Predictive Validity of a Three-Dimensional Model of Performance Anxiety in the Context of Tae-Kwon-Do

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We tested the predictive validity of the recently validated three-dimensional model of performance anxiety (Chang, Hardy, & Markland, 2009) with elite tae-kwon-do competitors (N = 99). This conceptual framework emphasized the adaptive potential of anxiety by including a regulatory dimension (reflected by perceived control) along with the intensity-oriented dimensions of cognitive and physiological anxiety. Anxiety was assessed 30 min before a competitive contest using the Three-Factor Anxiety Inventory. Competitors rated their performance on a tae-kwon-do–specific performance scale within 30 min after completion of their contest. Moderated hierarchical regression analyses revealed initial support for the predictive validity of the three-dimensional performance anxiety model. The regulatory dimension of anxiety (perceived control) revealed significant main and interactive effects on performance. This dimension appeared to be adaptive, as performance was better under high than low perceived control, and best vs. worst performance was associated with highest vs. lowest perceived control, respectively. Results are discussed in terms of the importance of the regulatory dimension of anxiety.

**Keywords:** regulatory dimension of anxiety, perceived control, Three-Factor Anxiety Inventory, interactive effects, contextual variables

In recent years, advances have been made in both the conceptualization and the measurement of performance anxiety in the sports domain. Nevertheless, there remains debate regarding fundamental issues. Noteworthy, empirical data concerning anxiety effects on sports performance have shown anxiety to be not only debilitative but also facilitative (Edwards & Hardy, 1996; Parfitt, Hardy, & Pates, 1995; Woodman & Hardy, 2003). Some researchers in sport psychology (Burton & Naylor, 1997; Jones, 1995; Jones & Hanton, 2001) have argued that facilitative anxiety is a mislabeling of positive (pleasant) affect states and that anxiety cannot be
Validity of Three-Dimensional Anxiety

associated with good performance. However, although anxiety is almost universally
defined as unpleasant or aversive (Diagnostic and Statistical Manual of Mental
Disorders, fourth edition, text revision; American Psychiatric Association, 2000; Ohman, 2000), this is insufficient grounds to conclude that such a complex emotion
can lead only to negative consequences with regard to sports performance. Like-
wise, it is also doubtful that pleasant states lead only to facilitative effects (Hanin,
1997; Hardy, 1998; Woodman & Hardy, 2001); for example, over-excitement may
impact performance just as negatively as maladaptive anxiety.

To account for some of the inconsistent conceptualizations in the anxiety-per-
formance literature in sport psychology, an integrated three-dimensional model of
performance anxiety (i.e., with cognitive, physiological and regulatory dimensions)
was recently proposed with some initial empirical support across cultures for the
associated Three-Factor Anxiety Inventory (Cheng, Hardy, & Markland, 2009, in
press). Within this model, the construct of performance anxiety was defined as an
unpleasant psychological state in reaction to perceived threat concerning the per-
formance of a task under pressure. Along with the intensity-oriented dimensions of
cognitive and physiological anxiety, a regulatory dimension of anxiety was included
as an explicit reflection of the potentially adaptive capacity of anxiety. This adaptive
potential emphasized in the three-dimensional framework of performance anxiety
is consistent with the evolutionary root of anxiety as a defense mechanism that is
meant to be functional (Ohman, 2000) by sending out warning signals that prepare
the individual to respond more effectively to perceived threat. Furthermore, Calvo
and Cano-Vindel (1997) suggested that anxiety accomplishes its protective function
by mobilizing resources to provide energy and prepare for vigorous action. Such a
notion is also reflected in processing efficiency theory (Eysenck & Calvo, 1992).
Eysenck and Calvo proposed that a control system (with respect to the central or
working memory executive) is involved in anxiety that monitors performance,
regulates the use of processing resources, and may allocate additional resources to
the task at hand. This appears to be one of the main characteristics that differenti-
ates anxiety from depression, as depressed individuals exhibit little application
of the control system to cope adaptively with perceived stress (Eysenck, 1992;
Mathews, 1992). Taken together, anxiety’s adaptive potential relates mainly to a
self-regulatory function to mobilize resources to cope adaptively with perceived
threat. The anxiety model incorporates the regulatory dimension so that not only
quantitative (intensity) but also qualitative variations (adaptive potential of mobiliz-
ing resources) in anxiety can better be represented.

