Subjective Experiences of Anxiety in Optimal Performance

An Application of the Individual Zone of Optimal Functioning (IZOF) Theory in Music Performance Anxiety Issues

By

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ABSTRACT

For a long time, music performance anxiety (MPA) has been regarded as a relatively negative psychological phenomenon that rarely appears in mainstream psychological journals or textbooks (Kenny, 2006). In fact, as a subjective emotional experience triggered by music performance, MPA is a very common and long-standing issue for musicians across different artistic levels and musical genres. Many professional musicians like Maria Callas, Luciano Pavarotti, Glenn Gould, Vladimir Horowitz, Arthur Rubinstein, Frederic Chopin, Sergei Rachmaninoff and even 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. In efforts to control the physical responses to performance anxiety, such as rapid heartbeat, shallow breathing, and high blood pressure, musicians explore a variety of de-arousal interventions like deep relaxation, breathing exercises, physical exercise, taking beta-blockers and so on to cope with the problem. A common assumption is that the lower a musician's performance anxiety level, the greater likelihood that he or she will achieve peak performance.

However, research in sports psychology suggests that anxiety reduction may not be the most appropriate strategy for intervention (Chamberlain, 2007). In the 1980s, Yuri L. Hanin introduced the theory of the Individual Zone of Optimal Functioning (IZOF), which proposed that an athlete's performance is successful when his or her pre-competition anxiety is within or near the optimal zone (Hanin, 2000). Moreover, as the subjective experience of anxiety varies from person to person, the optimal zone differs from person to person as well. Therefore, the location and the width of the optimal zone help determine possible peak performance for each individual. We know that

musicians and athletes are similar in their psychosomatic state before and during competitive performances in many ways. The findings in sports psychology raise doubts about the relationship between anxiety and music performance. In other words, lower anxiety levels do not necessarily correlate with better music performance. A musician's performance is successful when his or her pre-competition anxiety is within or near the optimal zone.

Solo pianists in particular report suffering from MPA (Yoshie, Kudo, Murakoshi & Ohtsuki, 2009), even compared with other instrumentalists, and this may be because they are challenged by factors such as length of pieces, memorization, extremely long practice hours and exceptional physical demands, loneliness. Therefore, this study seeks to verify and discuss three main issues of MPA in music performance, specifically as it pertains to pianists. First, do pianists even have IZOF? Second, can the IZOF model help to predict the results of pianists' upcoming performances? Third, what is the relationship between anxiety intensity and optimal performance? In the first phase of the study, inventory CSAI-2 was used to define the individual zone for each subject; each subject is an advanced pianist. This phase was a retrospective study, which included two separate tests: a pilot study (S=2) and a large-scale study (S=30). The second phase was a prospective test. By predicting upcoming performance outcomes, I was able to examine the hypothesis that the IZOF model can be fully applied in piano performance anxiety-related analysis.

With this study as a solid theoretical foundation for applying IZOF in MPA management, more efficient and personalized interventions can be designed to help pianists and other musicians feel more secure and positive about public music performance.

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ACRONYMS AND ABBREVIATIONS

MPA— Music Performance Anxiety

IZOF— Individual Zone of Optimal Functioning

CSAI-2— Competitive State Anxiety Inventory –Second Edition

SFA— Single Factor Analysis

APA— American Psychiatric Association

STAI—State Trait Anxiety Inventory

IRB— Institutional Review Board

SA—Somatic Anxiety

CA—Cognitive Anxiety

SC—Self-Confidence

SD—Standard Deviation

CHAPTER 1. OVERVIEW

Introduction

"If you're not nervous, you're dead."

—David Roland, *The Confident Performer* (1997)

In the world of music performance, music performance anxiety (MPA) is a common issue for musicians across different artistic levels and musical genres. Many professional musicians such as Maria Callas, Luciano Pavarotti, Glenn Gould, Vladimir Horowitz, Arthur Rubinstein, Frederic Chopin, Sergei Rachmaninoff and even pop singers like 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.

To a large extent, MPA affects the quality of a performance, but does not necessarily reflect technical capability or preparedness of the performer. Ironically, performers and audience members might easily ascribe an unsatisfying performance to MPA, but ignore the positive function MPA contributes to a satisfying performance. Not surprisingly, MPA has always been regarded as a negative and debilitating psychological phenomenon for musicians (Fishbein, Middlestadt, Attati, Strauss, & Ellis, 1988; Kenny, 2006; Steptoe, 2001). As a result, there are many musicians who are ashamed of admitting suffering from performance anxiety (Brugués, 2009; Bodner & Bensimon, 2008). For them, performance anxiety not only represents a series of psychosomatic manifestations but is also a furtive subject that makes them feel as though they are not qualified to perform (Lee, 1988). Additionally, this issue has often been consciously avoided by music educators in their teaching process since the management of anxiety is often beyond their training, talent, practice, experience, or dedication (Nideffer & Hessler, 1978).

Because of negative preconceived notions of MPA, de-arousal interventions are widely used to control the physical responses to MPA, 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 a musician's performance anxiety level, the greater likelihood that he or she will achieve peak performance. On the other hand, a more recent wave of studies shows that desensitization increases the tolerance of uncertainty and anxiety (Kenny, 2005; Kendrick, Craig, Lawson & Davidson, 1982; Kim, 2005). These researchers believe that performers should be exposed to high-arousal performance situations frequently in order to decrease their psychosomatic reactions to performance. 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 past decades, which further confuse the issue and perpetuate the practice of interventions that may or may not work for different individuals (McGinnis & Milling, 2005).

In an effort to prevent further confusion and explain the relationship between subjective experiences of anxiety and optimal performance, as well as to offer a new perspective of MPA, I start from a neutral position and explore both the functional and dysfunctional side of MPA that contributes or impedes optimal performance. I have used the theory of Individual Zone of Optimal Functioning (IZOF), which is borrowed from sports psychology. In addition, compared with the factors that lead to MPA and compromise performances, very little is known about factors that contribute to peak performances. Therefore, this study will also focus on discussing potential triggers and conditions for individual functional performance anxiety, and those which contribute to optimal performance.

Rationale

Anxiety occupies a central place in most psychological disorders (Kenny, 2011), and thus has been researched extensively in many performance-related areas like performing arts medicine and sports psychology. There are various representative theories explaining the relationship between performance and emotions (reflecting upon mental and physical arousal). Sport psychologists increasingly agree that uni-dimensional approaches to the arousal- or anxiety-performance relationship are ineffective and simplistic (Hanin, 2000). Thus, approaches that use a single cumulative score of anxiety to demonstrate the relationship between performance and emotions, such as linear or inverted-U hypothesis, are inappropriate for examining an occupation with the complex emotional and motor-skill requirements of music performance. More multidimensional approaches are called for in anxiety-related research.

The IZOF model proposed by the internationally renowned sport psychologist Hanin in the 1980s 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 individually optimal zone. Sports psychology researchers and practitioners have done a great deal of research exploring emotions in sports and the individual optimal zone. Unfortunately, far less research is published on the application of these theories and treatments specifically to MPA (McGinnis & Milling, 2005). By defining the optimal functioning zone for individual pianists and predicting upcoming performance results, this dissertation verifies that IZOF as a sports psychology theory and model can be utilized effectively for describing, predicting, explaining and regulating piano performance-related bio-psycho-social states as well.

In this thesis on study, I intend to reveal the regulation and relationship between subjective experiences of anxiety and piano performance results. Each individual has his/her own optimal level of anxiety resulting in good performance. With the help of the IZOF model, the study could define the “zone” for each individual in a quantified way. The IZOF model offers a quantitative, measurable outcome of functioning level of anxiety, which helps shed light on parsing out the factors that may contribute to different zone types in further studies. Meanwhile, the application of the IZOF theory in music performance offers us a new perspective on the management of performance anxiety. With this study as a solid theoretical foundation for applying IZOF in MPA management, further studies and interventions can be designed and executed to regulate performance-related psycho-bio-social states.

Structure of the Dissertation

Chapter 1 outlines the overall intention, questions/hypothesis and structure of the dissertation. It also clarifies why the theory of IZOF is used for studying MPA and its further development for interventions.

Chapter 2 addresses the topics as interdisciplinary research and includes two separate sections.

The first section reviews existing literature in MPA and discusses the nature, causation and management of MPA. The second section describes the core concept of the IZOF model in sports psychology and its applications in different scenarios. Additionally, the discussion clarifies the differences between optimal functioning zone and state of flow, as well as their co-relationship in performance. As a literature review, the second chapter lays a theoretical foundation for further discussion.

Chapters 3 and 4 present the two main phases of the study. Each phase was intended to verify and discuss the main issues of MPA in piano performance using the IZOF model. In the first phase (Chapter 3), CSAI-2 inventory was used to define the individual zone for each subject (subjects are advanced pianists studying at conservatories), and also to verify that pianists indeed have a "zone." This phase included two separate tests: a pilot study (two pianists) and a large-scale study (30 pianists). The second phase (Chapter 4) was an apagogic test. By predicting upcoming performances, I was able to examine the hypothesis that the IZOF model can be fully applied in piano performance anxiety-related analysis. Meanwhile, pianists may better prepare for upcoming performances with the help of the IZOF model.

Chapter 5 is a discussion and conclusion of the results. The chapter begins with a discussion of the results pertaining to each of the hypotheses mentioned in chapters 3 and 4. It addresses the essential elements of the application of the IZOF model and a limitation analysis is provided. Finally, the practical applications of the IZOF model to the field of music performance and direction of future research are discussed.

Purpose of the Study

In order to clarify the relationship between optimal piano performance and performance anxiety in a quantified way, individual factors must be taken into consideration for more accurate and personalized results. The retrospective study of the first stage examines the hypothesis that every pianist has an individual zone of optimal performance, and that each individual's zone can be defined with the application of the IZOF model. In the prospective study of the second stage, knowing the location and width of the optimal functioning zone assists in predicting the success of upcoming performances. This verifies that IZOF can be fully applied in piano performance as well as in sports. Moreover, the performance prediction process shows that it is vital to know each pianist's IZOF since it varies widely from person to person, and that in turn determines each pianist's personal training plan.

In summary, with the clarification of the existence of the zone, this study also explains how MPA can contribute to optimal performance. Factors that determine the different location and width of the optimal functioning zone are discussed.

Research Questions and Hypotheses

There are three major research questions. First, can the IZOF theory and model be applied to define optimal performance zone for pianists or not? This invites sub-questions, such as: do pianists even have a zone of optimal function? If so, might the location and width of the zone differ from person to person? Based on the hypothesis that pianists have different zones, attempting anxiety reduction (Kenny, 2005; Sweeney & Horan, 1982) or exposure therapies and systematic desensitization (Kenny, 2005; Kendrick, Craig, Lawson & Davidson, 1982; Kim, 2005) without knowing a musician's individual zone would be inappropriate or ineffective. For some pianists, the individual zone may locate at a high-arousal region, while others may have a low-arousal zone for optimal performance; therefore, some pianists have wider zones while others have narrower zones, and the biased strategies of coping with performance anxiety do not fully address individual differences.

The second question is: can the IZOF model help predict upcoming piano performance? Answering this question is absolutely necessary because if the theory fails to predict an upcoming performance, the application of IZOF is ineffective. Moreover, if performance results can be predicted accurately, the IZOF model can help pianists prepare in a more conscious way and regulate their mental and physical states before future performances.

The third question is: how do we understand and explain the zone? Based on this question, the sub-questions are: how does the optimal zone differ from person to person in locations and widths? What is the deeper meaning of wider and narrower zones? Is it true that pianists with broader zones consistently perform better than those with narrow zones?

CHAPTER 2. STATE OF RESEARCH

Literature Review on Music Performance Anxiety (MPA)

The Nature of Music Performance Anxiety

As expected, MPA is triggered by music performance. People who have MPA may or may not necessarily be anxious in other performance activities. In the immortal words of William Shakespeare “All the world's a stage, and all the men and women merely players” (*As You Like It,* Act II, Scene VII). When musicians suffer from MPA, they are at the center of their stage. That is the place where they feel and experience anxiety most intensively.

Anxiety

Anxiety occupies a central place in most psychological disorders, including MPA (Kenny, 2011). Though other similar concepts such as stress, arousal, fear, fright, and even anger overlap with anxiety, anxiety itself has often been treated as the basis of psychopathology. According to Hanin (2010), anxiety is an emotional experience and a component of the psycho-bio-social state, which can be demarcated based on five basic dimensions: form, content, intensity, context and time. Lazarus (2000) defines anxiety as a future oriented emotion while anger centers on a damaging confrontation in the past. From Lazarus’s point of view, stress and arousal address more current experiences of suffering. Besides differentiating emotions according to how they relate to the present, Freud (1973, 443) distinguishes anxiety, fear and fright according to their origins and results:

> Anxiety relates to the state and ignores the object, while fear draws attention precisely to the object. Fright, on the other hand, emphasizes the effect produced by a danger, which is not met by any preparedness for anxiety. Therefore, a person may protect himself from fright by anxiety.

There are two different types of anxiety that are often conflated: a). trait anxiety and b). state anxiety. When people talk about music performance anxiety, they usually mean state anxiety, which is defined as an unpleasant emotional arousal while facing threatening demands or dangers, caused by external factors like public performances, competitions and auditions (Korte & De Boer, 2003; Sweeney-Burton, 1988). This is in contrast to trait anxiety, which differs in its intensity, duration and the range of situations in which it occurs. However, a personality trait that affects one's trait anxiety in extent could also cause different individual temporary feelings in reacting to external stress and dangers (Spielberger, 2013). Lehrer et al. (1990) found that 25% of variance in music performance measures could be accounted for by trait anxiety. Significant positive correlations were found between state anxiety and trait anxiety levels (Topoğlu, 2014). Therefore, when Freud's definition of anxiety, "something felt," occurs to a musician, the subjective experience of anxiety is the result of both the external state and the musician's inner trait. In other words, anxiety can be experienced in different ways by different individuals, even with the same external triggers.

As a psychological disorder, anxiety has been diagnosed in both adults (Antony & Stein, 2009; Antony & Swinson, 2000; Flint, 1994) and children (Antony & Stein, 2009). In many studies, females are two to three times more likely to experience anxiety than males (American Psychiatric Association, 1994; Lewinsohn, Gotlib, Lewinsohn, Seeley & Allen, 1998). In addition, females have significantly higher MPA than males (Huston, 2001; Osborne & Franklin, 2002 and Sinden, 1999). Asian-Americans scored significantly higher than white Americans on measures of depression and social anxiety (Okazaki, 1997; Chang, 1997). Individual experience of anxiety varies dramatically according to gender, cultural background, stage of life and so on. In the following chapters, all the participants in this study are from different provinces of China. All are young pianists educated in the Chinese music education system and immersed in traditional Chinese culture. Their process of learning piano and performing music as well as their reflections on their performances are deeply impacted by their cultural environment.

The Scope of Music Performance Anxiety

Historically, there are several definitions of music performance anxiety based on different answers to some core issues such as: whether MPA is a kind of state anxiety; whether MPA is focal anxiety, which happens specifically in music performance, but not in other high-stress situations such as math tests or dance performances; how MPA differs from other anxiety disorders; whether MPA is negative emotion or a neutral factor for performers.

