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Anxiety and Optimal Piano Performance: A Pilot Study on the Application of the Individual Zone of Optimal Functioning (IZOF) Model

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Abstract

Music Performance Anxiety (MPA) is a common problem for musicians. Many musicians struggle with performance anxiety and rely on traditional de-arousal interventions to reduce performance anxiety before public performance. However, research in sports psychology suggests that anxiety reduction may not be the most appropriate strategy for intervention (Chamberlain & Hale, 2007). According to the Individual Zone of Optimal Functioning (IZOF) model proposed by Hanin, an athlete's performance is successful when his or her pre-competition anxiety is within or near the individual's optimal zone (Hanin, 2000). Based on the application of the IZOF theory in the context of piano performance, anxiety plays an important role in optimizing performance in music as well. This pilot study identified participants' IZOFs with the Competitive State Anxiety Inventory (CSAI-2). Support was found for Hanin's IZOF theory with respect to the SA (somatic anxiety) and SC (self-confidence) dimensions for both of the participating pianists, as well as the CA (cognitive anxiety) dimension of pianist A but not for the CA dimension of pianist B. Piano performances associated with anxiety of an intensity that fell within the IZOF were observed to be significantly better than piano performances associated with anxiety intensity outside the IZOF. All the peak performances were presented within the IZOFs. The study verified that the IZOF model can be applied in MPA management and may help pianists be more aware of in-zone/out-zone states and rethink their attitudes toward performance anxiety. With this pilot study as a foundation, larger scale research can be conducted to clarify the correlation between anxiety and optimal piano performance.

Keywords: performance anxiety, IZOF model, optimal performance

1. Introduction

1.1 The Problem

Music Performance Anxiety (MPA) is a common issue for musicians spanning musical genres and levels of artistry from amateur to professional. Many high-profile professional classical musicians like Maria Callas, Luciano Pavarotti, Glenn Gould, Vladimir Horowitz, Arthur Rubinstein, Frederic Chopin, Sergei Rachmaninoff, as well as pop singers such as Donny Osmond, Carly Simon and others (Oswald, 1994; Schonberg, 1963; Valentine, 2002; Kenny, 2006; Juslin & Sloboda, 2011; LeBlanc, Jin, Obert, & Siivola, 1997) have reported suffering from performance anxiety. MPA can, to a large extent, affect performance, and is often unrelated to a performer's technical readiness. Ironically, performers and audiences easily ascribe an unsatisfying performance to MPA, but ignore the positive function MPA may contribute to a satisfying performance. Not surprisingly, MPA has always been regarded as a negative and debilitating psychological phenomenon in musicians (Fishbein, Middlestadt, Attati, Strauss, & Ellis, 1988; Kenny, 2006; Steptoe, 2001). Therefore, many musicians are ashamed of admitting to suffering from performance anxiety (Brugués, 2009; Bodner & Bensimon, 2008).

With a negative preconceived cognition of MPA, de-arousal interventions are widely used to control the physical responses to performance anxiety, such as deep relaxation, breathing exercises, physical exercise, taking beta-blockers and so on (Kenny, 2005; Sweeney & Horan, 1982). A common assumption is that the lower the performance anxiety level, the greater likelihood of achieving peak performance. On the other hand, a more recent wave of studies shows that desensitization strategies increase tolerance of uncertainty and anxiety (Kenny, 2005; Kendrick, Craig, Lawson, & Davidson, 1982; Kim, 2005). Moreover, other paradoxical viewpoints suggest that anxiety is necessary and indeed, inevitable, in intense performance scenarios (Wolfe, 1989). Many great musicians and teachers insist that they must experience pre-performance anxiety or they will not perform at their best level (Nideffer & Hessler, 1978). Conflicting MPA related theories and treatments have emerged in the 21st century, which leads to confusion on the relationship between anxiety and optimal performance.

1.2 Why the IZOF Model?

In an effort to prevent future confusion and provide a theoretical framework for explaining the correlation between MPA and optimal performance, this study explores participants' anxiety intensity and optimal performance with the help of the Individual Zone of Optimal Functioning (IZOF) model.

