Precompetitive Emotions and Shooting Performance: The Mental Health and Zone of Optimal Function Models

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This study tested the utility of Morgan's (1980) Mental Health Model and Hanin's (1980) Zone of Optimal Function Model in an ecologically valid environment. A sample of 12 high-performance adult clay-target shooters were tested over an entire competitive season. Precompetitive mood states were assessed using Schacham's (1983) short version of the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971). Results revealed partial support for Hanin's model but no support for Morgan's model. Discussion focuses on the importance of multiple assessments of precompetitive emotions, recognition of individual differences, and selection of a precise measure of sport performance.

The ability to produce and maintain the appropriate emotional feelings before competition is universally recognized by athletes and coaches as one of the most important factors contributing to athletic performance. Thus it is not surprising that the relationship between precompetitive emotions and sport performance has generated considerable interest from researchers in the field of sport psychology (Gould, Horn, & Spreemann, 1983; Gould, Weiss, & Weinberg, 1981; Highlen & Bennett, 1979; Mahoney & Avener, 1977; Meyers, Cooke, Cullen, & Liles, 1979; Morgan, 1979, 1980; Morgan & Johnson, 1978; Morgan & Pollack, 1977; Silva, Schultz, Haslam, Martin, & Murray, 1985; Silva, Schultz, Haslam, & Murray, 1981).

From a methodological perspective, previous research has often focused on discriminating between successful and unsuccessful performers based on their mood states prior to competition. The Profile of Mood States (POMS) developed by McNair, Lorr, and Droppleman (1971) has been a popular instrument for measuring athletes' affective patterns prior to competition. Sport performance has usually been measured as the placement that athletes achieve in competition.

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relative to their competitors. This placement or ranking has then been used to categorize athletes into successful or unsuccessful groups (i.e., top 10 vs. top 50; qualifiers vs. nonqualifiers).

Results from these studies suggest that successful competitors evidence a more positive psychological profile than less successful competitors. More specifically, it appears that superior performance by elite athletes is reflected in low scores in tension, depression, anger, fatigue, and confusion and high scores in vigor during the precompetitive period. This positive mental health profile has been termed the "iceberg profile" by Morgan (1979), since the five negative emotions fall below the 50th percentile and the one positive emotion lies above it.

Unfortunately, the relationship between precompetitive emotions and sport performance presented by Morgan's Mental Health Model suffers from several conceptual, methodological, and interpretive problems. For instance, none of the studies mentioned above has assessed athletes' mood states more than once during a competitive season to determine whether the Mental Health Model can consistently explain and predict performance. In addition, these studies have exclusively used between-subject comparisons rather than focusing on intraindividual variations, and they have ignored the possibility that precompetitive mood state profiles related to successful and unsuccessful performances may vary across individuals.

Finally, there has also been a lack of precision in the manner that performance has been operationally defined in previous studies. This has created interpretive problems regarding the precompetitive mood state/performance relationship. For instance, some studies have shown that qualifiers for national squads have different mood state profiles at the precompetitive stage of the sport contest than do nonqualifiers (e.g., Silva et al., 1981; Silva et al., 1985). These findings have been interpreted to mean that the mood profile produced the good performances. This interpretation is confounded, however, by the fact that precompetitive status could just as easily produce the mood state profile. Highly ranked athletes who are assured selection are not likely to be overly stressed during qualifying rounds, and as a result they should demonstrate relatively positive precompetitive emotions. On the other hand, borderline athletes are more likely to perceive pressure and are also less likely to be selected. Thus, athlete status could determine mood profiles during the precompetitive period rather than mood profiles determining performance and status.

Support for this proposition is provided from research reported by Heyman (1982). He reanalyzed a series of articles comparing the psychological profile of successful and unsuccessful athletes and found that the successful ones had significantly better season records, more experience, and came from superior training programs. Thus, events preceding the psychological testing and performance criteria appear to have influenced the observed differences. The importance of how sport performance is measured in precompetitive emotion research also is illustrated in a study by Ebbeck and Weiss (1988), who found that A-state was not equally related to various performance measures (i.e., event results vs. the subjective evaluation of performance by coach and athlete). Their findings suggest that the nature of the anxiety/performance relationship is highly dependent on the performance measure selected.