Sweeney-Burton (1988) defines MPA as state anxiety. In his study, most student musicians with high pre-treatment state anxiety scored relatively lower in quality of performance, while those with low pre-treatment state anxiety scored higher in quality of performance. However, as mentioned above, research shows that MPA level can be influenced by trait anxiety (Lehrer, Goldman & Strommen, 1990). The subjective experience of MPA can result from both the external state and a musician's inner trait. Meanwhile, musicians who suffer significant levels of MPA may experience no significant anxiety in other activities of their life, such as public speaking (Kenny, 2011). Therefore, though MPA is regarded as state anxiety, it is still trait-anxiety based and its effects differ from person to person.

The American Psychiatric Association (1994) defines MPA as an anxiety disorder, specifically a social phobia if the performer demonstrates significant impairment and otherwise meets the criteria for social phobia. People show exaggerated fear of being watched and judged when they have social phobia (Kenny, 2011). For people who have social phobia, the audience or judges are often imaginary. In music performance, however, the audience is very real, and they often judge musicians' performance (Brotons, 1994). Thus, MPA has its own features that differ from social phobia or social anxiety disorder, though they share many common characteristics. Furthermore, unlike people who have social phobia, people with MPA are more worried about their competency of achieving the tasks associated with the performance itself, such as memorizing the score and managing difficult technical passages, rather than the audience's view of their performance.

Hence, Kenny (2009a, 433) has developed a more comprehensive and specific definition of MPA that distinguishes MPA from other anxiety disorders:

> Music performance anxiety is the experience of marked and persistent anxious apprehension related to musical performance that has arisen through underlying biological and/or psychological combinations of affective, cognitive, somatic, and behavioral symptoms. It may occur in a range of performance settings, but is usually more severe in settings involving high ego investment, evaluative threat (audience), and fear of failure. It may be focal (i.e. focus only on music performance), or occur comorbidly with other anxiety disorders, in particular social phobia. It affects musicians across the lifespan and at least partially independent of years of training, practice, and level of musical accomplishment. It may or may not impair the quality of the musical performance.

Normally, musicians and psychologists regard MPA as a negative emotion that brings harm to music performance and musicians' careers (Fishbein, Middlestadt, Attati, Strauss, & Ellis, 1988; Kenny, 2006; Steptoe, 2001). Brodsky (1996), however, argues that MPA is a more neutral concept and is viewed as "normal everyday healthy aspects of stress and anxiety that are intrinsic to the profession" (1996, p.91). In his study, he points out the problematic designs of previous studies and reveals the misleading definitions and ineffective remedies for managing performance-related psychological problems in musicians. Furthermore, Brodsky believes that when anxiety becomes more severe, the resulting negative effect is "stage fright," and he demonstrates that MPA and stage fright differ in attributes and level.

In addition, some clinic reports show that some musicians must experience pre-performance anxiety or they will not perform at their best level (Nideffer & Hessler, 1978). In this case, MPA is viewed as more positive emotion in performance for certain types of people. As shown in sports psychology research, competitive anxiety can be both facilitative and debilitative to performance (Burton & Naylor, 1997). This conclusion could describe the relationship between MPA and the quality of performance, though the interaction between anxiety level and actual performance remains in question and needs more research.

Symptoms

A great number of studies list negative and dysfunctional symptoms in order to claim that MPA may have devastating effects on the well-being and careers of professional musicians (Nagel, 2010). According to Brontons (1994) and Ely (1991), the negative effects have been placed into four different categories, which may occur independently or in conjunction with one another (Mcgrath, 2012):

1.) Physiologically, MPA causes increased heart rate, perspiration, respiration-rate, and blood pressure. It may also cause sweating, shortness of breath, shaking, clammy hands, dry mouth, upset stomach, headache and other changes within the body.

2.) Cognitively, MPA causes difficulty in maintaining extreme concentration and/or focus; loss of confidence and memory slips will occur.

3.) Behaviorally, musicians experience less or more exaggerated physical motions and irregularities in tempi and rhythm, lifting the neck and shoulders, trembling knees, and muscle tension.

4.) Psychologically, manifestations of MPA include panic, feelings of inferiority, intensified apprehension, fear of failure, irritability, and insecurity.

Amusingly, the descriptions sound like reading the side effects on a medication bottle. Additionally, none of the descriptions show the positive and functional side of MPA. With knowledge of only the negative effects of MPA, people naturally believe that MPA leads only to dysfunction and impairs successful performance. This results in a vicious circle in which negative expectations of MPA perpetuate a cycle of more damaging symptoms. However, when people are put into high stress situations, physical changes like breaking into a sweat, faster heart rate and increased blood pressure are actually helping them to energize and prepare for a challenge or potential threat. In research conducted recently at Harvard University, participants were taught to rethink their stress response as helpful before they went through a social stress test. Participants then would view these short-term symptoms as positive. A pounding heart aides the body in preparing for fight or flight. Faster breathing sends more oxygen to the brain. Increased blood pressure supplies the body with extra energy. Meanwhile, the human body sends chemical messages to release the hormone cortisol (Padgett & Glaser, 2003). The results showed that participants who learned to view the stress response as helpful for their performances felt less stressed out, less anxious, and more confident. The most surprising finding was that the participants physical stress response changed as well. Their blood vessels stayed relaxed and their heart pounding showed a much healthier cardiovascular profile, which looks like what happens in moments of joy and courage (McGonigal, 2013). In conclusion, the nature of the symptoms reflects our definition and understanding of MPA, which will also affect our coping strategies and interventions.

The Influencing Factors of Music Performance Anxiety

It is difficult to draw a conclusion of the causations of MPA since some of the causes might not directly lead to MPA. Moreover, individual experience of anxiety differs from person to person; what triggers anxiety in one person may lead to completely different emotions in someone else. In her study about self-reported causes of music performance anxiety, Kenny (2009b) lists possible causes of MPA such as pressure from the self, inadequate preparation for performance, attempting repertoire that is too difficult, excessive physical arousal prior to or during performance, previous bad performance experiences, etc. However, some items on her list could lead to performance anxiety for some students but be helpful or encouraging to others. Pressure from a teacher for example, can have a variety of effects on individuals, depending on students' previous learning experience, parental empathy, their own attitude and so on. Therefore, taking these situations into consideration, "influencing factors" might be a more appropriate way of describing the possible causations of MPA without confusing their functions in extent.

The influencing factors can be divided into two categories: a). internal factors and b). external factors. Internal factors include the individuals' nature or nurture state like age, gender, personality, technical competence, and previous performance experience. External factors include environmental conditions like audience, size of ensemble, the importance of performance to one's career, and difficulty of repertoire.

Internal factors

People may assume that children do not have MPA since many of them enjoy gaining attention from adults by performing. On the contrary, research provides compelling evidence that MPA also exists in children and shares many similarities with its manifestations in adults (Ryan, 1998, 2004, 2005). Age plays a part in individual susceptibility toward anxiety. Individuals are not equally vulnerable to performance anxiety across different age groups. Adolescents appear to have particular difficulty facing MPA when they take into consideration their own career development or peer pressure (Hallam, 1998; Papageorgi, 2007; LeBlanc, 1994).

Gender is also linked to performance anxiety. In many studies, females are two to three times more likely to experience anxiety than males (Abel & Larkin, 1990; Abrams & Manstead, 1981; American Psychiatric Association, 1994; Lewinsohn, Gotlib, Lewinsohn, Seeley & Allen, 1998). It follows that female musicians are more prone to experience high levels of performance anxiety (Abel & Larkin, 1990; Abrams & Manstead, 1981). In addition, females have significantly higher MPA than males (Huston, 2001; Osborne & Franklin, 2002 and Sinden, 1999; Topoğlu, 2014). Interestingly, in one study, females performed better in the final performance but reported higher anxiety and had higher heart rates than males (LeBlanc, Jin, Obert & Siivola, 1997). Conversely, a study in gender differences in MPA among children showed that boys' heart rates rise minimally prior to performing but exceed the girls' while performing. Boys also behave significantly more anxiously prior to and while performing than girls. Meanwhile, boys perform worse than girls when they are at a moderate level of performance anxiety and better than girls when they are at high level of performance anxiety (Ryan, 2004).

Personal trait is another influencing factor that has been discussed in conjunction with MPA. Studies have tested the hypothesis that perfectionism and personality are associated with MPA. Generally, musicians are introverted, emotionally unadventurous, unstable and cautious (Marchant-Haycox & Wilson, 1992). The personality trait of introversion or neuroticism seems to correlate with increasing anxiety levels since introverts appear to have lower thresholds of arousal, and thus are more likely to feel anxiety. (Kemp, 1996). In Marchant-Haycox and Wilson's (1992) research, musician participants were the most cynical, resigned, world-weary group being inactive, unsociable, submissive, unadventurous, unambitious, and controlling compared to other performing artists like actors and dancers. However, they were also the most empathic group tested. In addition, studies have found a correlation between perfectionists' high personal standards and performance anxiety (Mor, Day, Flett, & Hewitt, 1995). Musicians with the personality trait of perfectionism have unrealistically high expectations of themselves and others. Therefore, they are more likely to experience excessive MPA when performing (Wilson & Roland, 2002).

Competence of instrumental technique and the degree of mastering the musical work is a vital factor that affects musicians' confidence in performance. Music performance requires a high level of skill in fine motor dexterity and body coordination, accurate memory, long and intensive concentration, and overall musicality. All of these skills demand years of training, daily practice, and many performing experiences. Salmon and Meyer (1998) found that experienced performers may master performance anxiety more easily. Seasoned performers may feel less threatened by physiological arousal since they have learned to expect such arousal as a "given" of performing frequently (Papageorgi, Hallam & Welch, 2007). With more performing experiences, musicians learn to trust themselves and their level of competence as each performance approaches. At the same time, the hours that musicians dedicate to practice and preparation also determine how confidently they will perform (Brugués, 2011). Conversely, inadequate preparation may increase MPA. For pianists, inadequate finger technique, lack of whole body coordination, insecurity of playing from memory and choice of repertoire that exceeds the individual's capability will all increase fear of failure and contribute to MPA.

In addition, previous learning and performing experiences may affect performers' cognitive view and psychological activity when facing performance anxiety as well. Lack of a solid learning process will lead to insecure memory or inadequate muscle control and finger technique, which then results in uncertainty of performance and vulnerability in confidence. Therefore, surface learners who do not go through a solid learning process may find it more difficult to master musical works. Biggs (1984) reported that surface learners have strong self-doubts and are afraid of failure as they do not actually understand the music. The negative cognition of self-doubt and fear of failure could lead performers to experience MPA in a very negative way. One can hypothesize that deep learning individuals are more likely to have a positive cognitive and psychological attitude towards MPA as they know every detail of the music. Previous negative performing experiences that caused anxiety may contribute to inefficient use of acquired techniques, which can discourage students from further study of music (Appel, 1976). On the other hand, previous positive performance experiences may give confidence to a performer (Hanley, 1984), which can also affect performer's anxiety level.

External factors

Studies have shown that when people perform in front of an audience, even a small peer group, their performance anxiety increases significantly compared to when they practice alone (Abel & Larkin, 1990; Hamann, 1982; LeBlanc, Jin, Obert & Siivola, 1997; Leglar, 1979). Female musicians are even more sensitive to the audience factor when they experience MPA (Abrams & Manstead, 1981; Abel & Larkin, 1990). Child musicians' MPA levels also increase with audience size and perceived importance of the performance (LeBlanc, Jin, Obert & Siivola, 1997). Larger audiences or an audience with expert knowledge of performers' repertoire will elicit more performance anxiety from musicians (Kenny, 2011). Meanwhile, in many studies, the size of the ensemble has a relationship to performers' anxiety level. High self-exposure performances like solo recitals trigger the highest anxiety, while small ensembles such as quintet, trio or duo elicit less anxiety. Larger ensemble like orchestras have even less, and teaching settings elicit the least anxiety (Brotons, 1994; Cox & Kenardy 1993; Jackson & Latane, 1981; Kenny, 2004; Leglar, 1979).

Perception of the importance of a performance is a subjective concept. When asked, "How do you feel about your upcoming performance?" a solo pianist with 15 years' experience and over 50 solo recitals described the task importance of an upcoming solo recital at the China Conservatory of Music:

> It is a very special recital in my career as a pianist. I've been preparing this one for quite a long time. The last time I performed at this conservatory was seven years ago. You can't imagine how excited and nervous I am to perform in this place again. I chose repertoire very carefully and they are all my love and are very challenging for me, and for every pianist. I know my friends and teachers are very looking forward to my performance in this recital. I don't want to let anybody down. And I want them to see my progress in these years…and a different and more mature me through my music.

This pianist described how important the recital is for personal reasons, as well as an emotional reaction, to the strong motivation for achievement. Though motivation is determined by complex interactive factors, studies have found that parents and teachers have particular influence on performers' motivation (O'Neill & McPherson, 2002). In addition, fear of negative evaluation from experts, parents or teachers' influences MPA (Lehrer, 1987). Musicians' anxiety levels are influenced by a variety of factors, including task importance, motivation for achievement, the pursuit of long-term goals, and the effort put into preparation.

Like task importance, the difficulty of repertoire is a subjective issue as well and influences a performer's expectation of success. When a task is considered to be far beyond the performer's capabilities and he/she has not prepared well enough to face the performance, anxiety will increase and motivation will decrease (Papageorgi, Hallam & Welch, 2007). When the subjective value such as an acknowledged difficulty in music attached to a performance is great, the potential of experiencing high levels of anxiety increases (Papageorgi, Hallam & Welch, 2007; Pekrun, 1984). In the field of healthful piano technique, incompetence of technique or physical/structural incompetence can lead to over-contraction in muscles. Grindea (1995) insists that excessive tension in piano technique is the main cause of performance anxiety. And increasing studies have found that elevated muscle tension appears to be a consistent physiological finding related to anxiety (Plues, Conrad & Wilhelm 2009).

Environmental factors such as acoustics, condition of the instrument, humidity, temperature and lighting can affect MPA as well (Penn & Bootzin, 1990; Steptoe, 1982). For instance, Parasuraman and Purohit (2000) found that one major source of stress for musicians is actually task-irrelevant thoughts about things like air quality, humidity, seating comfort and readability of the musical score. When task-irrelevant thoughts slip into a musician's mind while performing, he or she must be able to dismiss them without becoming distracted from the work at hand (Steptoe, 1982). If these thoughts are overly intrusive or distracting, they can interfere with concentration, and thus can become the source of anxiety and threaten the success of a performance.