As anxiety occupies a central place in most psychological disorders and performance-related emotions, it has been researched extensively in many performance-related areas, such as performing arts medicine and sports psychology. There are various representative theories explaining the relationship between performance and anxiety (reflecting upon mental and physical arousal). Sport psychologists increasingly agree that a uni-dimensional approach to the arousal- or anxiety-performance relationship is ineffective and simplistic (Hanin, 2000). Thus, an approach that uses a single cumulative score of anxiety to demonstrate the relationship between performance and emotions, such as a linear or Inverted-U hypothesis, is inappropriate for examining a process that demands complex emotions and motor skills like music performance. There is a need for a more multidimensional approach in anxiety-related research. The IZOF model is a typical multidimensional approach of describing, predicting, explaining, and regulating performance-related bio-psycho-social states affecting individual and team activity (Hanin, 2000). The IZOF theory claims that an athlete's performance is successful when his or her pre-competition anxiety is within or near the individual's optimal zone. It is both a theoretical framework and a practical approach that enables qualitative and quantitative analysis of the functional relationship between anxiety and performance (Hanin, 2000).

Sports psychology researchers and practitioners have done a great deal of research on exploring anxiety in sports and individual optimal zone. Unfortunately, far less research is published on the application of these theories and treatments specifically to MPA (McGinnis & Milling, 2005). With the application of the IZOF model, musicians can describe, predict, explain and regulate MPA and performance results. Pianists can define their optimal performance zone in a quantified way, which may help them be more aware of in-zone/out-zone states and rethink their attitudes towards performance anxiety.

1.3 Applications of IZOF and Limitation

Compared to studies that claim MPA is a negative emotion, far fewer studies have been conducted to observe both the facilitating and debilitating effects of MPA and the relationship between situational emotions and music performance. Moreover, few studies of MPA are associated directly with the model (theory) of IZOF, though studies aimed at extending and testing IZOFs in non-athletic performance domains have been called for by scholars in the field of sport psychology (Gould & Tuffey, 1996). On the other hand, in sports, the IZOF model has been widely used for describing, predicting, explaining, and regulating performance-related psycho-bio-social states affecting individual and team activity, such as soccer, ice hockey, cricket and karate (Hanin & Syrjä, 1995a; Hanin & Syrjä, 1995b; Ruiz & Hanin, 2003; Hanin, 2000).

The IZOF model also has its limitations. For instance, recollection might be inaccurate in some situations (Gould, Tuffey, Hardy, & Lochbaum, 1993; Krane, 1993). Anxiety assessing instrumentation varies in different studies, which leads to confusion. Since any sport-specific anxiety measure is unlikely to adequately encompass the variability in all conditions (Raglin & Hanin, 2000), the results from assessing music anxiety with methods based in sports psychology assessments may not be convincing enough. In addition, the model divides the performance related state into functional (optimal) zone and dysfunctional zone and ignores moderate situations (Flett, 2015). The overlap between these zones needs more explanation.

1.4 Research Questions and Hypotheses

To verify that the IZOF model can be applied to define a pianist's optimal performance zone, it is necessary to answer the following questions: Do pianists also have a "zone" of optimal performance? Will the location and width of the zone differ from person to person? What is the relationship between the zone of optimal functioning and subjective experience of anxiety? If the hypotheses that pianists have different types of "zones" is true, anxiety reduction therapies (Sweeney & Horan, 1982) or exposure therapies (systematic desensitization) (Kendrick, Craig, Lawson, & Davidson, 1982; Kim, 2005) without knowing the musician's zone of optimal functioning would be inappropriate. Biased coping strategies may not work for everyone, for example a pianist whose zone locates at a high-arousal region or another pianist who may have relatively narrow zone.