An alternative approach to the study of the relationship between precompetitive emotion and sport performance which takes into account individual differences
has been proposed by Hanin (1980, 1986, 1989). According to Hanin, each individual has an arousal zone of optimal function (ZOF), and performance efficiency is best when the level of arousal falls within this zone. In other words, the ZOF theory predicts that some individuals will have their best performance when highly aroused, others when deeply relaxed, and others when moderately aroused. Hanin’s empirical evidence for this theory is based on the testing of athletes over many competitive trials and thereby demonstrating the validity of the ZOF (Hanin, 1980, 1986).

Empirically, Hanin found a correlation of .74 between successful athletic performance and the degree to which each athlete was able to achieve his or her optimal arousal as measured by the State-Trait Anxiety Inventory (STAI; Spielberger, 1972). Although the ZOF principle has not yet been extended to other emotions (e.g., anger, vigor, depression), it seems reasonable to suggest that there may be an individualistic ZOF for mood states other than arousal/anxiety.

Conceptual support for Hanin’s ZOF principle can be found in recent reviews on the relationship between arousal/anxiety and motor performance (Landers, 1980; Mahoney & Meyers, 1989; Neiss, 1988; Weinberg, 1990). These researchers argue that individual differences appear to mediate optimal arousal/anxiety levels. They recommend using intraindividual measures that compare an athlete’s usual level of arousal/anxiety with changes from this level, and then comparing the impact of these changes on sport performance. The importance of intraindividual analysis when investigating the arousal/anxiety-motor performance relationship has also been demonstrated by Burton (1988), Gould, Petlichkoff, Simons, and Vevera (1987), Klavora (1978), and Sonstroem and Bernardo (1982).

Adopting a multiple assessment approach, recognizing individual differences, and providing precise measurement of sport performance are some of the recommendations that Weinberg (1990) made in a recent review of the relationship between anxiety and motor performance. From a more global perspective, Martens (1987) similarly recommended that the study of athletic behavior be viewed within a heuristic paradigm that emphasizes an idiographic approach (i.e., the in-depth study of the individual performer).

The purpose of the present study was to test the utility of Morgan’s Mental Health Model and Hanin’s ZOF Model in an ecologically valid environment. The sport of shooting was chosen because it represented a closed skill and performance could be assessed precisely. It was hypothesized that precompetitive mood states would be related to shooting performance but that these mood states would be specific to each individual in a manner consistent with Hanin’s ZOF principle. Although no previous sport research directly bears on this issue, it does seem possible that Hanin’s (1980, 1986, 1989) findings on anxiety and athletic performance could be extended to other emotions.

**Method**

**Subjects**

A sample of 11 male and 1 female high-performance clay-target shooters took part in the study. They ranged in age from 16 to 51 years with a mean of 35.6 years. The average number of years of competitive shooting was approximately 11. All shooters were members of a training squad which comprised the best shooters in their state. Before participating, all completed a background information sheet
and consent form agreeing to take part in the study. Subjects were assured that their results would be kept in the strictest confidence.

**Procedure**

Initially, the state coaching director and state squad members were contacted to determine their interest and request their cooperation. A meeting was then arranged to explain and outline the research project, and a testing schedule was organized around the important competitions in each shooter's competitive season. Each shooter subsequently filled out a mood state inventory approximately 10 minutes before each competition throughout the 12-month period. Shooters participated in six to nine major tournaments throughout the 12-month period. The research project was part of a mental skills training program that was developed and implemented by the first author, who was present at approximately 75% of the competitions to ensure that subjects completed the mood state inventory at the appropriate time.

**Mood State Scale**

Schacham's (1983) shortened version of the Profile of Mood States (POMS) was used to assess precompetitive mood states. The scale consists of 37 items that contribute to subscales for tension, depression, fatigue, anger, vigor, and confusion. Schacham found that the correlation coefficients between the shortened and original scales were all above .95, indicating the suitability of the short version for estimating the original mood scale scores. The mood state subscales and the specific items related to them are presented in Table 1. In order to prevent subjects from developing a particular response set, several versions of the mood state inventory were randomly distributed to the shooters. Subjects were asked to respond in terms of how they felt "right now."