Specifically in this model, the regulatory dimension was indicated by perceived
control (concerning perceived capability of coping and goal-attainment of the
performance task under pressure), which is consistent with a number of conceptual
considerations (Carver & Scheier, 1988; Eysenck & Calvo, 1992; Ohman, 2000).
The notion of control has been suggested as playing a key role in the variations of
anxiety. In particular, Carver and Scheier proposed that favorable versus unfavorable
expectancy regarding coping and completion of an action was a critical variable,
resulting in a fundamental variation in response to, and the effects of, anxiety. Such
conceptualization closely taps the construct of perceived control. Furthermore,
perceived control is involved in self-evaluation, a key process underlying anxiety
dynamics (Gibbons, 1990; Izard, 1972). Consequently, in the three-dimensional
model of anxiety, it was proposed that anxious individuals may evaluate not only
environmental and internal threats (inducing cognitive/physiological anxiety), but also their capabilities for coping with them and meeting the task demands (perceiving various levels of control or lack of control) in reaction to perceived stress. In other words, perceived control appears to be one of the characteristics of anxiety, representing its regulatory component. The adaptive capacity (regarding mobilization of resources) involved in anxiety is channeled via how much the anxious individual perceives s/he is capable of coping and attaining goals of the task under pressure.

It is worth noting that the component of perceived control here may seem related both to “self-confidence” in the measurement model of Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Burton, Vealey, Bump, & Smith, 1990) and to the “directional dimension” in Jones’s (1995) control model of anxiety, as all these constructs concern goal-attainment. However, each is fundamentally different in relation to anxiety. Specifically, self-confidence was not originally conceptualized as part of anxiety; it emerged unexpectedly as a factor in the exploratory factor analysis and was later considered to be the opposite end of a bipolar factor to worry. Along similar lines, Jones’s directional dimension (relating to the notion of control) was not an integrated factor of anxiety as only symptoms that were interpreted as debilitative were regarded as anxiety. Clearly, neither self-confidence nor the directional dimension (i.e., symptom interpretation) reflects the adaptive capacity of anxiety, which in contrast is the main feature of the proposed regulatory dimension (i.e., perceived control) in the three-dimensional model of anxiety.

Another characteristic of the three-dimensional framework is that cognitive anxiety incorporates self-focused attention and worry, and that physiological anxiety incorporates autonomic hyperactivity and somatic tension. This was in accordance with the multidimensional approach in test anxiety where many researchers have argued that more components are necessary to better reflect the complexity of anxiety (Hagtvet & Benson, 1997; Hodapp & Benson, 1997; Schwarzer & Jerusalem, 1992). The main theoretical connection between self-focused attention (defined by Cheng et al., 2009, as an attentional shift to the self, leading to a self-evaluative state with an increased awareness of self-shortcomings concerning performance of the task under pressure) and anxiety is through the process of self-evaluation, one critical process involved in anxiety (Gibbons, 1990; Izard, 1972). Self-evaluation cannot occur unless attention is focused on the self, so that self-focused attention links directly to anxiety through its impact on emotional awareness and through the self-evaluation it causes (Gibbons, 1990). Schwarzer and Jerusalem (1992) further posited that anxious individuals can be characterized as being self-preoccupied especially regarding their personal limitations. Such a cognitive bias to attend to internal threat-related stimuli is suggested as a vulnerability factor in trait anxiety (Calvo & Cano-Vindel, 1997). In line with the accumulation of research relating self-focused attention to anxiety (Carver & Scheier, 1988; Derakshan & Eysenck, 2001; Liao & Masters, 2002; Schwarzer & Jerusalem, 1992; Wicklund, 1991), the three-dimensional model included self-focused attention to expand the scope of the cognitive dimension.