2. Method

The IZOF model is both a theoretical framework and a practical approach that enables qualitative and quantitative analysis of the functional relationship between anxiety and performance (Hanin, 2000). The theory has usually been tested by having performers recall previous personal performances and self-report corresponding feelings about the performances (Hanin, 1986, 1989). Based on the retrospective result, the zone of optimal functioning can be measured and defined. With the zone defined, it is then possible to predict the quality of upcoming performance with respect to the pre-performance emotional and physical state of the performer. The zone may guide performers to cultivate an optimal physical and psychological state for peak performances through further training.

To find the zone of optimal functioning, this research employs the Competitive State Anxiety Inventory-2 (CSAI-2; Martens et al., 1990) to evaluate pianists' multidimensional anxiety level. The CSAI-2 is a performance-specific self-reporting instrument that provides separate categories for the cognitive anxiety state, the somatic anxiety state, and the state of self-confidence values (Krane, 1993).

2.1 Participants

The pilot study consisted of two advanced adult pianists, both in their third year of studies at a music conservatory. As females are two to three times more likely to experience anxiety than males (American Psychiatric Association, 1994; Lewinsohn, Gotlib, Lewinsohn, Seeley, & Allen, 1998), both of the participants were female pianists. Pianist A is 20 years old and began learning piano at age of 5. She is a junior student in a conservatory in Beijing, China. She practices approximately 40 hours per week and recalled her pre-performance memory of 4 midterms and 5 final juries from the past two and a half years. Pianist B is 22 years old and began learning piano at age of 8. Pianist B is also a junior student in a conservatory in Beijing, China. She practices approximately 24 hours per week and recalled her pre-performance memory of 3 midterms and 3 final juries over the past two years. As this is a pilot study as well as a feasibility study, the group of pianists is smaller so that the observer can analyze data within each subject in a qualitative way. By estimating variability in outcomes, it is possible to determine sample size in future larger-scale studies. Moreover, by assessing the proposed data on a small-scale version of the pilot study, potential problems can be uncovered and revised in the plan for further research.

Consent forms were sent to the participants, as the results will be used for this research. This project has no risk associated with physical or psychological state of the participants. After comparing score and anxiety level, participants may benefit by becoming more aware of the correlation between music performance anxiety and self-regulation of emotion. This may then affect their future musical performance in a positive way. Moreover, when the data are collected and analyzed, the participants will know their individual zone of optimal functioning, which will in turn help them to anticipate their future performance anxiety and make adjustments in order to fit into the optimal zone. The benefits will be observed in the upcoming research.

2.2 Instrumentation and Measurement

Performance Scoring: The performances were evaluated by seven professional college level teachers. Four of them are associate professors in the conservatory. One is a professor in the conservatory. The other two are assistant professors. Each of them evaluated performances after the midterm or final on a 1-100 scale, where 1 = worst possible performance and 100 = best possible performance. Judges were told that their scoring is based on performance regardless of how the students presented in the practice room or piano class. The score was to represent an overall impression of the midterm and final jury performances. The highest and lowest scores were not counted in the final grading, which means the other five scores were valid. An average score was calculated as the final performance result. This procedure of calculating a pianist's score is ruled as a tradition in this conservatory to minimize errors and bias. The evaluation criterion can be found in Appendix I.

State Anxiety Level: The Competitive State Anxiety Inventory-2 (CSAI; Martens et al., 1990) is used to measure the pre-performance anxiety state. The CSAI-2 is mainly used in sports research and also works closely with the IZOF model. It is a self-report inventory that has 27 simple questions and takes about 5 minutes to complete for each performance evaluation. It shows the anxiety level of three different dimensions (subscales): cognitive, somatic, and self-confidence. Participants answered questions using a scale ranging from 1 = not at all to 4 = very much so. The subscales of each of the three dimensions range from 9-36.

Data were collected to identify the optimal functioning zone for each pianist on all three anxiety state subscales. According to Hanin (1986, 1989), the zone is established by adding and subtracting four anxiety units (i.e., one-half standard deviation) from the anxiety score obtained prior to the personal best performance. The study identifies the optimal zone for each subscale (cognitive, somatic and self-confidence). Standard deviations were calculated based on individuals' CSAI-2 subscale scores.