The Interventional Studies of Music Performance Anxiety

There are books and dissertations on treating MPA, however, all the findings in interventional studies rely on their corresponding theoretical belief of what defines MPA. Those who regard MPA as a unidimensional symptom turn to the coping methods that only take a specific dimension as the parameter. For instance, their treatments either focus on physiological or psychological symptoms and ignore the interaction of other dimensions. Similarly, someone who regards MPA as only a negative emotion is more likely to use de-arousal strategies such as mindfulness-based stress reduction, progressive muscle relaxation training, or even pharmacotherapy. If one holds the viewpoint that maximizing performing experiences can desensitize MPA, they may use performance-based approaches and expose the pianists to performances as often as possible. Based on what has been discussed so far, this study treats MPA as a neutral concept that can manifest in ways that both facilitate and debilitate performance. Additionally, it is viewed as a normal everyday healthy aspect of stress and anxiety that are intrinsic to the profession (Brodsky, 1996). In this section, I will address some related studies that verify and support this theoretical belief, even though far less research supports the view that anxiety is both helpful and harmful for MPA compared to similar performance anxiety research in the field of sports psychology.

Some research supports cognitive therapy, the goal of which is to change faulty thinking patterns that give rise to maladaptive behaviors (Kenny, 2011). Cognitive therapy can be the optimal type of intervention to correct one's tendency to make incorrect inference regarding a specific task (Beck, 1979). It changes the performer's perspective on himself or herself and his or her problem and helps him or her to self-correct with more confidence and a positive attitude. In the context of cognitive therapy, anxiety has not been regarded as a negative emotion. However, anxiety as a subjective emotional experience can lead to negative cognition (dysfunctional belief).

In cognitive therapy, how attention is distributed in the task affects the task performance. According to Kenny (2011), there are three main foci in music: a). the self, b). the audience, and c). the music (task). However, scholars conclude that absorption in musical tasks tend to be associated with the lowest level of performance anxiety (Wolverton &Salmon, 1991), which replaces the concept of negative (dysfunctional) cognition by performance anxiety. Therefore, the conclusion we can draw from their study is that shifting attention from the self and the audience to the music (task) itself may reduce the number of negative thoughts.

Other cognitive strategies include reverse dysfunctional cognition as well as more realistic and positive thinking. For instance, positive self-talk is a strategy in which the performer has an internal dialogue that goes from "I can't cope with this performance" to "I believe I can nail it since I have prepared for this performance with a lot of effort" (Kenny, 2011). Another similar strategy is to reverse the negative and dysfunctional side of anxiety to its corresponding positive and functional side. Performers with different levels of anxiety or self-cognition will interpret anxiety differently, as either a helpful or harmful emotion. Research shows that musicians who experience a high level of anxiety are generally more likely to interpret their anxiety as debilitative, while musicians with high self-confidence are more likely to interpret their anxiety as facilitative (Gill, Murphy, & Rickard, 2006). Therefore, more recent studies have started to reveal the relationship between the perception of performance anxiety and performance results. The results show that when individuals reappraise anxiety as excitement by self-talking such as, "I'm excited," they tend to perform better compared to those who attempt to calm down when suffering anxious arousals (Brooks, 2014; Lucey & Reay, 2000). In the referential research associated with stress, McGonigal found that when people regard stress as a helpful response reacting to upcoming challenges or difficulties, their body systems (such as blood vessels and cardiovascular system) function in healthier ways. On the contrary, when people regard stress as a negative thing, they are more likely to suffer from a heart attack (McGonigal, 2013, 2016). Stress coping strategies also reflect the principle of cognitive therapy that reframes dysfunctional cognition into positive thoughts.

Recent studies have observed the relationship between physical movement and psychological cognition that follow the principles of behavioral therapy. Behavioral therapy focuses on changing dysfunctional behaviors in anxious situations (Eysenck, 1960). Older behavioral therapy studies are based on the problematic assumption that reducing MPA (progressive muscle relaxation, breathing regulation, and heartbeat adjustment) and normalizing (performance systematic desensitization and behavioral rehearsal) are the only ways to achieve the best performance (Appel, 1976; Sweeney & Horan, 1982; Grishman, 1989). However, some other studies hold the view that behavioral manifestations that go with peak performance can help to change performers' cognition about themselves or even affect the levels of hormones such as testosterone and cortisol. For instance when people feel good about themselves or their performance, they tend to expand their body, their heartbeat goes up, and their muscles are refreshed. Carney, Cuddy and Yap (2010) found that by simply changing physical postures to more powerful physical postures before performance, one can prepare his or her physical and physiological systems to endure difficult and stressful situations, such as interviewing for jobs, speaking in public, or taking potentially profitable risks. These so-called "power postures" might actually improve performers' confidence when they feel anxious and vulnerable before performing, though the effectiveness of this technique has very recently been called into question (Ranehill, Dreber, Johannesson, Leiberg, Sul, & Weber, 2015). Therefore, behavioral therapy can result in very different research results, again based on the researchers' belief regarding the nature of MPA.

Literature Review on Individual Zone of Optimal Functioning (IZOF)

Central Tenets

The IZOF model was proposed by the internationally renowned sport psychologist, Yuri L. Hanin, in the 1980s. Hanin's model is based on evidence that emotions in sports presented as a component of psycho-bio-social state are situational, multimodal, and dynamic manifestations of the the total human functioning (Hanin, 2000). The IZOF model theory is distinctive from other performance anxiety-related theories in three important ways. First, the IZOF model views performance anxiety as a neutral and normal emotional reaction to upcoming performance. Simply measuring high or low levels of anxiety cannot be the only condition for predicting performance results. Second, the IZOF model emphasizes personal differences in reaction to performance. Individual emotional experiences of anxiety are subjective and thus vary widely in how they contribute to successful, average, and poor performances. Third, the IZOF theory claims that each athlete has his or her own zone of optimal functioning. The zone indicates the range and the specific relationship of the optimal and dysfunctional emotional state (anxiety level) and the quality of its corresponding performance. The zone is central for understanding, assessing, and optimizing an individual's emotional state and performance process (Hanin, 2000). An athlete's performance is successful when his or her pre-competition anxiety is within or near the individually optimal zone.

The IZOF model not only observes the relationship between anxiety and performance; it also addresses performance emotional profiling, though anxiety is a vital part in describing performance related emotions. The IZOF model provides the functional explanation of the dynamics of emotion-performance relationships according to athletes' recollection of their subjective experiences. Meanwhile, it reveals the emotion-performance relationship by examining two major aspects: a). energizing (de-energizing) and b). organizing (disorganizing) effects of pleasant and unpleasant emotions upon optimal or poor performance (Hanin, 2000). The model is important for practical application because it can assist athletes in identifying their emotional state associated with successful or unsuccessful performances and enable more personalized and interventional emotion self-regulation (Robazza, Pellizzari & Hanin, 2004).

Additionally, the definition of optimal is also distinctive as it differs from peak performance to pleasing performance. More discussion about optimal functioning and optimal performance is included later in this chapter.

Applications of IZOF in Sports

Compared to studies that regard MPA as a negative emotion, far fewer studies have been done to observe both facilitating and debilitating effects of MPA and the relationship between situational emotions and music performance. Moreover, few studies in 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 fields of sports and 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 has been applied as a practical tool to identify and describe the zone (location and width) of optimal performance in which an athlete will most likely achieve peak performance (Hanin, 1989). Hanin has developed two methods to identify an athlete's optimal state anxiety range; in the first method, 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 (Raglin & Hanin, 2000). Therefore, the pre-competition anxiety level needs to be assessed until an athlete has an outstanding performance; this might take a long time to achieve. The second method is based on retrospective study, in which the athlete recalls his/her memory of the best past performance. In the measurement procedure, Hanin used Spielberger's State Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch & Lushene, 1970) in order to determine the athlete's pre-competitive state anxiety score. However, the accuracy of recollection is easily doubted (Gould, Tuffey, Hardy, & Lochbaum, 1993; Krane, 1993). Therefore, several studies claim that a multidimensional measurement such as the Competitive State Anxiety Inventory-2 (CSAI-2) (Martens, Burton, Vealey, Bump, & Smith, 1990) is more efficacious (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. Still, STAI has been used as well for more general measurement or when the recollection is inaccurate.

Hanin (1989) proposed that athletes with precompetitive state anxiety levels within their IZOF mightl perform better than athletes whose anxiety levels are outside their IZOF. Therefore, the IZOF model predicts performance results according to athlete's pre-performance anxiety value. One may achieve best performance when his/her anxiety value is within the IZOF. Moreover, with the IZOF model, athletes can also predict how anxious they will feel before upcoming competitions (Hanin, 1978, 1986). Under the framework of IZOF, interventions are designed to help athletes regulate their emotional state into optimal intensity and optimize the process of task execution. The zone is used as criterion to evaluate if the current and anticipated anxiety should be reduced, increased, or maintained at individual's optimal level (Hanin, 2010). Therefore, the IZOF model takes advantage of the dynamic emotion-performance relationship and provides athletes (as well as coaches) with more indexes for self-recognition and self-correction.

The IZOF model has its limitations, however, for instance, recollection might be inaccurate in some situations (Gould, Tuffey, Hardy, & Lochbaum, 1993; Krane, 1993). Assessing instrument choice is sometimes confusing and unconvincing since any sport-specific anxiety measure is unlikely to adequately encompass the variability in conditions and athletes (Raglin & Hanin, 2000). In addition, the model divides the performance related state into optimal zone and dysfunctional zone and ignores the moderate situations (Flett, 2015). The overlap between zones needs more explanation.

Zone of Optimal Functioning and State of Flow

Optimal performance does not necessarily mean peak or best performance. The zone shows a range of the individual's high-quality or successful performances. The term, functioning refers to the specific optimal (or dysfunctional) effect of emotion (or its components) upon the quality of performance process (Hanin, 2000). Good functioning brings good energy and organizes individual emotional content and intensity upon performance to an optimal value.

When explaining optimal function, people may think of another similar term: state of flow. In fact, as a specific optimal psychological state experienced during performance, flow state has been yearned for by both athletes and musicians. Both athletes and musicians describe flow as being "in the groove," "on auto," or "on a high." This part of the chapter briefly explains the conceptual differences of IZOF and a state of flow, though the distinction between them is ambiguous.

Flow is defined as an optimal and positive psychological state in which complete absorption in the task at hand leads to number of positive experiential qualities (Jackson, 2000). According to Csikszentmihalyi (1996), flow contains features from nine dimensions: a). clear goals for every step of the way; b). immediate feedback to one's actions; c). balance between challenges and skills; d). merging of action and awareness; e). excluding distractions from consciousness; f). no worry of failure; g). loss of self-consciousness; h). losing track of time; i). autotelic performance.

Compared to the features above, IZOF is more emotion-oriented whereas flow is more task management-oriented. Though flow is a positive psychological state, it does not associate with emotions like happiness or joy in the process of accomplishing a task. It is a precursor and pathway to positive experience (Jackson, 2000). Additionally, the IZOF provides possibilities for measuring and defining the emotion-performance relationship. On the other hand, flow is an optimal experience and state. It is hard to find an appropriate method for assessing flow. Therefore, some scholars believe that flow should not be measured (Jackson, 2000), even though it is always linked to ideal performance.

Hanin (2000), however, makes the distinction between optimal and ideal performance. Ideal performance only involves positive characteristics of a dream or flow state, whereas optimal performance includes both positive and negative emotions that could be used to enhance the quality of performance. From the perspective of experience, flow state is manifested in similar features mentioned earlier, while experience of the IZOF differs from person to person. Finally, in an interview-based study, flow was controllable (Jackson, 1995). Similarly, a performer's emotional and physical state is controllable. By adjusting emotional and physical state to an optimal state and intensity, performers will be able to perform in or near their IZOF. However, performers cannot directly control their existing IZOF. In short, flow state must be in the IZOF, but it is not the only component of being in the zone.

CHAPTER 3. STUDY 1 LOCATING THE ZONE

Pilot Study

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. Then, with the zone defined, it is possible to predict the quality of upcoming performance with respect to the pre-performance emotional and physical state of the performer in Chapter 4. The zone may guide us to cultivate an optimal physical and psychological state for peak performances through further training or adjustment.

To find the zone of optimal functioning, in the first phase of this research, the CSAI-2 (Martens et al., 1990) was used to evaluate multidimensional anxiety level. The CSAI-2 is a performance-specific self-reporting instrument that provides separate categories for cognitive anxiety state, somatic anxiety state, and state of self-confidence values (Krane, 1993).

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. At the time of the study, Pianist A was 20 years old and a junior in a conservatory in Beijing, China. She began learning piano at age of five. She practices approximately 40 hours each week and recalled her pre-performance memory of four midterms and five final juries from the past two and a half years. Pianist B was 22 years old at the time of the study and also a junior in a conservatory in Beijing, China. She began learning piano at the age of eight and practices approximately 24 hours each week. She recalled her pre-performance memory of three midterms and three final juries in the past two years. Because this is a pilot study as well as a feasibility study, the group of pianists was smaller so that by assessing the proposed data on a small-scale version of the pilot study, potential problems could be uncovered and revised in the plan for further large scale research.

Consent forms were sent to the participants from the IRB, as the results were used for this research. This project had 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 may 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 subsequent research.

Instruments and Measurement

Performance Scoring

The performances were evaluated by seven professional college level teachers. Four of them were associate professors in the conservatory, one was a professor in the conservatory. The other two were assistant professors. Each of them evaluated performances after the midterm or final on a 1 to 100 scale, where 1 was the worst possible performance and 100 was the best possible performance. Judges were told that their scoring was 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 that 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 in order to minimize errors and bias. The evaluation criterion can be found in Appendix A.

State Anxiety Level

The CSAI-2 (Martens et al., 1990) was used to measure the performance anxiety state. The CSAI-2 is mainly used in sports research and also works closely with the IZOF model. It is a self-reported inventory that has 27 simple questions and takes about five minutes to complete for each performance evaluation. It shows the anxiety level of three different dimensions (subscales): a). cognitive, b). somatic, and c). 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 to 36. See Appendix B for Chinese version and translated English version.

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 to determine the range of the IZOF.

Research Procedure

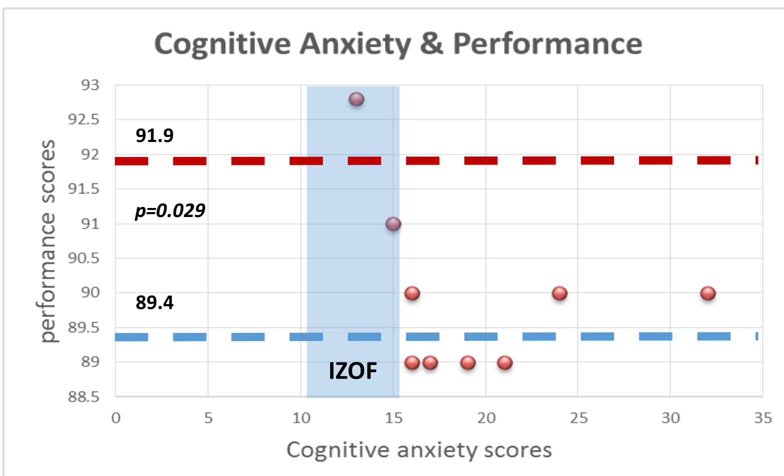
In order to save time testing the best performance among a series of juries and maintain the accuracy of determining the optimal zone, this study had pianist A and pianist B recall their performance-related memories to the best of their abilities.