In terms of the differentiation of physiological anxiety components, the criteria used for generalized anxiety disorder in the DSM-III-R (APA, 1987) were applied. In detail, the anatomical structure (voluntary vs. involuntary muscle groups) was used to define the two physiological subcomponents of autonomic hyperactivity

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(defined as physiological reactions involved with the involuntary muscle groups that are associated with the body’s inner organs, manifested as breathlessness, cold sweat, dry mouth, etc.), and somatic tension (defined as physiological reactions involved with the voluntary muscle groups that are motor-oriented, manifested as trembling, muscle tension, fatigue, etc.). The content of the physiological dimension in the three-dimensional model was thus better represented by such a conceptual differentiation. However, research on the proposed model showed support for a three-dimensional first-order model (in which the pairs of cognitive and physiological anxiety subcomponents were combined) rather than a hierarchical five-dimensional model. Consequently, these subcomponents of cognitive and physiological anxiety were retained at a conceptual level until further discriminant validity is obtained (for detail, see Cheng et al., 2009). Nevertheless, the integrity of the conceptual framework is considered intact, as such a factor structure of three dimensions distinctly reflects the three major processes (cognitive, physiological, and regulatory) that are proposed to be activated in the dynamics of anxiety experience.

Based on conceptual and empirical considerations, the main assumptions of the three-dimensional framework were that the regulatory dimension of anxiety (Carver & Scheier, 1988; Eysenck & Calvo, 1992; Jones, Swain, & Hardy, 1993) and the interactions between the anxiety dimensions (Edwards & Hardy, 1996; Woodman & Hardy, 2003) would prove to be strong predictors of anxiety effects upon performance. The present study aimed to examine the predictive validity of the three-dimensional model of anxiety in the competitive context of elite tae-kwon-do sports performance. Consistent with the assumptions of this model, three predictions were developed in the present research. These are introduced next.

As an initial test of the model, the relative impact of the three anxiety dimensions upon sports performance was to be assessed. Within the conceptual framework, the additional regulatory dimension in particular was proposed to contribute to the complex anxiety-performance relationship (Cheng et al., 2009). Indeed, although previous research using the CSAI-2 (Martens et al., 1990) to investigate the anxiety-performance relationship has shown equivocal (and sometimes nonsignificant) results (Edwards & Hardy, 1996; Gould, Petlichkoff, Simons, & Vevera, 1987; Krane, Williams, & Feltz, 1992), the subscale of self-confidence in the CSAI-2 appears to be a reliable predictor of performance (Craft, Magyar, Becker, & Feltz, 2003; Jones et al., 1993; Woodman & Hardy, 2003). Furthermore, research on Jones’s directional dimension of anxiety has revealed that interpretation of anxiety symptoms predicts performance better than intensity of anxiety (Jones et al., 1993). These findings suggest that factors concerning goal-attainment would critically impact performance under the anxiety dynamics. Consequently, we hypothesized in the current study that perceived control would account for significant additional performance variance when controlling for cognitive and physiological anxiety.

Another important issue contributing to the prediction of the anxiety-performance relationship is the interactive influence of anxiety subcomponents upon performance. As long ago as the 1960s, research in test anxiety revealed interactive effects for worry and emotionality upon performance (Liebert & Morris, 1967). In sport anxiety, the cusp catastrophe model was the first model to explicitly predict interactive effects of anxiety variables (Hardy, 1996). Consequently, the second objective of the present research was to examine the predictive potential of interactions
among the anxiety dimensions. Consistent with previous findings (Edwards & Hardy, 1996; Hardy, Woodman, & Carrington, 2004; Liebert & Morris, 1967; Woodman & Hardy, 2003), and Hardy’s (1996) proposition that interactions between anxiety components would contribute to performance, we hypothesized here that interactive effects of the anxiety components would account for significant additional performance variance over and above the main effects.

Given the complexity of the present model, there exists the possibility of three two-way interactions and one three-way interaction. As the regulatory dimension is the main feature of the model, it was of particular interest to examine the interplay between this qualitative dimension (concerning the adaptive capacity of anxiety) and the other quantitative (intensity) dimensions. Based on the proposition that perceived control is associated with the adaptive potential of anxiety within the three-dimensional model, and Hardy’s (1996) suggestion that self-confidence might protect cognitively anxious individuals from catastrophic drops in performance, we hypothesized that perceived control would attenuate the maladaptive effects of (cognitive and/or physiological) anxiety intensity upon performance.