**Performance Measures**

Each competition consisted of 100 targets which were shot in four separate rounds of 25. Subjects' performance scores over the competitive season were subdivided

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue</td>
<td>Worn out, bushed, fatigued, exhausted, weary</td>
</tr>
<tr>
<td>Anger</td>
<td>Peeved, bitter, resentful, grouchy, angry, furious, annoyed</td>
</tr>
<tr>
<td>Vigor</td>
<td>Cheerful, vigorous, full of pep, active, energetic, lively</td>
</tr>
<tr>
<td>Tension</td>
<td>Restless, nervous, on edge, tense, uneasy, anxious</td>
</tr>
<tr>
<td>Confusion</td>
<td>Bewildered, forgetful, confused, unable to concentrate, uncertain about things</td>
</tr>
<tr>
<td>Depression</td>
<td>Helpless, sad, worthless, miserable, discouraged, unhappy, blue, hopeless</td>
</tr>
</tbody>
</table>
into one of three categories: optimal, acceptable, and worst. The optimal performance category represented each shooter’s two best scores for the year. The acceptable performance category represented each shooter’s midrange scores. The worst performance category represented each shooter’s two lowest performance scores for the year.

**Results**

**Performance Categories**

Preliminary analyses were conducted to verify that performance scores differed across the three performance categories. Results of a one-way repeated measures ANOVA indicated that there were significant differences among categories, $F(2, 22) = 40.22, p < .001$. Follow-up comparisons using Tukey’s HSD procedure revealed that shooting scores for the optimal category ($M = 83.75$) differed significantly ($p < .01$) from the acceptable category ($M = 78.66$). The acceptable category also differed significantly ($p < .01$) from the worst category ($M = 72.58$).

**Hanin’s ZOF Model**

In order to test the utility of Hanin’s ZOF Model, the following computational procedure was employed. Scores were calculated for the average level of a given mood prior to optimal, acceptable, and worst performance for all subjects. Two difference scores were then obtained for each mood-state variable: (a) that between the level of the mood during optimal and acceptable performances, and (b) that between the level of the mood during optimal and worst performances. Since Hanin’s ZOF Model focuses on the amount rather than the direction of these difference scores, they were treated in terms of their absolute values in the analysis.

Hanin’s theory would be supported if the absolute difference scores between optimal and acceptable performances yielded smaller values than the absolute difference scores between optimal and worst performances. One-way ANOVAs were used to compare difference scores (optimal minus acceptable vs. optimal minus worst) for each of the individual mood state subscales.

A total mood disturbance (TMD) score was also calculated to obtain a single global estimate of mood state. TMD was calculated by adding the five negative mood states (tension, depression, fatigue, anger, and confusion) and then subtracting the one positive mood state (vigor). According to McNair et al. (1971), the TMD score is clinically relevant, and it can be presumed to be highly reliable because of the intercorrelations among the six primary POMS factors.

The validity of TMD has been demonstrated in a number of sport studies using the POMS (e.g., Meyer, Sterling, & LeUnes, 1988; Morgan, Brown, Raglin, O’Connor, & Ellickson, 1987; Nation & LeUnes, 1983; Robinson & Howe, 1987). With the TMD score as the dependent measure, a one-way ANOVA was used to determine whether mood state variations were greater across optimal and worst shoots than across optimal and average ones. Table 2 shows absolute values for the differences obtained between optimal and acceptable shoots as well as those between optimal and worst shoots for TMD and the six POMS subscales.

Results of the ANOVAs conducted on the individual subscales revealed significant differences for anger, $F(1, 11) = 6.59, p < .03$; depression, $F(1, 11) = 7.18, p < .03$; and confusion, $F(1, 11) = 4.85, p < .05$. A trend toward significance was found for fatigue, $F(1, 11) = 3.50, p < .09$. No significant dif-
### Table 2
Absolute Values of Difference Scores for Precompetitive Mood States

<table>
<thead>
<tr>
<th>Variables</th>
<th>Optimal vs. acceptable performances</th>
<th>Optimal vs. worst performances</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Tension</td>
<td>2.40</td>
<td>1.42</td>
</tr>
<tr>
<td>Anger**</td>
<td>1.65</td>
<td>2.53</td>
</tr>
<tr>
<td>Fatigue*</td>
<td>2.59</td>
<td>1.58</td>
</tr>
<tr>
<td>Vigor</td>
<td>2.72</td>
<td>1.92</td>
</tr>
<tr>
<td>Depression**</td>
<td>1.54</td>
<td>1.49</td>
</tr>
<tr>
<td>Confusion**</td>
<td>0.87</td>
<td>1.53</td>
</tr>
<tr>
<td>TMD**</td>
<td>7.56</td>
<td>5.45</td>
</tr>
</tbody>
</table>

*TMD = total mood disturbance; *p < .10; **p < .05.