Two junior advanced piano major students then recalled their previous memory of juries based on their pre-performance states and filled 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 that they recalled; 3). The subjects completed the CSAI-2 for every performance according to their recollection. Pianist A took 45 minutes to recall her performance experiences and filled the form nine times based on her experience of nine different performances. Pianist B took 35 minutes to recall her memory and filled the form six times based on her experience of six different performances. 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.

Results

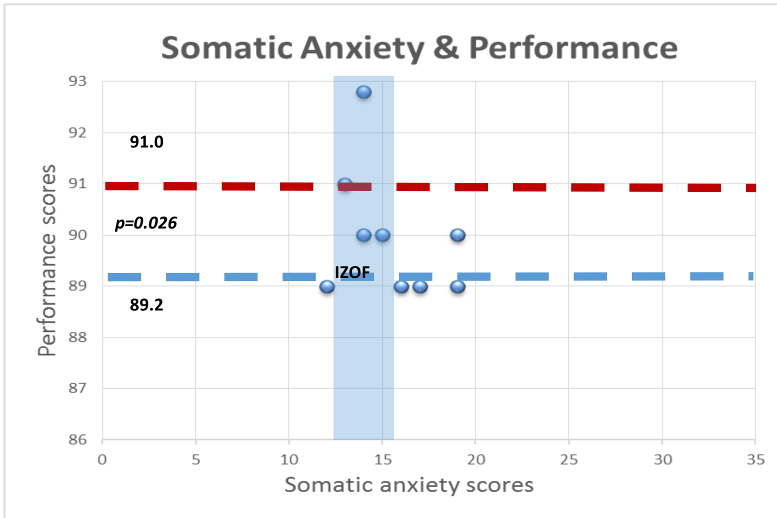
An analysis was conducted to test whether the performance values within the subscale-based optimal zone were higher than the performance values outside the zone. In pianist A's case, the corresponding cognitive anxiety (CA) score of the best performance score was 13, SD=5.83. The range of IZOF for CA is 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.

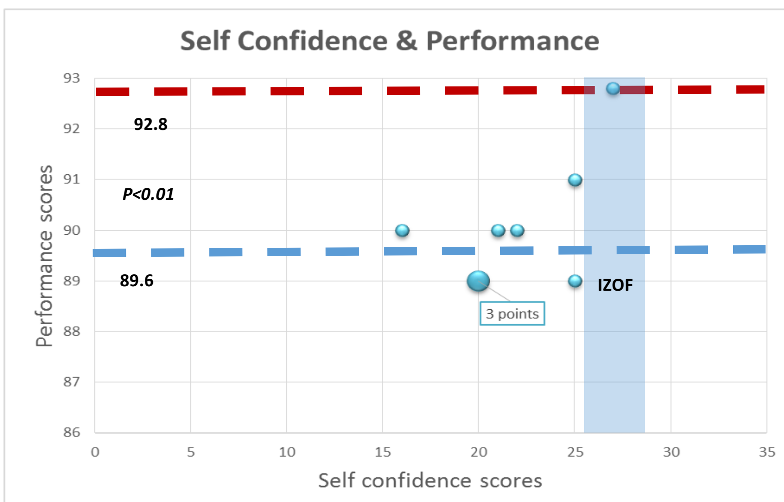
Figure 1. In-zone/out-of-zone CSAI-2 subscale score (cognitive anxiety) and corresponding performance scores for pianist A.



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 ($p=0.01$).

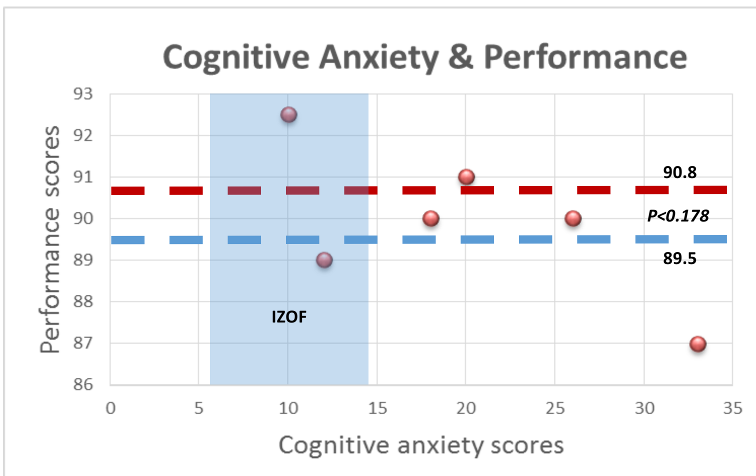
Figure 2. In-zone/out-of-zone CSAI-2 subscales scores (somatic anxiety and self-confidence) and corresponding performance scores for pianist A.





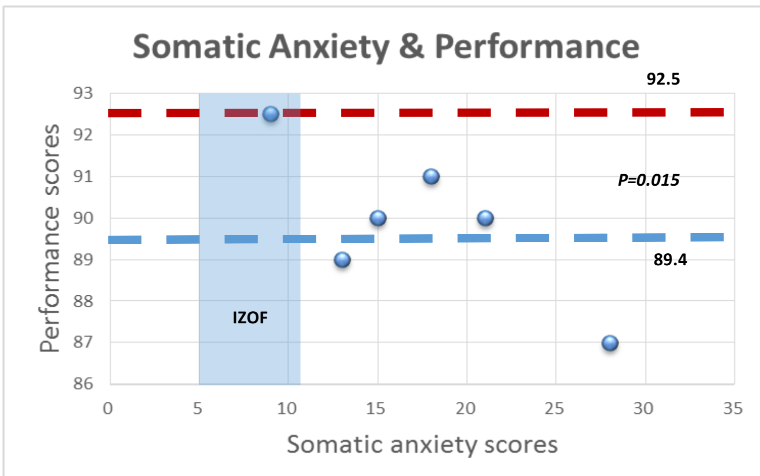
In pianist B's case, the corresponding cognitive anxiety (CA) score of her best performance score was 10. SD=8.64. The anxiety state CA subscale score of pianist B was wider compared to pianist A. However, this does not necessarily mean pianist B had a greater chance for optimal performance since she offered less performance data to begin with, which might have led to bias in identifying the zone. The range of IZOF for CA was from 5.68 to 14.32. Though pianist B had a 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 may need slightly more CA for peak performance.

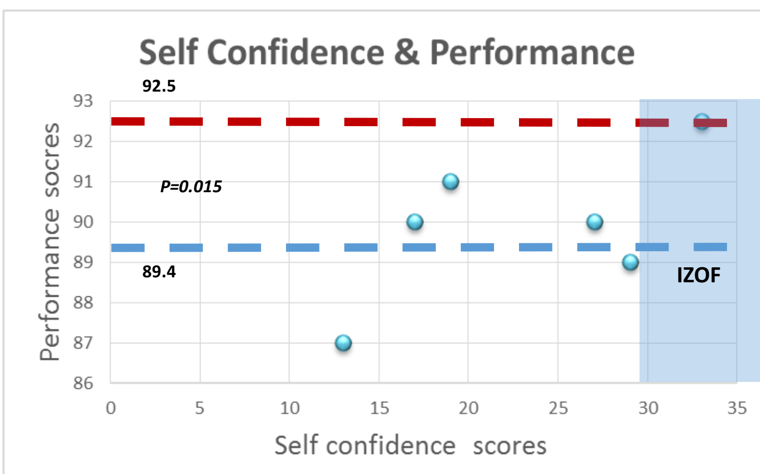
Figure 3. In-zone/out-of-zone CSAI-2 subscale scores (cognitive anxiety) and corresponding performance scores for pianist B.



In the somatic anxiety subscale, one performance fit into the zone. The highest score in the 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.





Summary and Revelation

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 samples were not large enough. For this pilot study, there were only two pianists, which may be insufficient for examining the SD. 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 might be associated with pianist B's overall skill. As in the self-reported material pianist B offered, she did not 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 subjects can be expanded. Second, additional questions that are more specific to music learning/performing experience and parental/professorial influence can be included. Inventories like the Kenny Music Performance Anxiety Inventory (K-MPAI) (Kenny, Davis, & Oates, 2004) offer more possible factors that may influence pianists' performance, and the additional questions may help improve the accuracy of recollection and minimize memory errors. Third, in a large scale study the pianists would only recall four most impressive (in a good or bad way) performances in order to minimize memory errors as well.

Larger Scale Study

Design and Statistical Analysis

In this phase of the study, participants were required to reflect upon four most impressive (in a good way or a bad way) midterm/final jury performance experiences in a written format. Piano juries are usually held four times every academic year, which is far less frequent than sports performances. If the subjects in this study recall four performance experiences over the time span of one year, the accuracy of recollection can be more reliable. Additionally, subjects were told to reflect on their most impressive performance so that their memory about the performance was fresher for them and easier to recall. In the pilot study, the investigator found that the frequency of recollections may affect the accuracy of filling the CSAI-2, since it is extremely difficult to recall six to nine performances. Therefore, in the large-scale study, only four performances were required for recollection. Undeniably, fewer recollections would increase the difficulty of defining the zone, however, negotiations and adjustments had to be made in order to adapt for piano performance situations compared to sports competitions.

Pianists wrote down the repertoire and the performance score results for the four performances that they recalled. Then, they completed the inventory CSAI-2 four times based on four different juries. They were asked to spend no more than five minutes on each inventory. In the process of completing the file, they provided their personal information such as age, gender, nationality, and grade.

The larger scale study was anonymous as well. No names or any other identifiable information were recorded. Consent forms were sent to the participants before they filled out the form. This study had no risk associated with physical or psychological state of the participants. For inventory collection, subjects handed in their consent form with inventory and questionnaire to their piano department office so that the investigator could gather all the paperwork.

Statistically, continuous data are shown as the personal best performance's corresponding somatic anxiety value $\pm\frac{1}{2}$SD. To compare differences between performance in the IZOF and out of the IZOF, independent t test was implemented. All tests were considered statistically significant with 2-sided $p<0.1$. Data analysis were performed using IBM SPSS statistics for Windows (Version 22.0; IBM Corp., Armonk, N.Y., USA).

Participants

In this phase of the study, 35 questionnaires and inventories were sent out and 34 were returned. Since 4 of the inventories were not completed or statistically unreliable, the remaining 30 were taken for statistical analysis. Among these 30 participants, there were seven males and 23 female advanced pianists. They were all piano performance major undergraduates in a conservatory in Beijing, though they came from different provinces of China, including Beijing, Hebei, Henan, Guangxi, Sichuan, Hunan, Jilin, Fujian, Guizhou, Heilongjiang, Shanxi, Liaoning, Jiangsu and Inner Mongolia. At the time of the survey, six of them were sophomores, ten of them were juniors and 14 of them were seniors, all in a four-year bachelor degree system. Their ages ranged from 18 to 24, and the average age was 21.07. In their educational history, the age of beginning piano studies ranged from three years-old to seven years-old. Most pianists started learning piano systematically before starting school, at around 4 to 6 years old. Five pianists, 16.7%, began learning piano before turning four years-old. Eleven pianists, 36.7% of them, started learning piano at the age of four, and an equal number, again 36.7% of them, began studies at the age of five. Only three pianists started their piano training as late as eight years-old. On average, 66.7% of them practice 3-4 hours each day. 26.7% practice 5-6 hours a day. Only one pianist practices less than two hours and one pianist practices 7-8 hours daily.

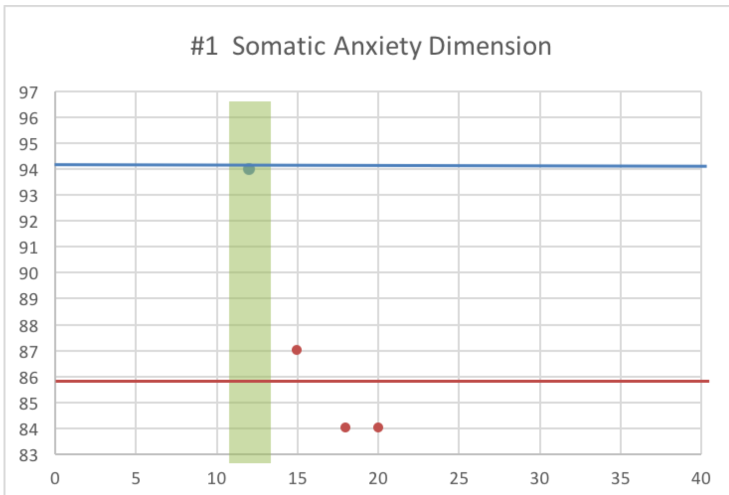
<u>Somatic Dimension</u>

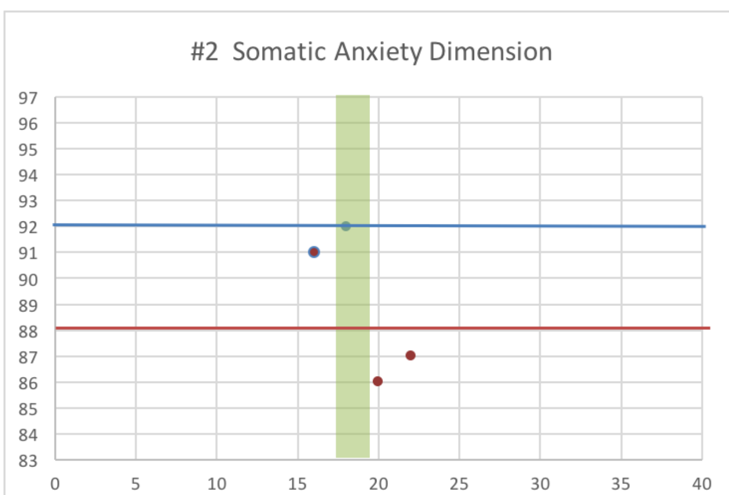
Zones of each subject were identified separately in three dimensions: a). somatic anxiety dimension, b). cognitive anxiety dimension and c). self-confidence anxiety dimension. According to the data collected from CSAI-2, the optimal functioning zone for each pianist on all three anxiety state subscales was identified (Raw data I see Appendices B).

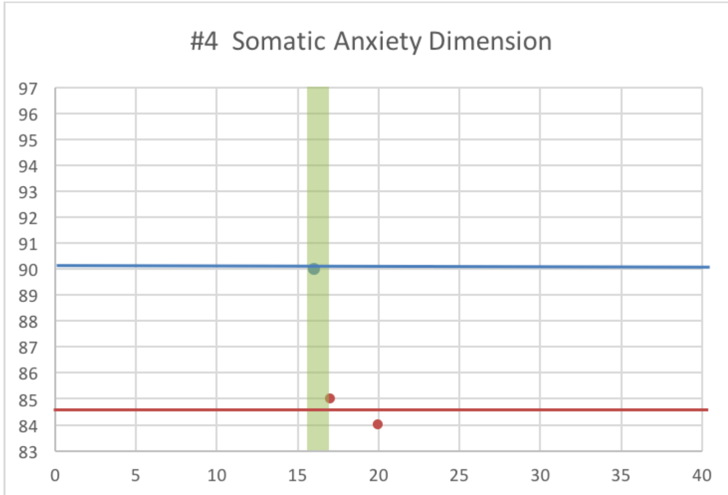
Somatic anxiety subscales showed that all the pianists' best performances were in their optimal functioning zones. Average performance scores (indicated as blue lines) in the zone were significantly higher than the scores (indicated as red lines) out of the zone. Due to the infrequency of juries, four dots in the charts presented in three different situations: one best performance in the SA zone and three other performances out of the SA zone, as shown in #1, #2, #4, #5, #6, #7, #11,

#12, #16, #17, #23, #26, #29 (See figure 5.); two performances in the SA zone and two other performances out of the SA zone, as shown in #3, #8, #9, #10, #13, #15, #18, #19, #20, #21, #22, #24, #25, #27, #28, #30 (See figure 6); three performances in the SA zone and one performance out of the SA zone like #14 (See figure 7).