**Method**

**Participants**

Because contextual variables may impact the anxiety-performance relationship (Jones et al., 1993; Martens et al., 1990), we investigated only a single sport: tae-kwon-do. This sport was specifically chosen for several reasons. First, individual sports have been suggested to evoke greater changes in, and higher levels of, precompetitive anxiety than team, noncontact, and objectively scored sports (Cerin, 2004; Martens et al., 1990; Woodman & Hardy, 2003). Second, the overall duration of a complete tae-kwon-do contest is relatively short (10 min) such that the variation in anxiety between pre- and within-competition should be minimized. Given that it is practically impossible to measure anxiety during performance, the anxiety state measured before such a sports competition may show better predictive power with regard to subsequent performance than would other sports of longer duration.

The participants of the study were all university-based tae-kwon-do athletes at the National Intercollegiate Athletic Games, which is the most important and largest-scale annual competition for all university sports in Taiwan. There were two levels of sports ability involved in this tae-kwon-do competition. Only those competing at a highly skilled level (i.e., who majored in tae-kwon-do and trained daily for several hours) were included in the current study. As skill level may exert a significant effect in the context of anxiety and performance (Jones et al., 1993), this subgroup of a very high standard was targeted because such athletes are more aware of their stress states and have a better capacity to assess their own performance than would performers at a less-skilled level. The sample consisted of 99 participants ($n_{men} = 54$; $n_{women} = 45$) from the sports majoring departments of seven universities in Taiwan. Thirty-seven participants were international competitors, and 15 had won medals in world-class competitions. The mean age was 20.51 years ($SD = 1.72$), which was comparable across sexes (men = 20.61, $SD = 1.88$; women = 20.38, $SD = 1.51$).
Measures

**Anxiety Measure.** The Chinese version of the Three-Factor Anxiety Inventory (TFAI; Cheng, 2007; Cheng et al., in press) was used in this investigation. The development of this measure of performance anxiety was based on the three-dimensional model and its accordant measure previously established in English (for detail, see Cheng, 2007; Cheng et al., 2009). Factorial validity of both versions has previously been confirmed via confirmatory factor analysis (CFA) in multiple samples (i.e., two in English and three in Chinese) of 1502 participants in total. All the fit indices for the final three-dimensional model revealed a fit in the five CFA studies, with RMSEA values ≤ .06, CFI values ≥ .97, SRMR values < .08, and robust chi-square ratios ranged from 1.5 to 2.4. (Cheng, 2007; Cheng et al., 2009, in press). The Chinese TFAI comprised 21 items, with 10 items for the cognitive dimension, 7 items for the physiological dimension, and 4 items for the regulatory dimension (see the appendix at the end of this article for an English translation of all scale items). A 5-point Likert scale from 1 (*totally disagree*) to 5 (*totally agree*) was adopted. The internal consistency of the three subscales was assessed by Cronbach’s alpha reliability coefficient. Good internal consistency was revealed, with alpha ranging from .78 to .87 in previous validation studies (Cheng, 2007; Cheng et al., in press) and .85 to .86 in the present sample.

**Performance Measure.** Using the approach previously adopted by Hardy and Hutchinson (2007), a self-report measure of tae-kwon-do sport performance was specially developed for the current study. A total of six items for assessing elite tae-kwon-do performance were developed in consultation with the former Olympic coaching team for the Taiwan tae-kwon-do athletes that won two Olympic gold, one silver, and two bronze medals (in the 2004 and 2008 Olympics), as well as several senior and internationally licensed referees in Taiwan. Based on the consensus of these tae-kwon-do experts, the six items of the performance scale assessing elite tae-kwon-do were (a) attacking aggressively and effectively, (b) fighting back efficiently, (c) putting personal effort into optimal performance, (d) employing effective competitive strategies, (e) having sufficient physical energy and strength, and (f) reacting appropriately to all competitive situations. Level of performance was self-rated on a 10-point Likert scale from 1 (*totally unsatisfactory*) to 10 (*highly satisfactory*). This performance measure was pilot tested on seven tae-kwon-do performers from the targeted study population to ensure the clarity of the wording and comprehensibility of the scale. Factorial validity of the single-factor performance measure was confirmed in the present sample (*N* = 99) via CFA, $\chi^2(9) = 19.82$, RMSEA = .06, CFI = .99, SRMR = .05. The factor loadings of the six performance items ranged from .85 to .61, and the Cronbach alpha of the scale was .85.