Results of the TMD analysis revealed a significant difference in mood state variation for “optimal minus acceptable” performances as compared to “optimal minus worst” performances, $F(1,11) = 7.66, p < .02$. As predicted, scores were greater for the “optimal minus worst” condition than for the “optimal minus acceptable” condition for all variables in which differences were obtained (see Table 2). A graphic representation of these results is presented in Figure 1.

**Morgan’s Mental Health Model**

In order to test the utility of Morgan’s Mental Health Model, raw mood state scores were compared across the different performance categories (optimal, acceptable, and worst). One-way ANOVAs were conducted for TMD and each of the six subscales in order to make these comparisons. TMD was calculated by adding the five negative mood states (tension, depression, fatigue, anger, and confusion) and then subtracting the one positive mood state (vigor). Evidence supporting this model would be obtained if generalized differences in mood state scores were found across performances of varying quality.

Mean values of the mood state variables for each performance category are presented in Table 3. Results of the ANOVAs revealed no significant differences in TMD across optimal, acceptable, and worst performances, $F(2,22) = 0.02, p > .98$. Similar results were obtained for each of the six POMS subscales when they were examined (all $F$ ratios < 1, all $p$ values > .45). A graphic representation of these results is presented in Figure 2.

**Discussion**

The results of this field investigation provide partial support for the utility of Hanin’s ZOF Model but no support for the utility of Morgan’s Mental Health Model. When mood states were examined in relation to intrasubject variation,
significant differences were evident across acceptable and worst performances for anger, depression, confusion, and TMD. There was also a trend (p<.09) toward differences in fatigue (see Table 2 and Figure 1). When mood states were examined without respect to intrasubject variation, no such differences were obtained (see Table 3 and Figure 2).

One possible reason the data failed to support the utility of Morgan’s theory, and the results from some previous studies (e.g., Morgan, 1979, 1980; Silva et al., 1985), may be the different testing procedure used in the present investigation. In previous research for instance, subjects’ precompetitive mood states have often been assessed only once whereas subjects in the present study were assessed many times over the competitive season.

Our findings from this multiple-assessment approach support the suggestion that mood states are extremely malleable (Vallerand, 1984) and individualistic (Landers, 1980; Mahoney & Meyers, 1989; Neiss, 1988; Weinberg, 1990)
Table 3

Raw Precompetitive Mood State Scores for Optimal, Acceptable, and Worst Performances

<table>
<thead>
<tr>
<th>Variables</th>
<th>Optimal</th>
<th></th>
<th>Acceptable</th>
<th></th>
<th>Worst</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Tension</td>
<td>8.60</td>
<td>3.03</td>
<td>8.76</td>
<td>4.23</td>
<td>7.95</td>
<td>4.18</td>
</tr>
<tr>
<td>Anger</td>
<td>2.68</td>
<td>3.34</td>
<td>2.77</td>
<td>4.75</td>
<td>2.33</td>
<td>4.73</td>
</tr>
<tr>
<td>Fatigue</td>
<td>2.90</td>
<td>1.94</td>
<td>2.61</td>
<td>3.03</td>
<td>3.70</td>
<td>4.94</td>
</tr>
<tr>
<td>Vigor</td>
<td>9.15</td>
<td>5.17</td>
<td>8.23</td>
<td>5.41</td>
<td>8.45</td>
<td>5.34</td>
</tr>
<tr>
<td>Depression</td>
<td>2.90</td>
<td>3.92</td>
<td>2.16</td>
<td>3.16</td>
<td>2.45</td>
<td>4.34</td>
</tr>
<tr>
<td>Confusion</td>
<td>2.36</td>
<td>2.45</td>
<td>1.54</td>
<td>1.76</td>
<td>2.41</td>
<td>2.76</td>
</tr>
<tr>
<td>TMD&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.36</td>
<td>3.90</td>
<td>9.62</td>
<td>5.35</td>
<td>10.41</td>
<td>7.88</td>
</tr>
</tbody>
</table>

<sup>a</sup>TMD = total mood disturbance;

Note. None of the group differences are significant.

and that the relationship between precompetitive mood states and sport performance is more complex than is acknowledged by Morgan’s model. To simply average across subjects ignores the possibility that a score of 5 on a particular mood subscale may be a high score for one athlete but a low score for another. Thus, similar scores could produce performance differences for different individuals. In other words, an athlete’s specific reaction and pattern of emotional change may be more important than the absolute level of the emotion in determining performance (Weinberg, 1990).