2.3 Research Procedure

Hanin has developed two methods to identify an athlete's optimal of state anxiety range: in the first method, the zone was established by adding and subtracting four anxiety units (i.e., one-half standard deviation) from the anxiety score obtained prior to the personal best performance (Raglin & Hanin, 2000). Therefore, the pre-competition anxiety level needs to be assessed repeatedly until an athlete has an outstanding performance. This can be a long process, and it is sometimes difficult to identify which performance is the best one. The second method is based on retrospective study. Athletes need to recall their best past performance. Hanin used the Spielberger State Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970) in order to calculate the athlete's precompetitive state anxiety score. However, the accuracy of recollection is in doubt (Gould, Tuffey, Hardy, & Lochbaum, 1993; Krane, 1993). Therefore, several studies claimed that the multidimensional measurement such as Competitive State Anxiety Inventory-2 (Martens, Burton, Vealey, Bump, & Smith, 1990) was more effective (Gould, Tuffey, Hardy, & Lochbaum, 1993). Meanwhile, the multidimensional anxiety approach can reflect not only the athlete's emotional readiness, but also cognitive and somatic anxiety level. This study intends to combine both methods to save time testing the best performance as well as accurately determine the optimal zone. In addition, it provides more data for correlation analysis on in-zone and out-zone performances. The study keeps track of a series performances of each pianist, while also having them recall their performance-related memories.

Two junior advanced piano major students were required to recall their previous memory of their pre-performance states and then fill out several files: 1) The subjects offered the observer some general personal information, like age, gender, nationality, grade and so on; 2) The subjects provided a list of the repertoire and the score result of all the performances they recalled; 3) The subjects filled up the Competitive State Anxiety Inventory (CSAI-2) for every performance according to their recollection. Pianist A took 45 minutes to recall her memory and filled up the form 9 times based on her experience of each performance. Pianist B took 35 minute to recall her memory and filled up the form 6 times based on her experience of each performance. Seven judges made their assessments immediately after the piano exams. The files were translated into Chinese and sent through email. The CSAI-2 form was presented as an online questionnaire. The data were collected for further comparison and analysis.

3. Results

An analysis was conducted to test whether performance values within the subscale-based optimal zone were higher than performance values outside of the zone. In pianist A's case, the corresponding Cognitive Anxiety (CA) score of the best performance score was 13. SD = 5.83. The range of IZOF for CA is from 10.09 to 15.91. Two of her performances fit into the zone, the mean of which was 91.9. Based on the Mann-Whitney test, $p = 0.029$. A significant difference ($p < 0.05$) was found for pianist A on the cognitive anxiety dimension.

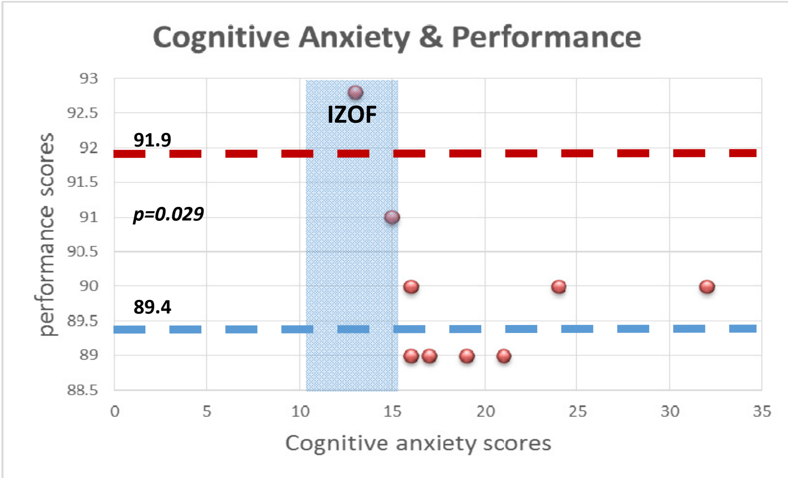

Figure 1. In-zone/out-of-zone CSAI-2 subscale score (cognitive anxiety) and corresponding performance scores for pianist A

In the somatic anxiety subscale, four performances fit into the zone, the mean of which was 91. The mean of the out-zone performance score was 89.2. Only one performance in the self-confidence subscale fit into the zone. The highest score was 92.8. The mean of the other performance score was 89.6. By using T test and One-Sample T test, significant differences ($p < 0.05$) were also found for pianist A on her Somatic Anxiety (SA) dimension ($p = 0.026$) and Self-Confidence (SC) dimension ($p = 0.01$).