**Procedure**

All participants and team coaches were contacted and briefed on the objective of the study by the first author two weeks before the competition, and were briefed again on the procedure one day before their competition. Written informed consent was provided by each participant. The tae-kwon-do competition lasted for four days with matches from Round 1 to Round 5 if performers continued to win. Round
I was specifically targeted so that data could be collected from all participants. They were asked to complete the Three-Factor Anxiety Inventory 30 min before their first round match. Within 30 min after this match, performers completed the six-item performance measure in relation to the contest that they had just finished. Confidential treatment of the participants’ responses was guaranteed. All questionnaires were anonymous and administered by a small group of trained research assistants, who were familiar with tae-kwon-do sports and therefore had a better capacity for building good rapport with participants under the stressful circumstances.

**Data Analysis**

The main analysis was moderated hierarchical regression. However, *t* tests were conducted first to examine possible gender effects (Edwards & Hardy, 1996) in the independent variables (the scores of the three TFAI subscales) and dependent variable (tae-kwon-do performance score). The data from the three anxiety subscales were then standardized before forming the cross-product terms to remove the potential problem of multicollinearity in interactive models (Cronbach, 1987; Jaccard, Turrisi, & Wan, 1990). Based on the predictions of the present research, the predictors were entered in the regression in three steps: (1) cognitive anxiety, physiological anxiety, (2) perceived control, and (3) cognitive anxiety × physiological anxiety, perceived control × cognitive anxiety, perceived control × physiological anxiety, and the three-way interaction term.

**Results**

No significant gender differences were detected using *t* tests in any of the independent and dependent variables. Correlational analysis was initially used to identify zero-order relationships among variables (Table 1). The largest correlation among independent variables was between the cognitive and physiological dimensions, which was moderate (*r* = .56, *p* < .001). With regard to the correlations between the anxiety subcomponents and performance, perceived control was most strongly related to performance (*r* = .46, *p* < .001). Descriptive data (*M* and *SD*) on the scores of the three anxiety dimensions and tae-kwon-do performance are reported in Table 2.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Intercorrelations Among Three Dimensions of Anxiety and Performance</th>
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<tr>
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<td>2</td>
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<tr>
<td>1</td>
<td>Performance</td>
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<tr>
<td>2</td>
<td>Perceived control</td>
</tr>
<tr>
<td>3</td>
<td>Physiological anxiety</td>
</tr>
<tr>
<td>4</td>
<td>Cognitive anxiety</td>
</tr>
</tbody>
</table>

**p < .001.**
As no significant gender differences were obtained, data were standardized within the whole sample before being subjected to moderated hierarchical regression analysis (Cronbach, 1987; Jaccard et al., 1990). The total performance variance explained by the whole model was 37%, $F(7, 91) = 7.59, p < .001$. A summary of the results is presented in Table 3. Cognitive and physiological anxiety accounted for only 2% of performance variance; perceived control accounted for a significant additional 20% of performance variance. However, the prediction of cognitive anxiety on performance was enhanced significantly ($\beta = .32, p < .01$) when the perceived control $\times$ physiological anxiety interaction was added to the regression model (at Step 3).

### Table 2 Descriptive Data on the Anxiety Dimensions and Tae-Kwon-Do Performance

<table>
<thead>
<tr>
<th></th>
<th>$M$</th>
<th>$SD$</th>
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<tbody>
<tr>
<td>1. Cognitive anxiety</td>
<td>3.19</td>
<td>0.70</td>
</tr>
<tr>
<td>2. Physiological anxiety</td>
<td>2.38</td>
<td>0.79</td>
</tr>
<tr>
<td>3. Perceived control</td>
<td>3.63</td>
<td>0.75</td>
</tr>
<tr>
<td>4. Tae-kwon-do performance</td>
<td>5.30</td>
<td>1.64</td>
</tr>
</tbody>
</table>

*Note.* The measures of anxiety and tae-kwon-do performance are with 5-point and 10-point Likert scales respectively.