Figure 5. Subjects who have one best performance in the SA zone, three other performances out of the SA zone



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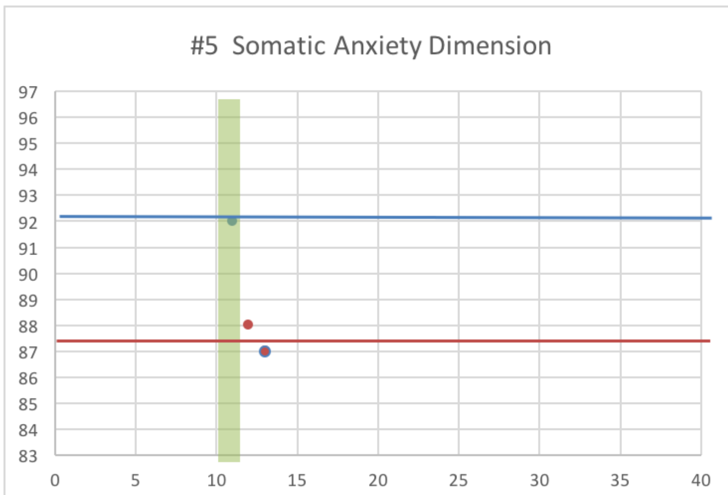
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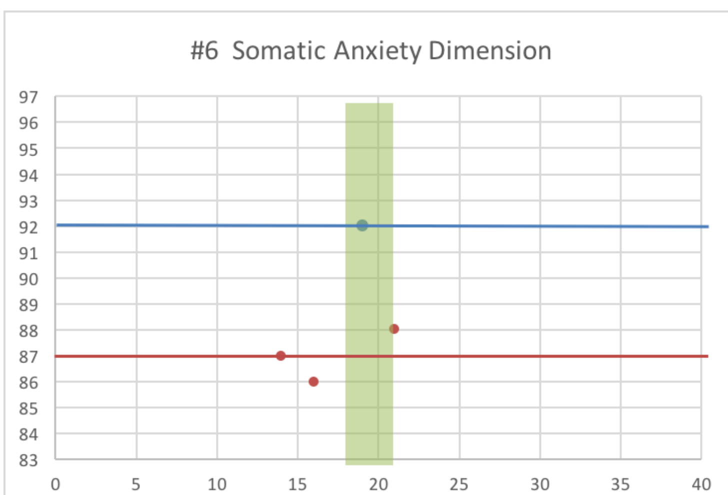
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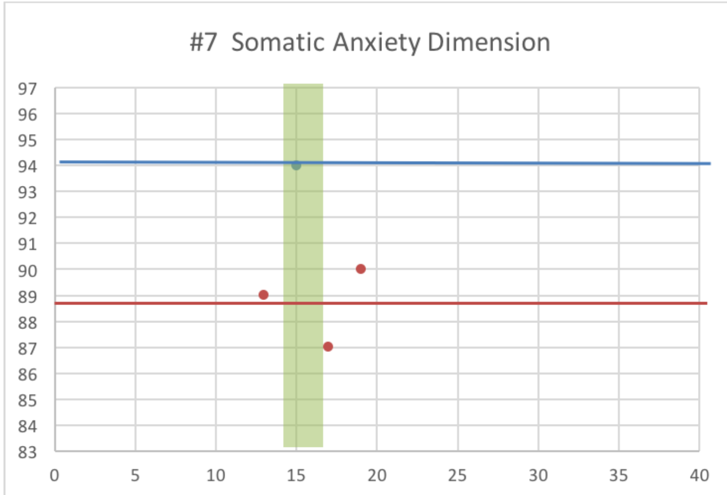
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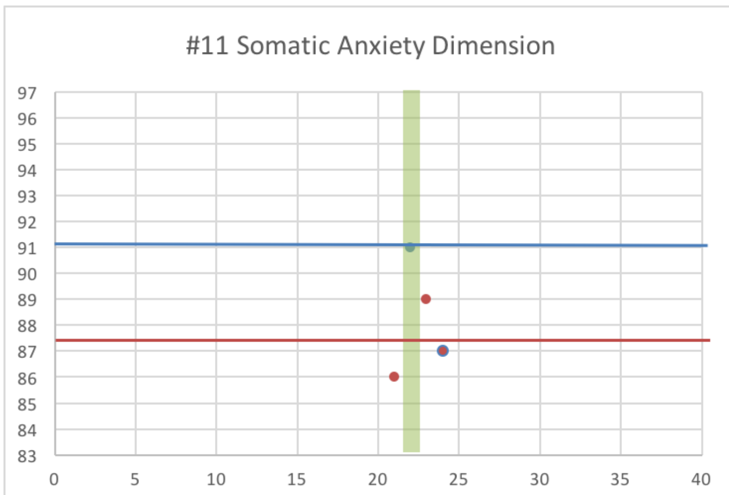
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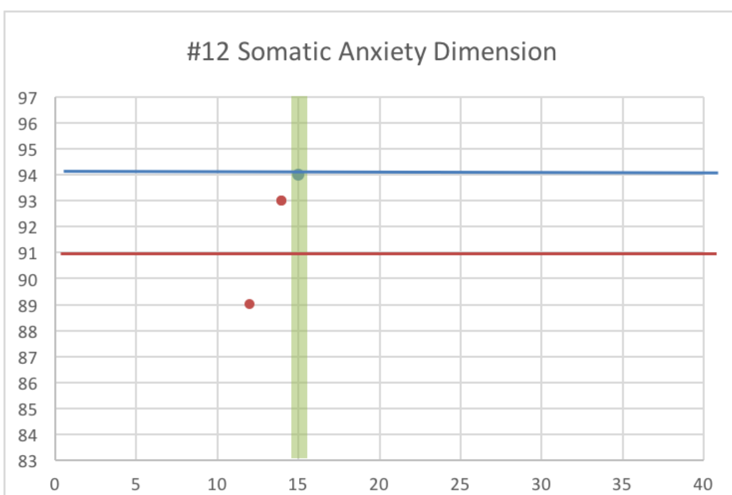
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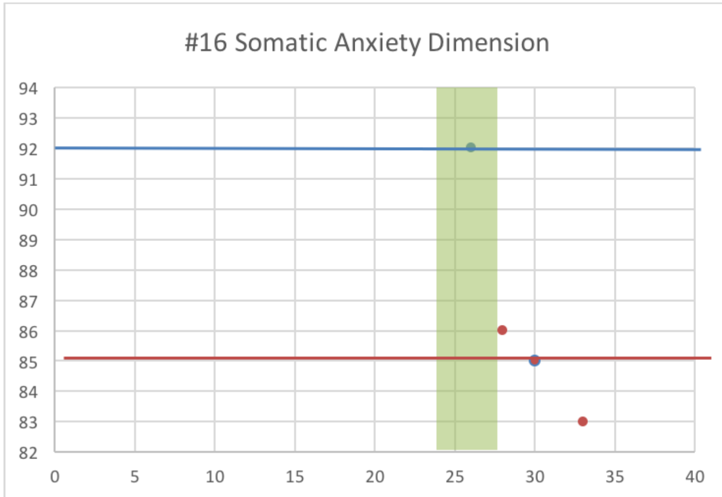
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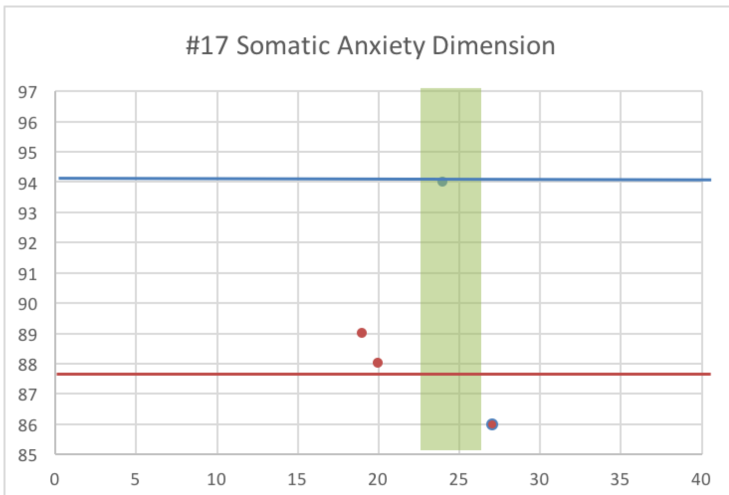
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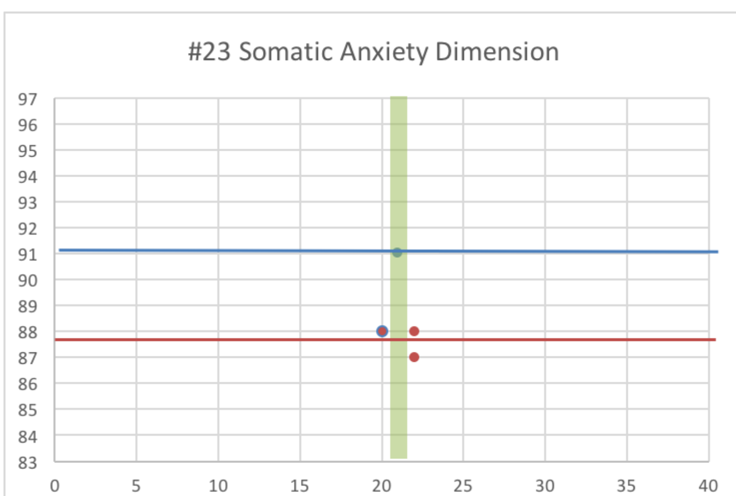
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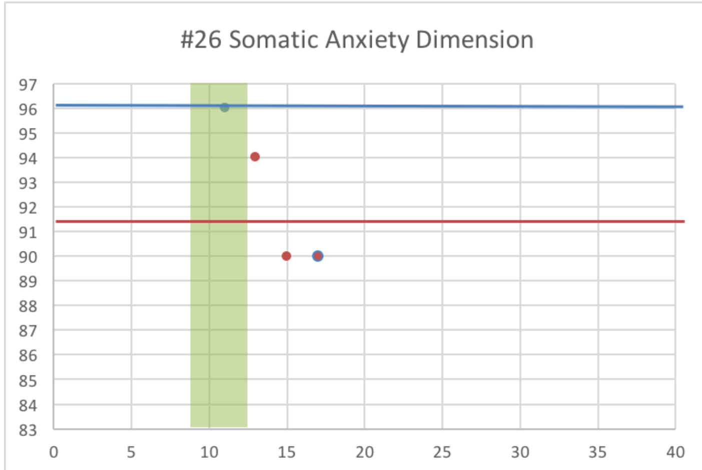


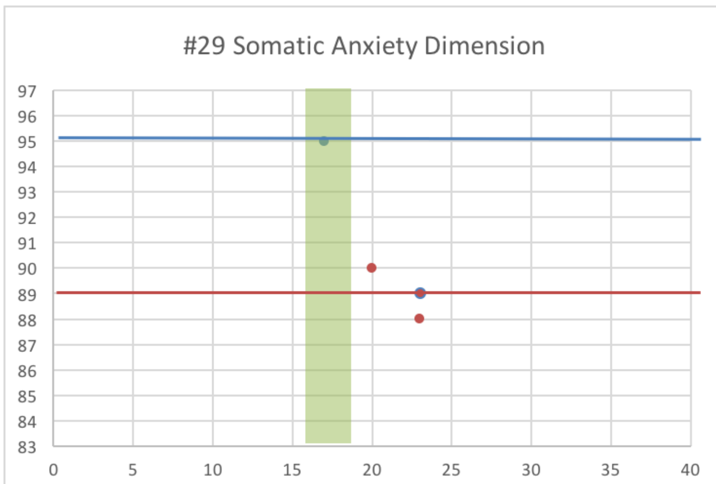
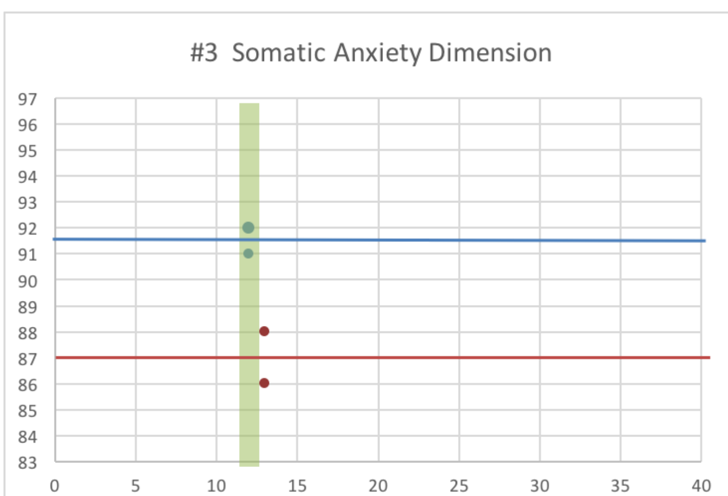
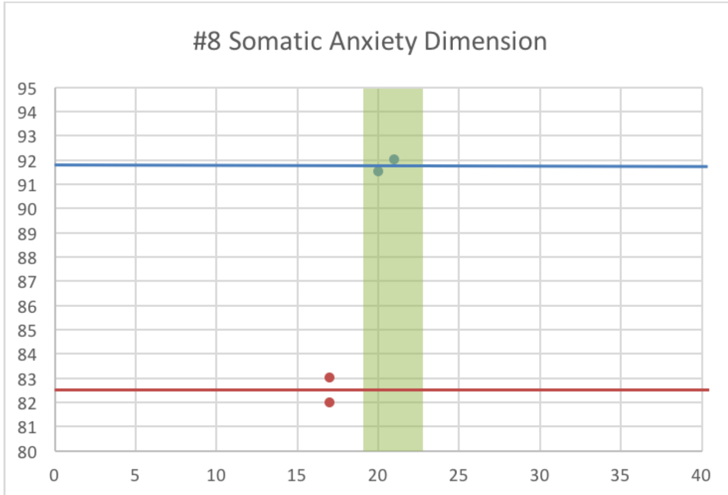


Figure 6. Subjects who have two performances in the SA zone and two performances out of the SA zone

