize draw in return for continued participation. This resulted in a dataset of 567 administrations of the scale.

Measures

Anxiety Pre-competition anxiety was assessed using the revised Competitive State Anxiety Inventory-2 (CSAI-2R: Cox, Martens, & Russell, 2003). The CSAI-2R is a 17-item scale that measures cognitive state anxiety (5 items), somatic state anxiety (7 items) and self-confidence (5 items) in a competitive setting. Respondents rate their feelings before competition (e.g., *I feel jittery, I am concerned about losing*) on a scale anchored by 1 = *not at all* and 4 = *very much so*. Subscale scores are calculated by summing items in each subscale, dividing by the number of items, and multiplying by 10. Score range is 10 – 40 for each subscale. The factorial validity of the CSAI-2R was supported by Cox et al. (2003) using confirmatory factor analysis on data from 331 athletes, which showed a good fit of the hypothesised measurement model to the data. Recent independent re-evaluations of the scale have also supported its psychometric integrity (Terry, Lane, & Shepherdson, 2005; Terry & Munro, 2008). Alpha coefficients for the present study were cognitive anxiety = .86, somatic anxiety = .84, and self-confidence = .90.

Mood Pre-competition mood responses were assessed using the Brunel Mood Scale (BRUMS: Terry, Lane, Lane, & Keohane, 1999; Terry Lane, & Fogarty, 2003). The BRUMS, a derivative of the Profile of Mood States (McNair, Lorr, & Droppleman, 1971), is a self-report measure of six, 4-item subscales (anger, confusion, depression, fatigue, tension, vigour). Participants respond to 24 mood descriptors using a response timeframe "How do you feel *right now*?" Subscale scores range from 0-16. Terry and colleagues (1999, 2003) have provided comprehensive support for the validity and reliability of the BRUMS. Alpha coefficients for the present study were anger = .88, confusion = .80, depression = .86, fatigue = .84, tension = .87, and vigour = .87.

Performance All performances were dichotomized into winning and losing outcomes for the purpose of cross-sectional analysis. To assess intra-individual variations in performance, a performance measure was calculated for each set played, by taking the number of games lost from the number of games won and adding a constant of six to avoid negative scores. A player winning a set 6-0 scored 12, whereas a player losing a set 0-6 scored 0.

Procedure

The project received ethical approval from the University of Southern Queensland and all participants provided written informed consent. Participants completed the CSAI-2R and BRUMS approximately 10 minutes prior to each competition. All participants were provided with instructions designed to minimize the influence of social desirability (Martens et al., 1990).

To control for order effects, half of the participants completed the CSAI-2R followed by the BRUMS, while the other half completed these in reverse order.

Results

Data were checked for missing values, distributional properties, and the presence of outliers. Assumptions underlying the statistical procedures used were confirmed. The dataset showed an approximately equal split of winning (n = 290) and losing (n = 277) performances. A discriminant function analysis showed that tennis performances could be correctly classified as winning or losing matches on the basis of pre-competition anxiety and mood scores with 60% accuracy (see Table 1). This represented a significant improvement over chance classification ($\lambda = .952$, $\chi^2 = 27.9$, $p < .01$). Two-thirds of winning performances were correctly classified from pre-competition anxiety and mood scores, whereas only just over half of losing performances were correctly classified.

Anxiety scores alone provided 58.7% correct classifications ($\lambda = .968$, $\chi^2 = 18.4$, $p < .001$) with approximately equal effectiveness for predicting winning and losing performances. Mood scores alone provided 56.8% correct classifications ($\lambda = .971$, $\chi^2 = 16.8$, $p < .01$). For mood scores, it was observed that a much higher percentage of winning performances (74.5%) than losing performances (38.3%) were correctly classified, raising the possibility of a greater potential for predicting winning performances from positive moods than losing performances from negative moods.

Table 1: Correct classification of winners and losers from anxiety and mood scores (N = 567)

Actual group	n	Predicted winners		Predicted losers	
		n	%	n	%
Winners	290	196	67.6	94	32.4
Losers	277	133	48.0	144	52.0

Note. % Correctly classified overall: n = 340 (60.0%)

The discriminant function analysis also identified those subscale scores contributing most to the correct classification of winning and losing performances (see Table 2). CSAI-2R subscale scores for somatic anxiety and self-confidence, and BRUMS subscale scores for anger, confusion, depression and tension, were all significant predictors of performance outcome. Winning performances were, as anticipated, associated with higher self-confidence, and lower somatic anxiety, anger, confusion, depression, and tension.

Given the observed effectiveness of pre-competition psychological measures to correctly classify the outcome of tennis matches on a cross-sectional basis, the same relationships were explored on an intra-individual basis. To facilitate intra-individual analysis it was necessary to trim the dataset to include only those participants who had competed in an adequate number of matches. The threshold was set at seven matches with at least two wins and two losses. This criterion, which included 35 participants, was chosen to provide a balance of performance outcomes across an adequate number of matches to facilitate a meaningful analysis. It is consistent with previous investigations of intra-individual performance (e.g., Lane & Chappell, 2001; Terry, Janover, & Diment, 2004).

Table 2: Discriminant function analysis to classify performance from anxiety and mood scores (N = 567)

Predictor variable	r	F	p
CSAI-2R – Cognitive anxiety	-.34	3.3	NS
CSAI-2R – Somatic anxiety	-.51	7.6	.006
CSAI-2R – Self-confidence	.76	16.5	.000
BRUMS – Anger	-.43	5.4	.02
BRUMS – Confusion	-.70	13.9	.000
BRUMS – Depression	-.61	10.8	.001
BRUMS – Fatigue	-.11	0.4	NS
BRUMS – Tension	-.48	6.7	.01
BRUMS – Vigour	.20	1.2	NS

Note. NS = non-significant.