### Table 3 Summary of Moderated Hierarchical Regression for Anxiety Variables Predicting Performance

<table>
<thead>
<tr>
<th>Variables Entered</th>
<th>$R^2$</th>
<th>$R^2_{\text{change}}$</th>
<th>$F_{\text{change}}$</th>
<th>$\beta$</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive anxiety</td>
<td>.02</td>
<td>.02</td>
<td>.92</td>
<td>.32</td>
<td>2.73*</td>
</tr>
<tr>
<td>Physiological anxiety</td>
<td></td>
<td></td>
<td></td>
<td>-.05</td>
<td>-.43</td>
</tr>
<tr>
<td>Step 2</td>
<td>.22</td>
<td>.20</td>
<td>24.87**</td>
<td>.41</td>
<td>3.94**</td>
</tr>
<tr>
<td>Perceived control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>.37</td>
<td>.15</td>
<td>5.27**</td>
<td>.10</td>
<td>.83</td>
</tr>
<tr>
<td>Cognitive anxiety $\times$ Physiological anxiety</td>
<td></td>
<td></td>
<td></td>
<td>.09</td>
<td>.74</td>
</tr>
<tr>
<td>Perceived control $\times$ Cognitive anxiety</td>
<td></td>
<td></td>
<td></td>
<td>-.38</td>
<td>-3.60**</td>
</tr>
<tr>
<td>Perceived control $\times$ Physiological anxiety</td>
<td></td>
<td></td>
<td></td>
<td>.16</td>
<td>1.44</td>
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<tr>
<td>Perceived control $\times$ Cognitive anxiety</td>
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*Note.* The $\beta$ values are the results of the inclusion of all seven anxiety variables in the regression model. $^*p < .01$. $^{**}p < .001$. 

The interactive effects of anxiety variables significantly accounted for 15% of the performance variance after the variance explained by the three main effects of anxiety were controlled for. Noteworthily, only the interaction of perceived control \( \times \) physiological anxiety significantly improved the prediction (\( \beta = -.38, p < .001 \)). The nature of the significant perceived control \( \times \) physiological anxiety interaction is illustrated in Figure 1. In line with Tabachnick and Fidell’s (2001) recommendations, a plot was generated by solving the regression equation with unstandardized coefficients at chosen levels of physiological anxiety (using ±1 for high and low physiological anxiety, respectively). Moreover, the significant interaction was followed up by the analysis of simple regression on perceived control predicting performance under high physiological anxiety (scores above the mean; \( n = 46, SD = .48 \)) and low physiological anxiety (scores below the mean; \( n = 53, SD = .44 \)). Tests of these simple slopes showed that the positive relationship between perceived control and performance was significant under low physiological anxiety (\( \beta = .66, t = 6.29, p = .00 \)) but not under high physiological anxiety (\( \beta = .20, t = 1.38, p > .05 \)).

![Figure 1 — Interaction between perceived control and physiological anxiety on performance.](image)

**Discussion**

This study aimed to examine the predictive validity of the proposed three-dimensional model of performance anxiety. The main characteristic of this model is that a regulatory dimension is included to explicitly reflect the potential adaptive capacity underlying the dynamics of anxiety. Based on this conceptual framework of anxiety, two of the predictions for precompetitive anxiety on elite tae-kwon-do performance were initially supported by the current findings. More research is required to further evaluate the third hypothesis.
Consistent with the first hypothesis, perceived control accounted for a significant proportion of performance variance over and above that accounted for by cognitive and physiological anxiety. In fact, perceived control was the single best predictor of performance, which supported our proposition that the regulatory dimension of anxiety would exhibit a crucial impact on performance. This finding is compatible with the related suggestion that self-confidence (as a factor concerning goal-attainment) may protect against potential debilitative anxiety effects (Hardy, 1996; Hardy et al., 2004). In addition, cognitive anxiety may positively predict performance. However, the prediction of cognitive anxiety was not significant until the interaction of perceived control × physiological anxiety was included in the regression. This implies a suppression effect (Conger, 1974; Tabachnick & Fidell, 2001) that the importance of an independent variable (i.e., cognitive anxiety) was considerably enhanced by the other predictor (i.e., perceived control × physiological anxiety) via the suppression of irrelevant variance in that variable (cognitive anxiety). Although the nature of such effect is beyond the scope of the present research, this finding is not in conflict with any of the three predictions tested in the study.