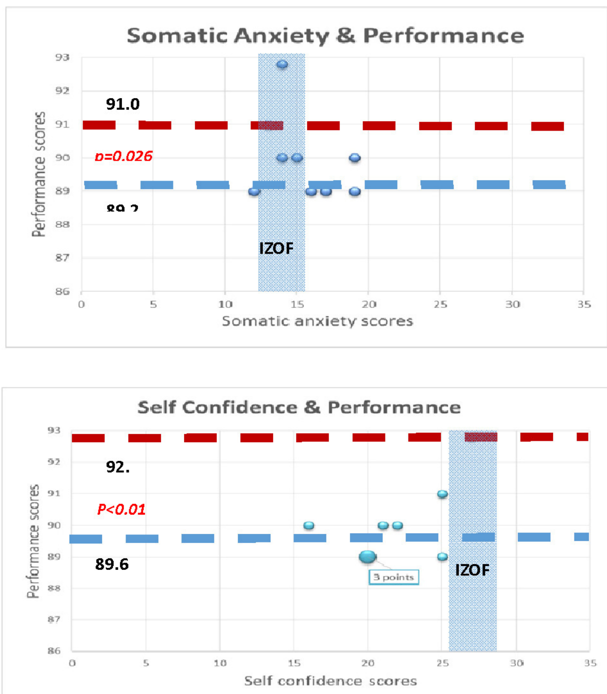

Figure 2. In-zone/out-of-zone CSAI-2 subscales scores (somatic anxiety and self-confidence) and corresponding performance scores for pianist A

In pianist B's case, the corresponding Cognitive Anxiety (CA) score of the best performance score was 10. SD = 8.64. The anxiety state CA subscale score of pianist B was wider compared to pianist A. However, this does not necessarily mean pianist B has a greater chance for optimal performance since she offered less performance data to begin with, which may lead to bias in identifying the zone. The range of IZOF for CA was from 5.68 to 14.32. Though pianist B had wider zone for CA, only two of her performances fit into the zone, the mean of which was 90.8. Based on the T test, p = 0.178 (p > 0.05), which indicates that no significant (p > 0.05) CA subscale score differences were based on the performances. To compare the zones of pianist A and B in the CA subscale (looking horizontally on the charts), pianist A's zone was more to the right side, which shows her optimal cognitive anxiety value was higher than pianist B. In other words, pianist A needs slightly more CA for peak performance.

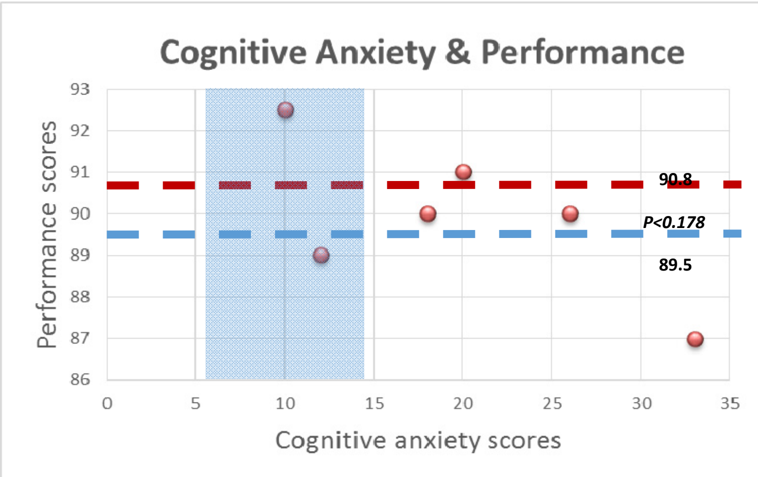

Figure 3. In-zone/out-of-zone CSAI-2 subscale scores (cognitive anxiety) and corresponding performance scores for pianist B