Another possible reason for failure to support the utility of Morgan’s theory may be the different way that sport performance was operationally defined in the present study. For example, previous studies have shown that qualifiers for national squads have different mood profiles before competition than do non-qualifiers. These findings have often been interpreted to mean that the profile produced the good performance. However, this interpretation is confounded by the fact that precompetitive status could just as easily have produced the mood profile. Athletes who were assured selection were likely to demonstrate positive precompetitive mood states whereas those who were borderline were likely to have been more anxious, tense, confused, and so forth. Thus, status may determine the mood state profile before competition rather than the mood state profile determining performance and status.

Heyman’s (1982) research comparing successful and unsuccessful competitors provides general support for this proposition. His findings suggest that previous success needs to be considered along with preperformance psychological assessment when predicting contest outcome. In the present study, sport performance was operationalized in more personal terms whereby the athletes competed against their own performance standard. Therefore status was unlikely to bias the relationship between precompetitive emotions and performance.

The results of the present study supported the hypotheses that precompetitive
mood states related to shooting performance would be specific to each individual in a manner consistent with Hanin’s Zone of Optimal Function Model (Hanin, 1980, 1986, 1989). Support for the utility of Hanin’s theory was clearly demonstrated by the finding that mood state difference scores across optimal and acceptable performances consistently yielded smaller values than difference scores across optimal and worst performances. TMD and all six mood state subscales conformed to this pattern, with significant differences evident in four of these measures (i.e., anger, depression, confusion, and TMD).

These findings are consistent with the suggestion that individual differences need to be considered when investigating the relationship between emotions and sport performance (Landers, 1980; Mahoney & Meyers, 1989; Martens, 1987; Neiss, 1988; Weinberg, 1990). The present findings also support the suggestion that Hanin’s ZOF principle can be extended to emotions other than anxiety (e.g., confusion, anger, depression). Hanin’s research as well as that of others (Burton, 1988; Gould et al., 1987; Sonstroem & Bernardo, 1982) who have utilized an intrasubject approach have exclusively investigated the emotion of anxiety.
A number of important implications can be drawn for the coach and practicing sport psychologist. For instance, since precompetitive mood states related to optimal performance were found to vary across individuals, it would seem prudent to ascertain what can be done to help athletes develop and maintain their ideal performance mood state prior to competition. It is recommended that precompetitive mood state levels particular to each athlete be measured over a series of competitions. This would help identify the specific mood states that are conducive for optimal performance to consistently occur.

Once this is done, specific self-regulation strategies such as biofeedback (Daniels & Landers, 1981; DeWitt, 1980), coping skills (Meichenbaum, 1977), psyching-up (Weinberg, Gould, & Jackson, 1980), and/or mental imagery (Feltz & Landers, 1983) could be introduced to alter debilitating precompetitive mood states and to facilitate productive mood states. The findings of the present study argue against the use of group oriented assessment as well as the use of group oriented intervention procedures because they do not consider individual differences.

Although we have argued that these data support the utility of Hanin’s ZOF Model, the findings must be interpreted with certain methodological limitations in mind. Perhaps the most important of these limitations is the use of multiple univariate analyses and the corresponding risk of Type I error. If a more conservative alpha had been employed to compensate for multiple ANOVAs, some of the effects noted in Table 2 may not have been statistically significant.

We acknowledge the possibility that one or more of these differences could be due to chance, but we believe there is evidence for the utility of the ZOF model despite this potential problem. To begin with, two-tailed (.05) tests were used to examine directional hypotheses which could have been justifiably evaluated using one-tailed (.10) tests. In addition, all of the significant differences occurred for the Hanin model rather than the Morgan model. This pattern of results suggests that the differences were systematic rather than random.

Finally, the difference scores calculated from the three performance categories were consistently in the direction predicted by the ZOF Model. This characteristic of the data is apparent in both Table 2 and Figure 1, which show that all seven mood state variables produced scores that were in the expected direction. Nevertheless, at this stage it may be prudent to interpret these differences as consistent trends rather than significant effects.

The small sample size represents a second methodological limitation in the present study. Certainly replicative research using an in-depth idiographic approach with larger numbers of subjects is needed to provide more definitive support of Hanin’s ZOF Model. A particularly interesting direction for this research appears to be the extension of Hanin’s ZOF principle to emotions other than anxiety. Studies along these lines could provide a number of practical benefits for coaches, athletes, and sport psychologists.

References


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