As hypothesized, the interactive effects of anxiety variables made a significant contribution to performance variance once the main effects had been accounted for. Noteworthy, the interaction of perceived control and physiological anxiety emerged as a significant predictor. This is interesting in that the relationship of physiological anxiety and performance thus appears to be nonlinear in the current study, which is consistent with previous assumptions on the pattern of physiological anxiety and performance in other anxiety models, i.e., multidimensional anxiety theory (Martens et al., 1990) and catastrophe model (Hardy, 1996).

The present interaction shows that performance was enhanced more obviously by increased perceived control under low physiological anxiety (see Figure 1). Best performance was thus associated with high perceived control and low physiological anxiety. Although performance was not significantly improved with increased perceived control under high physiological anxiety, it was at least maintained (not impaired). Perceived control appeared to be adaptive as performance was better with high (than with low) perceived control despite the level of physiological anxiety. However, the beneficial effects of perceived control on performance were neutralized by high physiological anxiety in this sample of highly skilled tae-kwon-do competitors. More research is thus required to further investigate the third prediction that perceived control would attenuate maladaptive effects of anxiety intensity. Of note, the worst performance was when physiological anxiety and perceived control were both low. Speculatively, motivation may shed some light on this finding. That is, individuals who are less aroused (low physiological anxiety) and lack perceived control may be least motivated to mobilize resources (e.g., effort) to perform the task at hand, which could lead to impaired performance.

To enhance the validity of the present research, some methodological issues were considered. To begin with, as contextual variables may influence the anxiety-performance dynamics, it was advantageous to limit the study context. As a result, elite level of skill ability (with better awareness for the self-assessment of performance) and only a single sport of tae-kwon-do with short duration of competition were targeted. Furthermore, as absolute performance outcome (e.g., win/loss) is rather global and lacks precision, it was not considered the best criterion variable (cf. Butt, Weinberg, & Horn, 2003; Jones, 1995). Composite forms of performance
assessment have been previously proposed to better tap the sensitive relationship between anxiety and performance (Edwards & Hardy, 1996; Gould et al., 1987; Hardy & Hutchinson, 2007; Hardy et al., 2004). Hence, a composite performance measure of optimal tae-kwon-do sports was developed using interviews with expert coaches, and validated via CFA for this investigation. Nevertheless, a self-assessed measure of performance may be argued to be subjective and possibly affected by social desirability or defense mechanism (such as denial as a coping strategy) under competitive pressure. Regardless, it is difficult to see how this can have been a confounding factor in the interactive findings from the present research in that it is difficult to see how any main effect (such as social desirability) could easily produce a significant interactive effect (such as between perceived control and physiological anxiety) as obtained in this study. Notwithstanding this, caution is always warranted in anxiety performance research in dealing with possible response factors associated with self-rated instruments.

In sum, the current study provides initial support for two of the three predictions within the three-dimensional framework of performance anxiety in the context of elite tae-kwon-do performance. The addition of a regulatory dimension (i.e., perceived control), and the interaction of the anxiety elements, particularly between the quantitative (intensity) and qualitative (adaptability) characteristics of anxiety, have been shown to help predict sports performance. That is, the adaptive potential of anxiety stressed in the present anxiety model appears central in the dynamics of the anxiety-performance relationship. Undoubtedly, further tests are necessary across other sport contexts and cultures.

References


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Appendix: The Chinese Scale Items of the Three-Factor Anxiety Inventory in an English Translation

Dimension of Cognitive Anxiety

I am worried that I may not perform as well as I can.
I am worried about making mistakes.
I am worried about the consequences of failure.
I am worried about performing poorly.
I tend to dwell on shortcomings in my performance.
I find myself evaluating unfavorable factors concerning performance.
I am aware of my own negative emotions.
I am conscious that others will critically judge my performance.
I dwell on how I might fail to impress important others.
I am aware that important others will notice my shortcomings in performance.

Dimension of Physiological Anxiety

My hands are clammy.
I feel the need to go to the toilet more often than usual.
I am not breathing smoothly.
My chest feels tight.
I feel restless.
I feel easily tired.
My neck feels tense.

Regulatory Dimension of Anxiety

I can stay focused during my performance.
My performance goal is achievable.
I feel ready for my performance.
I believe in my ability to perform.