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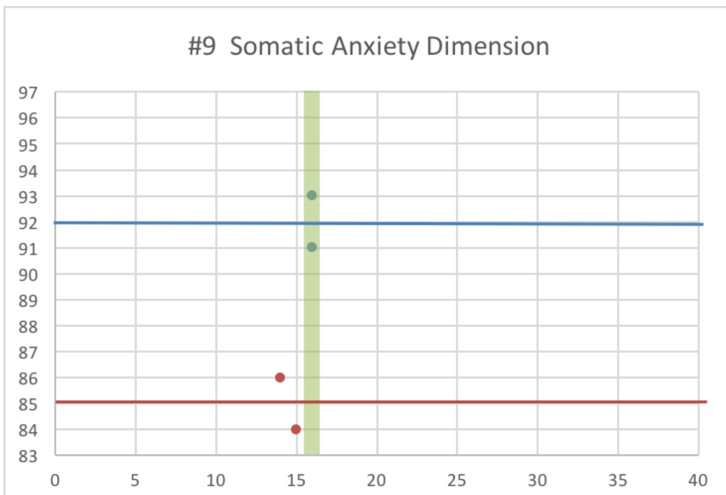
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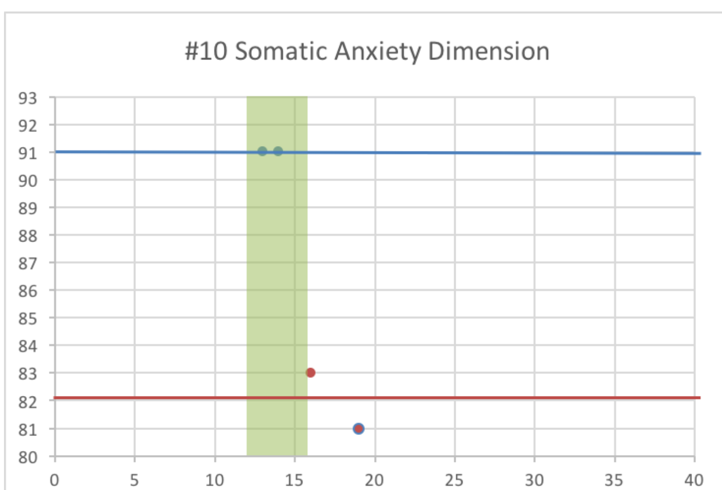
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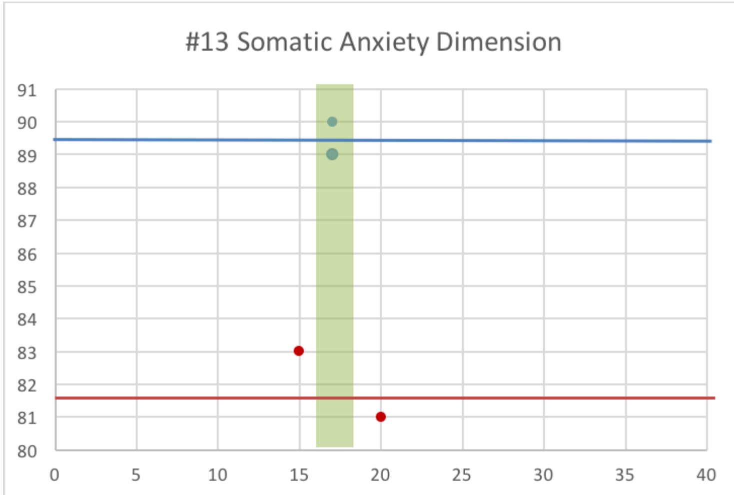
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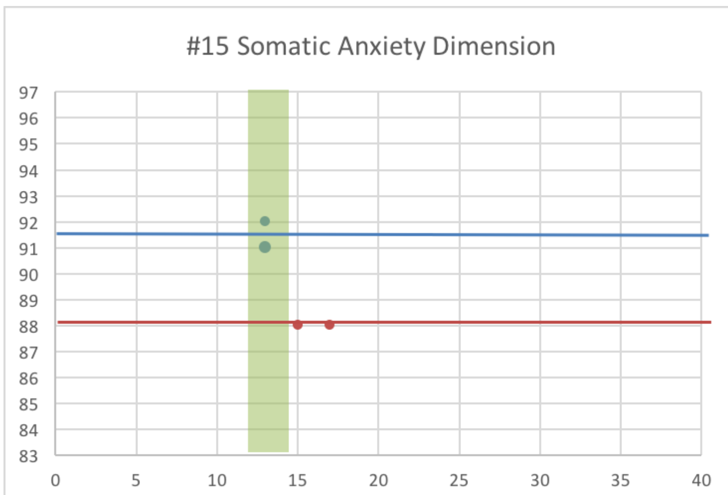
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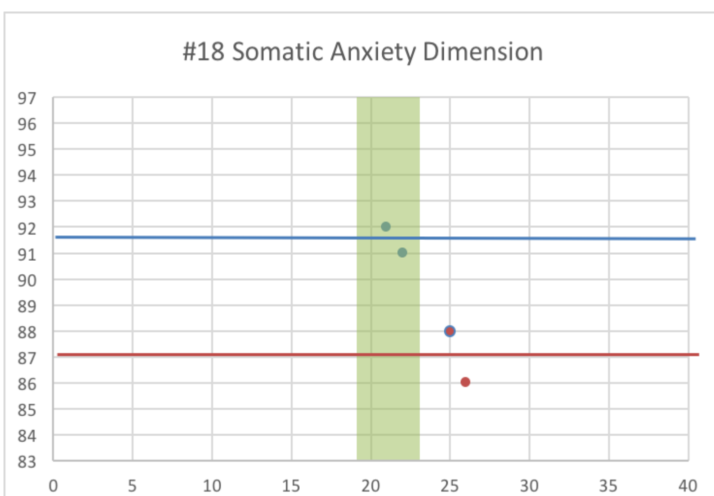
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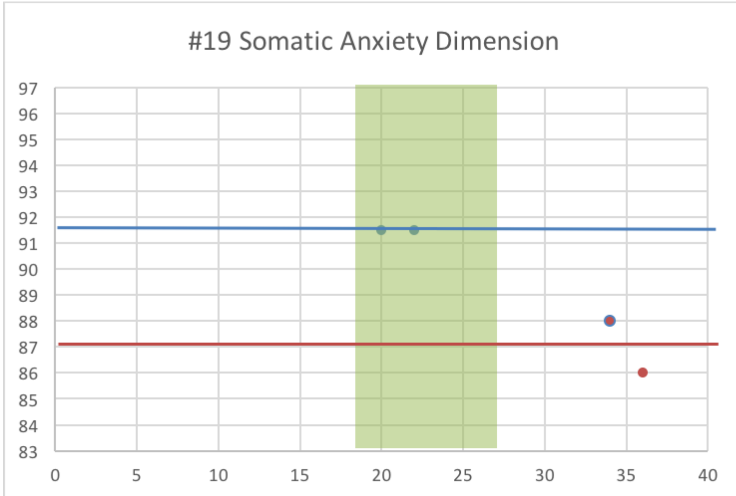
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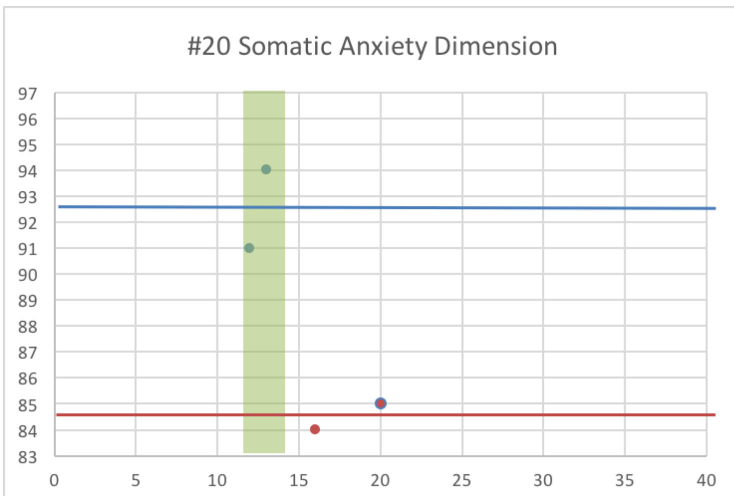
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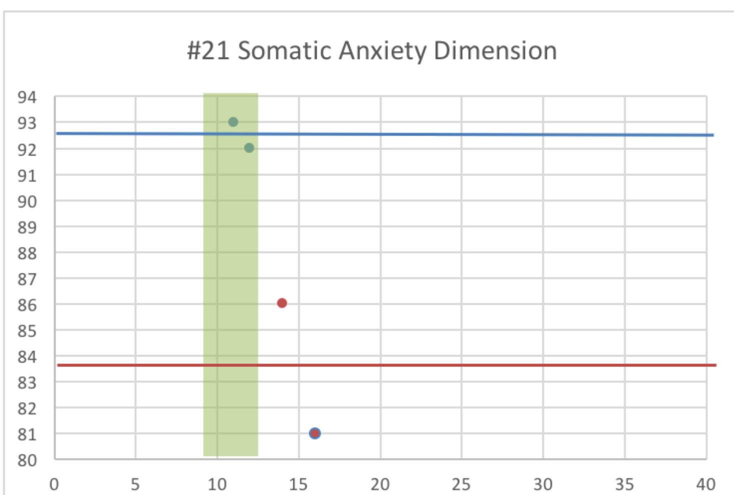
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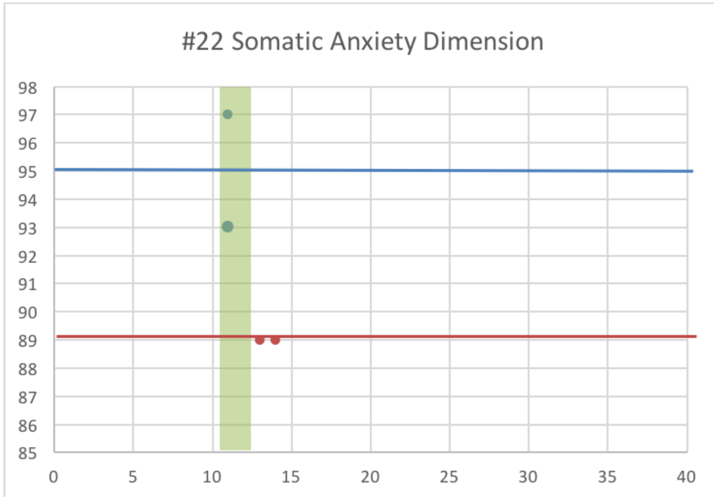
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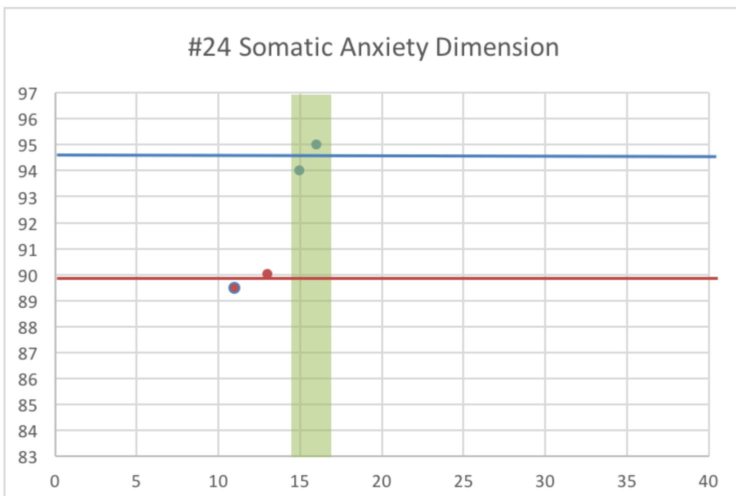
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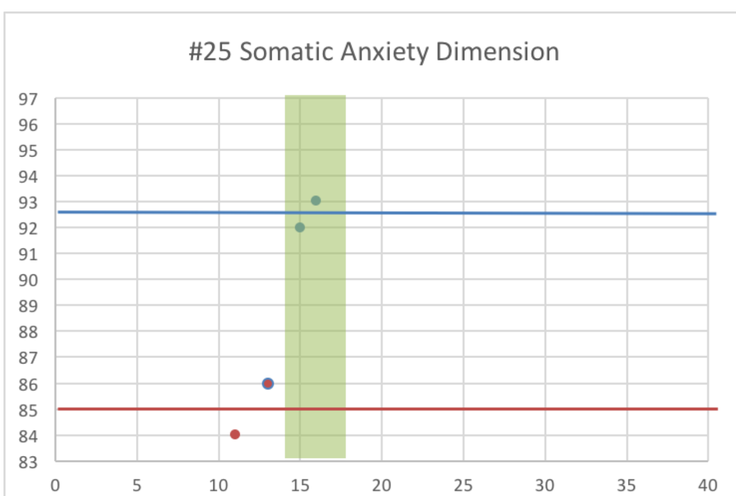
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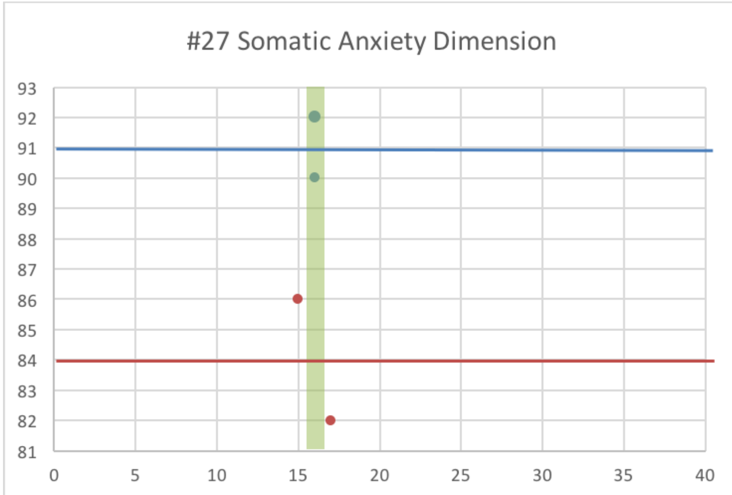
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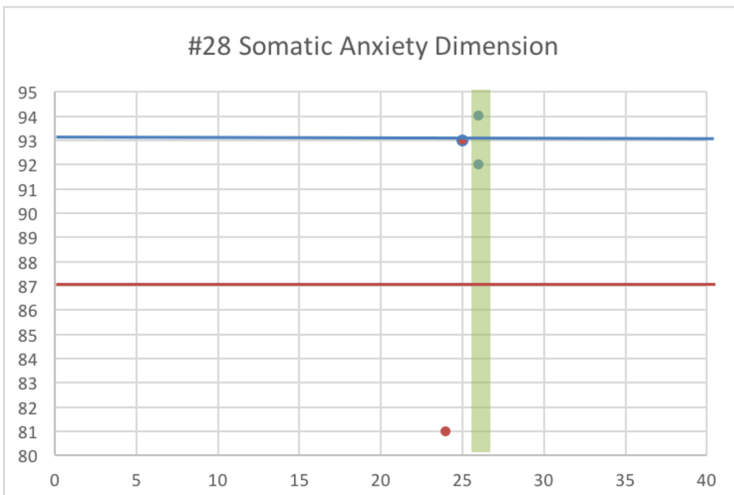
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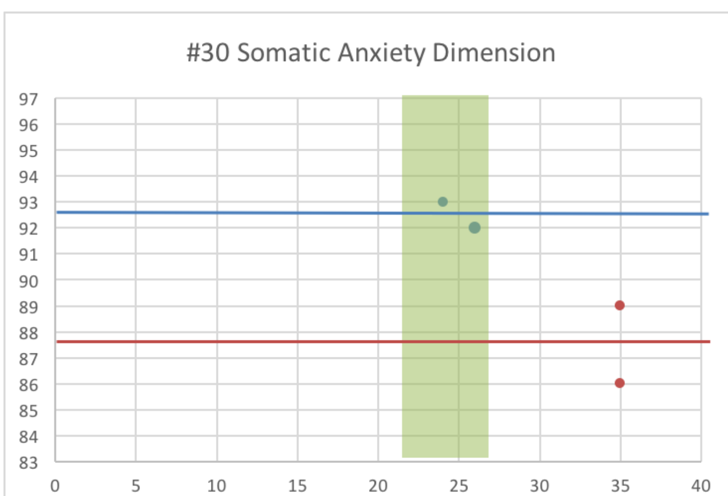
#30 Somatic Anxiety Dimension
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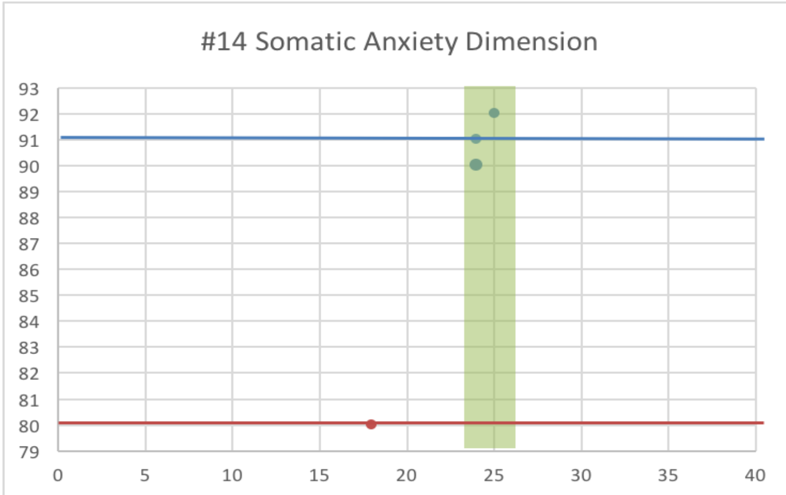
Figure 7. Subjects who have three performances in the SA zone and one performance out of the SA zone