Single-factor MANOVAs showed that 12 of the 35 participants (34%) displayed a significant association between tennis performance and reported pre-match anxiety and mood responses. Given the availability of normative data for the BRUMS (Terry et al., 2003), data from three participants were converted into standard T-scores to illustrate differing mood-performance relationships among different individuals. Participant A (see Figure 1) reported higher scores on all six subscales prior to losing performances compared to winning performances. The lower vigour scores associated with winning performances ran counter to Morgan's (1985) mental health model and were also inconsistent with typical cross-sectional findings.

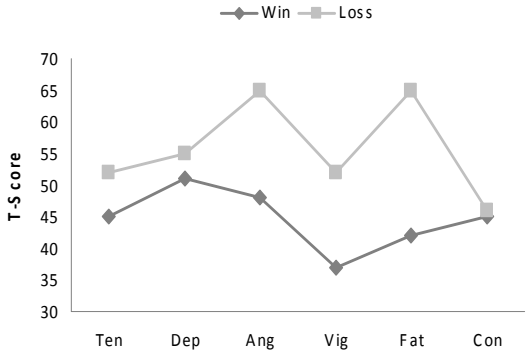

Figure 1. Mean pre-competition mood responses for Participant A prior to winning (n = 5) and losing (n = 2) matches.

Consistent with the mental health model, Participant B reported lower scores for tension, depression, fatigue and confusion and higher scores for vigour prior to wins compared to losses (see Figure 2). On average, tension scores were at the 47th percentile prior to wins and at the 67th percentile prior to losses. Similarly, confusion scores were at the 52nd percentile prior to wins but at the 70th percentile for losses. Atypically, profiles for this player indicated that pre-match anger was facilitative of performance rather than debilitative.

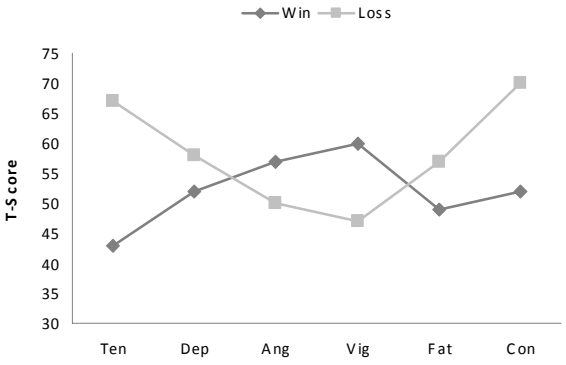

Figure 2: Pre-competition mean mood responses for Participant B prior to winning (n = 4) and losing (n = 3) matches.

Participant C (see Figure 3) reported lower tension, depression, anger, fatigue and confusion, and higher vigour (albeit marginal) prior to winning performances. Notably, depression and anger scores were around the 70th percentile prior to losses but below the 50th percentile prior to wins. These differences are consistent with the mental health model and are stereotypical of the mood-performance relationship as traditionally described (Morgan, 1980).

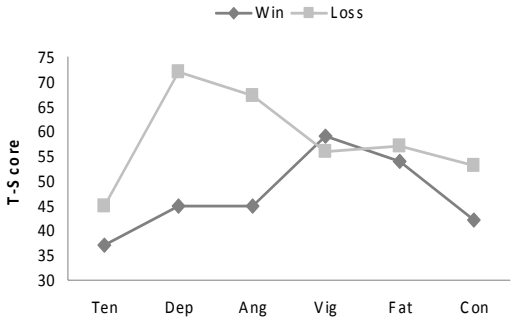

Figure 3: Pre-competition mean mood responses for Participant C prior to winning (n = 4) and losing (n = 3) matches.

Discussion

Results of the present study showed that, from a cross-sectional perspective, pre-competition anxiety and mood responses were predictive of performance outcome among social-competitive tennis players. The outcome of tennis matches was correctly classified from pre-match psychological data in 60% of cases. Predictive effectiveness in the present study was lower than in a previous cross-sectional investigation of tennis players (Terry et al., 1996), which yielded 72% correct classifications of performance outcomes. This is possibly explained by the higher standard of the players recruited previously by Terry and colleagues (national level juniors), given the proposal that psychological factors have a greater influence on performance at higher competition levels, other things being equal (see Terry, 1995). Results of the cross-sectional analysis were generally in line with multidimensional anxiety theory (Martens et al., 1990) and the mental health model (Morgan, 1985).

From an intra-individual perspective, 34% of players showed significant differences in pre-match anxiety and mood responses prior to winning performances compared to losing performances. Importantly, the specific nature of the differences in mood responses varied considerably from individual to individual, and was not always consistent with the mental health model. These findings provide strong support for the notion that mood-performance relationships are highly individualized in the sport of tennis, as has also been demonstrated in the sports of basketball (Lane & Chappell, 2001) and swimming (Terry et al., 2004). Further, the findings confirm that the performances of some tennis players are closely associated with pre-match mindset whereas for other players performance is unrelated to anxiety and mood responses. Such individual differences may serve to mask the predictive

effectiveness of anxiety and mood measures during cross-sectional analyses and researchers should remain aware of this possibility during future investigations. From an applied perspective, these findings may help to guide interventions among tennis players that are designed to enhance performance. It is apparent, however, that practitioners should be mindful of the need to understand the specific association between pre-match mindset and subsequent performance for the individual players involved.

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