In the somatic anxiety subscale, one performance fit into the zone. The highest score in zone was 92.5, and the mean of out-zone performance score was 89.4. Only one performance in the self-confidence subscale fit into the zone. The highest score was 92.5. Figure 4 shows that pianist B performed better when her somatic anxiety score was low and self-confidence score was high. The mean of the other performance score was 89.6. Compared with pianist A, pianist B needs much less SA intensity and higher SC intensity to achieve optimal performance. By using the One-Sample T test, significant differences (p < 0.05) were found for pianist B on her Somatic Anxiety (SA) dimension (p = 0.015) and Self-Confidence (SC) dimension (p = 0.015). In general, among all those cases (all subscales with two pianists), optimal performances appeared within the IZOF zones except the CA subscale for pianist B. Moreover, consistent with IZOF theory, IZOFs showed considerable difference between pianist A and pianist B on each subscale, supporting the individual nature of each.

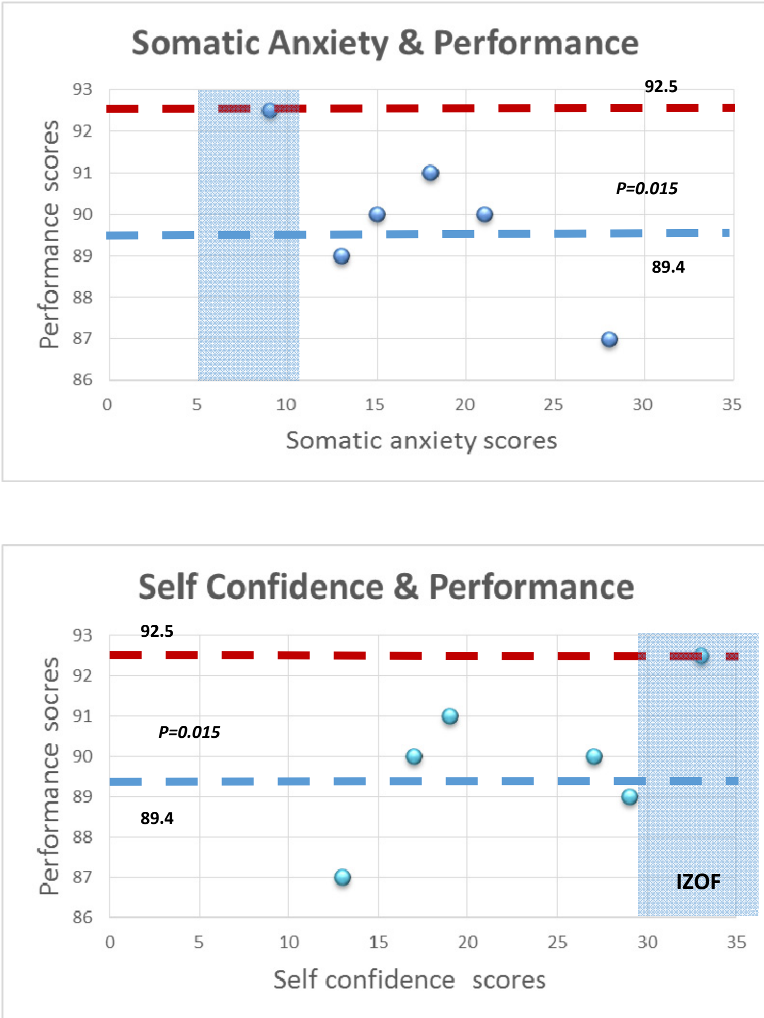

Figure 4. In-zone/out-of-zone CSAI-2 subscale scores (somatic anxiety and self-confidence) and corresponding performance scores for pianist B

4. Discussion

This study represents an application of the IZOF model in the context of piano performance. Support was found for Hanin's IZOF theory in respect to the SA and SC dimensions for both pianists, as well as the CA dimension of pianist A but not for the CA dimension of pianist B. The average score of the in-zone performance results was significantly better than the average score of out-zone performance results. Piano performances associated with anxiety of an intensity that fell within the IZOF were observed to be significantly better than piano performances associated with anxiety intensity outside the IZOF. All the best performances were presented in the IZOFs.