An analysis was conducted to test whether each performance value within the somatic subscale-based optimal zone was higher than performance values outside of the zone. Though all the blue lines were above the red lines, the result shows that subjects #28 had one quite high out-zone performance values, even higher than one of the in-zone performance values. However, #28 is the only exception where the out-zone performance values are higher than the in-zone performance among all these subjects in the somatic subscale.

In addition, in figures 5, 6 and 7, the width and location of the zone varies from person to person. Pianists like #19 and #30 have quite wide zones, while #9, #12, #27 have very narrow zones. Some pianists' zones locate at the right side of the scale, which means they need more somatic anxiety intensity to fit their performances into the zone, such as #14 and #16. On the contrary, many others need lower somatic anxiety intensity to get into their optimal zones, such as #5, #21, #26 etc. The variety in shape and location of each zone indicates the individual nature of the optimal functioning zone for different pianists.

Some subjects' out-zone dots all presented at the right side of their IZOF, including pianists #1, #3, #4, #5, #10, #15, #16, #18, #19, #20, #21, #22, #26, #29, #30. Their out-zone performance anxiety intensities were higher than the upper threshold of the in-zone performance anxiety intensity. Meanwhile, some others' dots all presented at the left side of their IZOF, including pianists #12, #8, #9, #24, #25, #28, #14. Therefore, their out-zone performance anxiety intensity was below the lower threshold of the in-zone performance anxiety intensity. In the chart of pianists #2, #6, #7, #11, #13, #17, #23, #27, dots distributed at both sides of the IZOF. The location of the dots showed that the subjects are more likely to give an unsatisfying performance if they have somatic anxiety intensity higher than the upper threshold of their IZOF or below the lower threshold of their IZOF.

To compare differences between performances in the IZOF and out of the IZOF in the somatic dimension, an independent T-test was implemented (See figure 8). Significant differences ($p<0.10$) between in-zone performances and out-of-zone performances were found for 27 pianists (90%) in their somatic anxiety (SA) dimensions.

Figure 8. The comparison of mean of SA in-zone performances score and out- of-zone performance score

	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Mean (In-zone)	94	92	91.5	90	92	92	94	91.8	92	91
Mean (Out-of-zone)	85	88	87	84.5	87.3	87	88.7	82.5	85	82
Sig. (2-tailed)	0.046	0.321	0.057	0.008	0.020	0.049	0.094	0.004	0.038	0.012

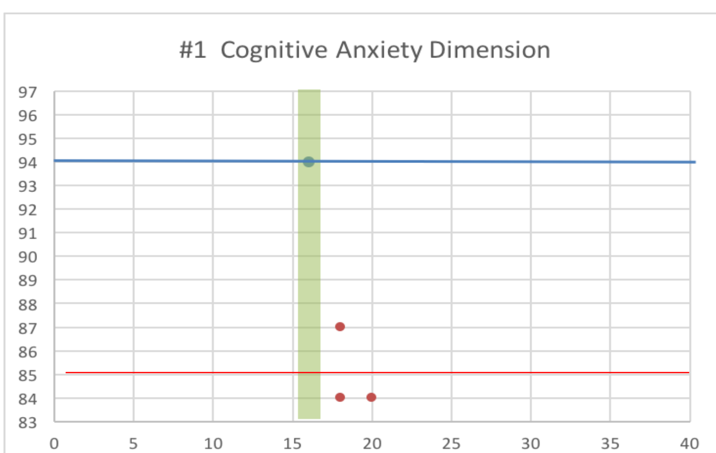
	#11	#12	#13	#14	#15	#16	#17	#18	#19	#20
Mean (In-zone)	91	94	89.5	91	91.5	92	94	91.5	91.5	92.5
Mean (Out-of-zone)	83.7	91.7	82	80	88	84.7	87.7	87	87	84.5
Sig. (2-tailed)	0.093	0.474	0.022	0.011	0.020	0.053	0.070	0.057	0.046	0.037

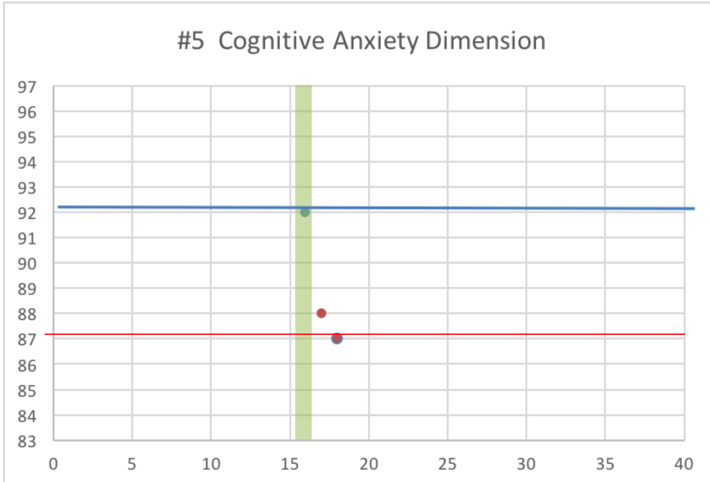
	#21	#22	#23	#24	#25	#26	#27	#28	#29	#30
Mean (In-zone)	92.5	95	91	94.5	92.5	95	91	93	95	92.5
Mean (Out-of-zone)	83.5	89	87.7	89.75	85	90	84	87	89	87.5
Sig. (2-tailed)	0.072	0.095	0.038	0.014	0.022	0.038	0.089	0.428	0.035	0.087

Cognitive Dimension

In the cognitive anxiety dimension, results also showed that all the pianists' best performances were in their cognitive optimal functioning zones. The average performance scores (indicated as blue lines) in the zone were significantly higher than the scores (indicated as red lines) outside the zone. Four dots in the charts presented in three different situations: one best performance in the CA zone and three other performances out of the CA zone, as shown in #1, #5, #6, #7, #11, #13, #16, #17, #20, #23, #29 (See figure 9.); two performances in the CA zone and two other performances out of the CA zone, as shown in #2, #3, #4, #8, #9, #10, #15, #18, #19, #21, #22, #24, #25, #26, #27, #28, #30 (See figure 10); three performances in the CA zone and one performance out of the CA zone like #12, #14 (See figure 11).

Figure 9. Subjects who have one best performance in the CA zone, three other performances out of the CA zone