Statistically speaking, the result of pianist B's CA intensity did not support Hanin's IZOF theory. One of the best performances can be found in the zone, while a bad performance (performing score < 89.5, lower than the mean of out-zone performance scores) was also in the optimal zone. There are several possible explanations for this unexpected finding. One possible reason is that performance samples were not large enough. In this study, pianist B was evaluated only 6 times to determine the zone, which may be insufficient. A second possibility is that recalling from memory when filling out the CSAI-2 is a retrospective procedure, which might not be entirely accurate. Pianist B's cognitive reaction to the performances fluctuated dramatically. Therefore, the result of CA intensity might be influenced due to errors in recollection. Yet another possible explanation may be associated with pianist B's overall skill. As in the self-report material pianist B offered, she didn't start learning piano until she was 8 years old; in the conservatory, she practiced 24 hours per week, far fewer hours than pianist A, who practiced 40 hours a week. It is reasonable to assume that she might have had some problems with technique, memorization, and musical interpretation that affected her evaluative scores no matter what her CA level.

Several efforts can be made to avoid those problems in future research. First, the sample size of performances needs to be increased (at least 9 times) to determine IZOF for each individual. Second, using anxiety measuring instruments that are more specific to music performance, such as the Kenny Music Performance Anxiety Inventory (K-MPAI) (Kenny, Davis, & Oates, 2004), may help improve the accuracy of recollection and minimize memory errors. Third, future researchers might seek to improve the self-awareness abilities of the subjects or seek subjects who are technically competent.

This study verified that the IZOF model is applicable in the area of piano performance. The application of the IZOF model in music performance offers us a new perspective on pre-performance anxiety management. With application of the IZOF model, further research can be conducted to support music performance anxiety management studies. According to the IZOF, we can identify an optimal state of anxiety intensity for piano performance. It will help both piano performers and teachers predict the success of a performance as well as take measures to improve performance. In the next phase, larger-scale studies can be put into practice. Meanwhile, performance predicting and intervening methods will be explored to see whether self-regulation of emotion is effective in adjusting the state of MPA intensity to an optimal level in order to achieve peak performance.

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Appendix A

Evaluation Criterion for Piano Major Midterm and Final in A Conservatory of Music in China

1) *Repertoire for midterm*: Two etudes (at least one by Chopin). A Bach prelude and fugue from *The Well-Tempered Clavier* or several substantial movements from a suite or partita. *Repertoire for final*: A movement from a major sonata. A representative work from 19th to 20th century. At least one of the pieces should be technically and interpretively demanding and at least ten minutes in length. All repertoire should be performed from memory.

2) Scoring scale: Hundred-mark system, 95 is the recommended highest score. 80 is the passing line.

3) The result will take the average grade. However, the highest and lowest scores will not be counted in the final grading.

4) Evaluation criterion detail:

(1) Method and technique:	
Correct	95-90
Almost correct	90-85
Problematic	85-80
Improper	Below 80
(2) Score reading	
Accurate	95-90
Almost right	90-85
Some mistakes or ignorance	85-80
Problematic	Below 80
(3) Fluency	
Fluent	95-90
A few mistakes	90-85
A few stops	85-80
Not Fluent	Below 80
(4) Music genre and style	
Accurate	95-90
Almost right	90-85
To some extent	85-80
Improper	Below 80
(5) Artistic interpretation	
Very good	95-90
Good	90-85
Normal	85-80
Poor	Below 80