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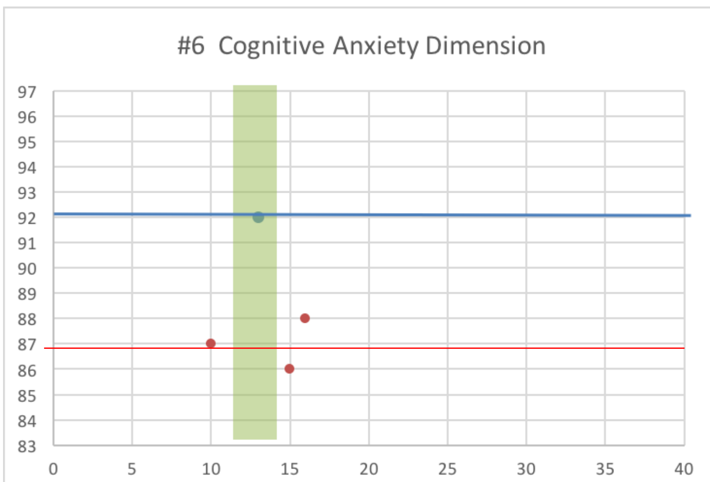
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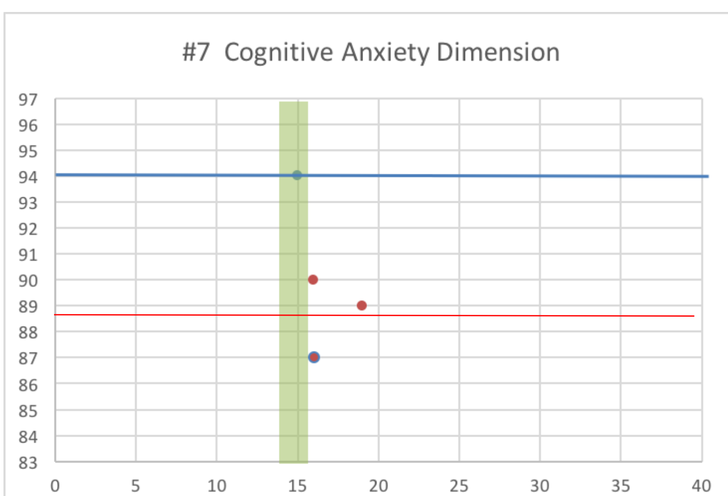
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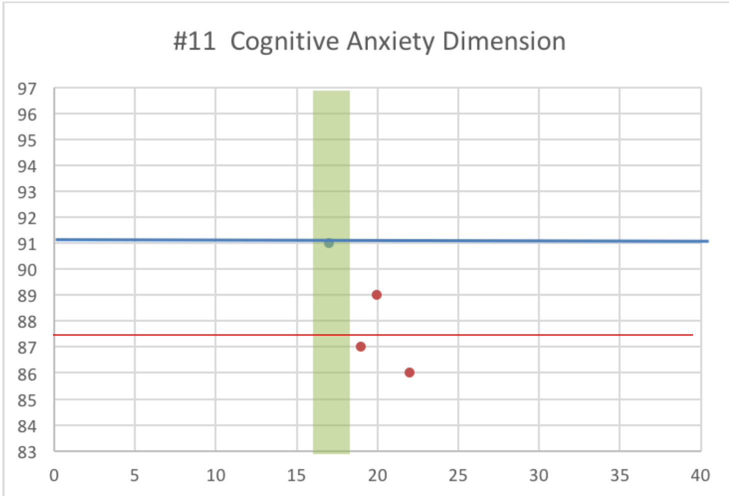
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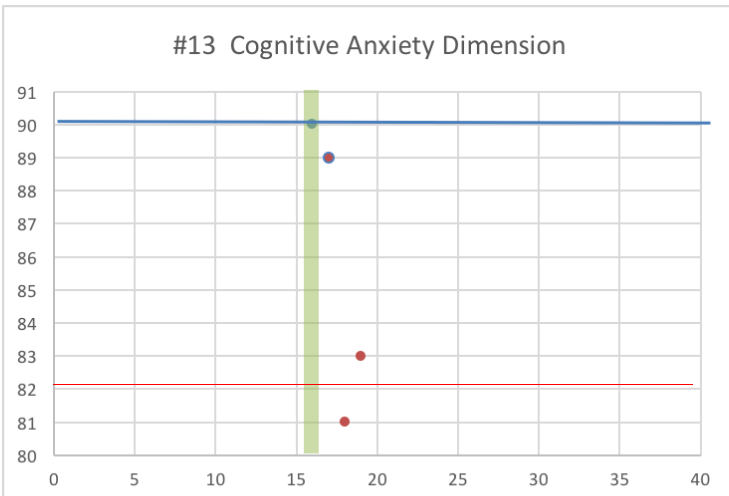
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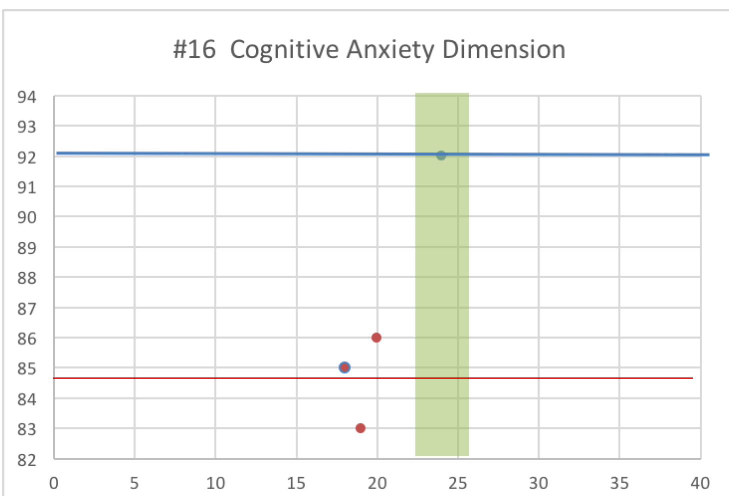
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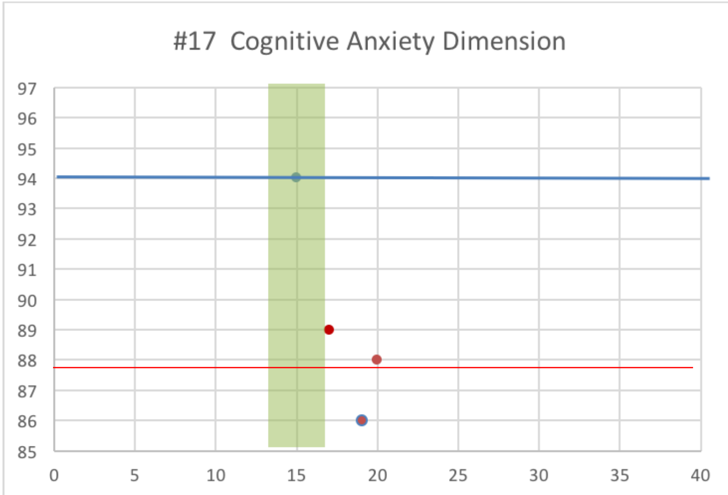
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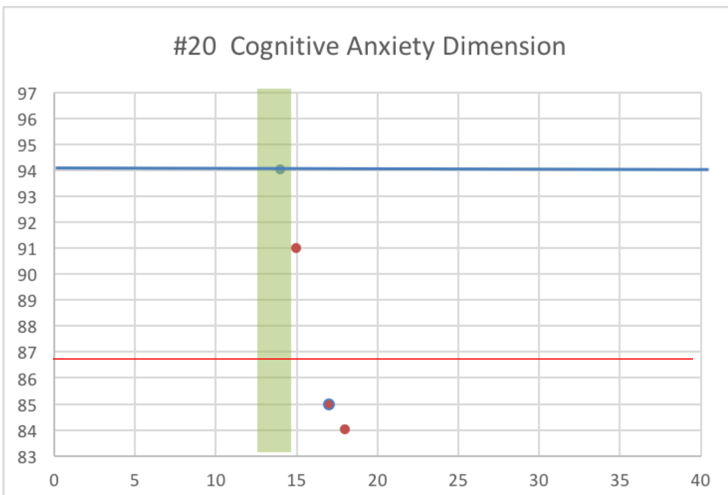
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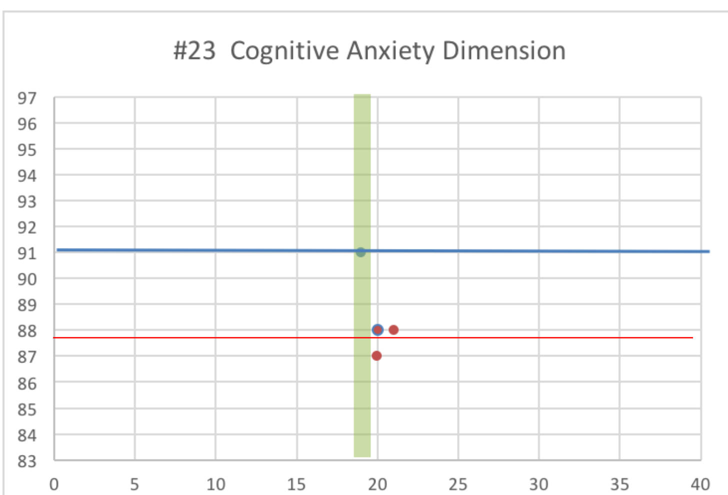
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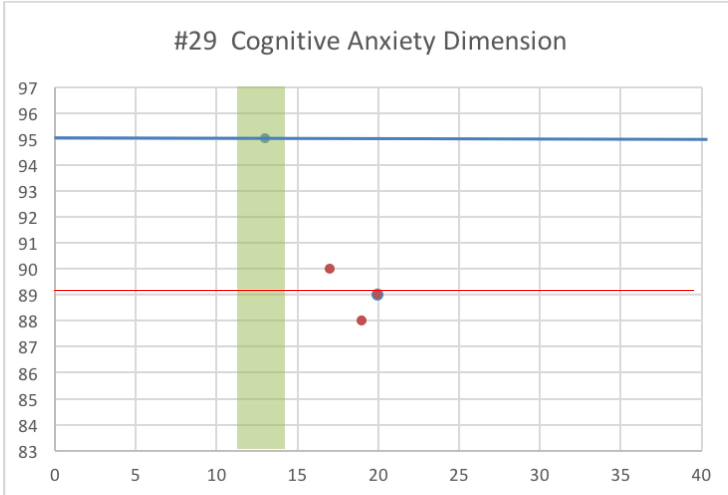
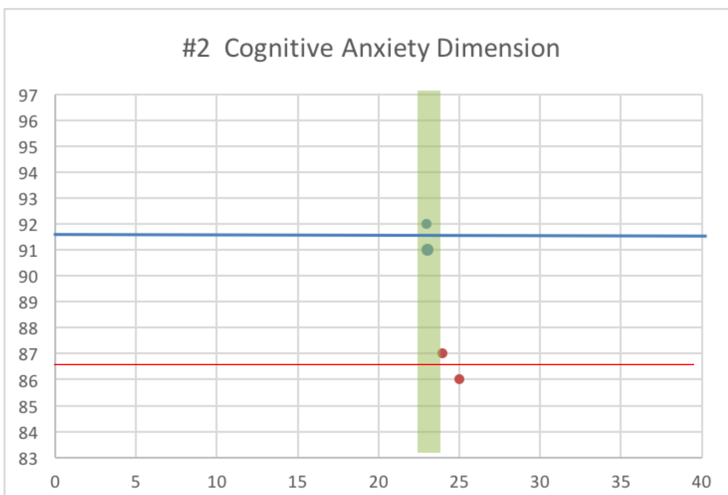
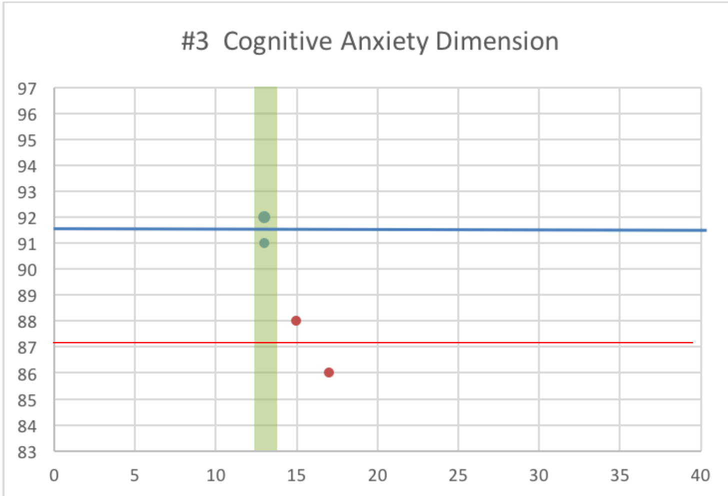


Figure 10. Subjects who have two best performances in the CA zone, two performances out of the CA zone

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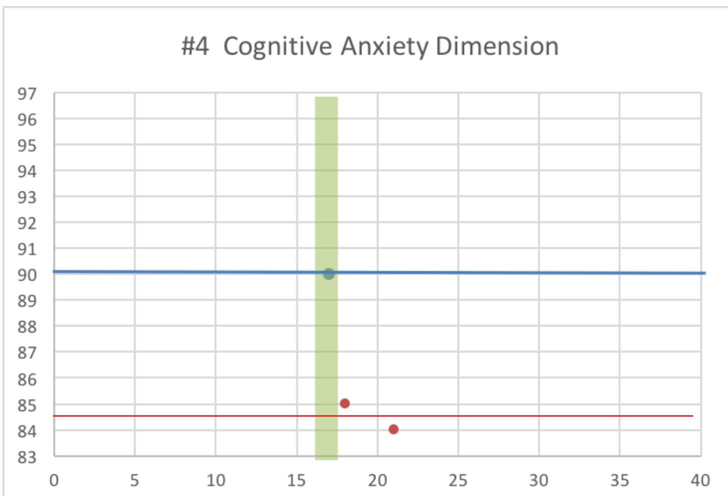
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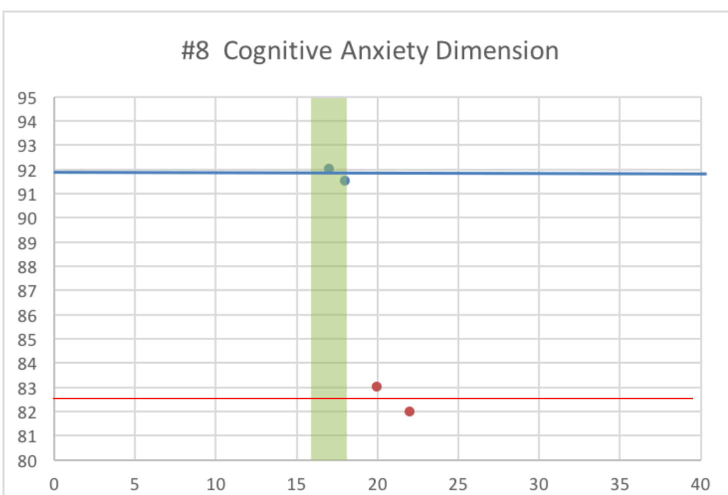
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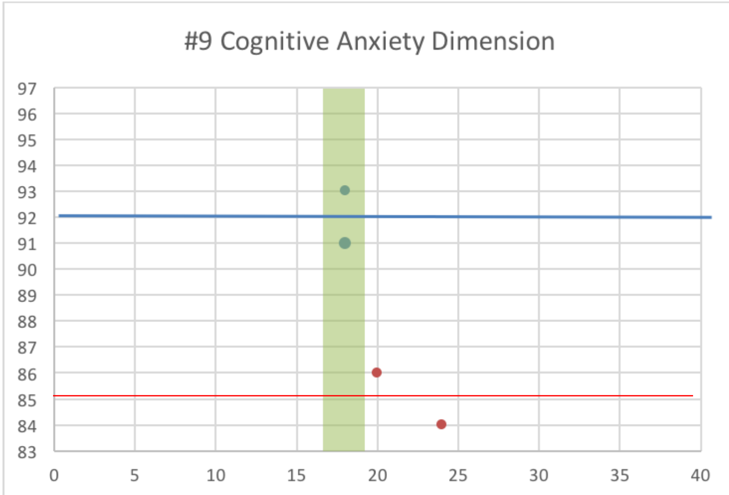
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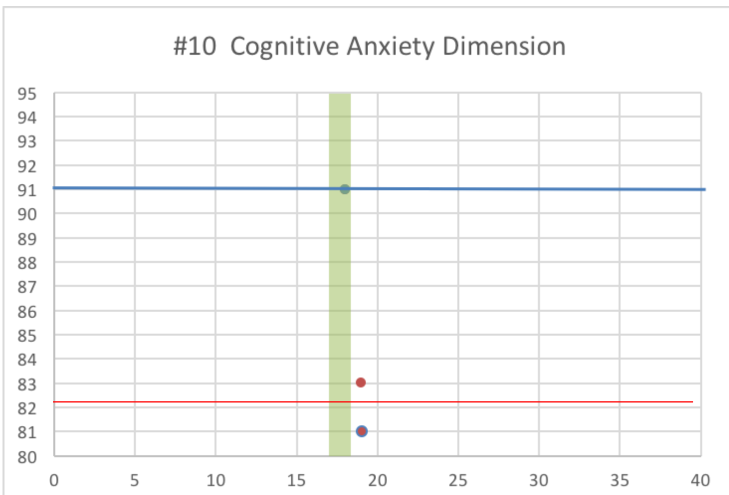
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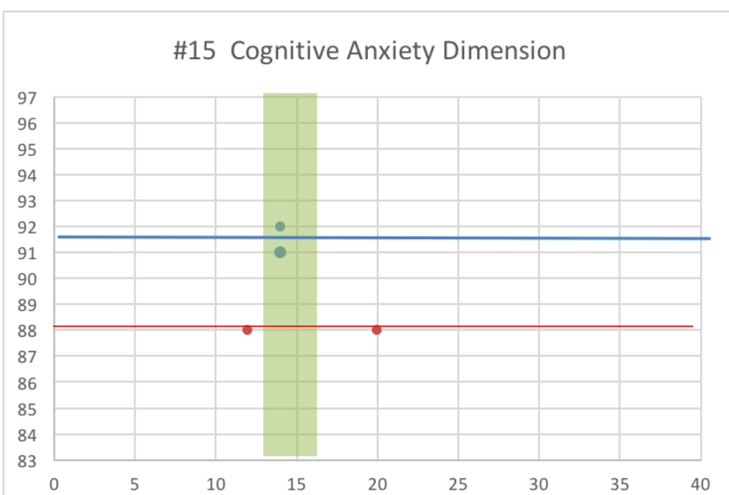
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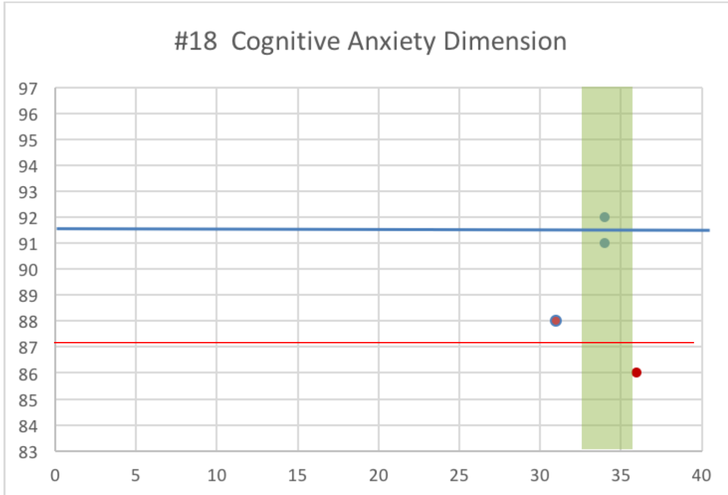
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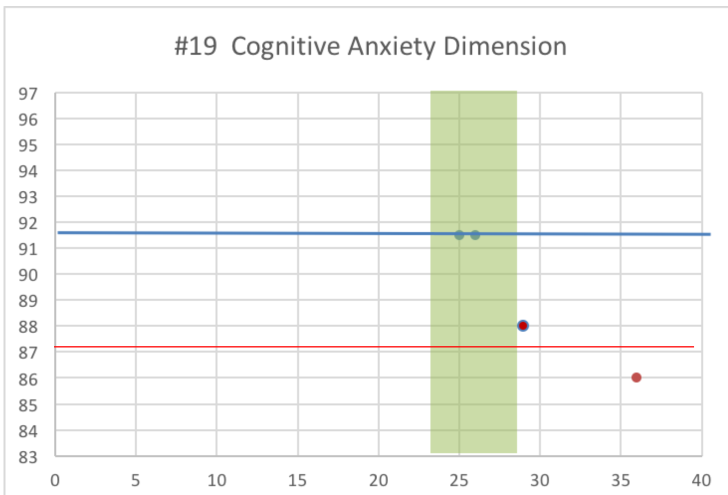
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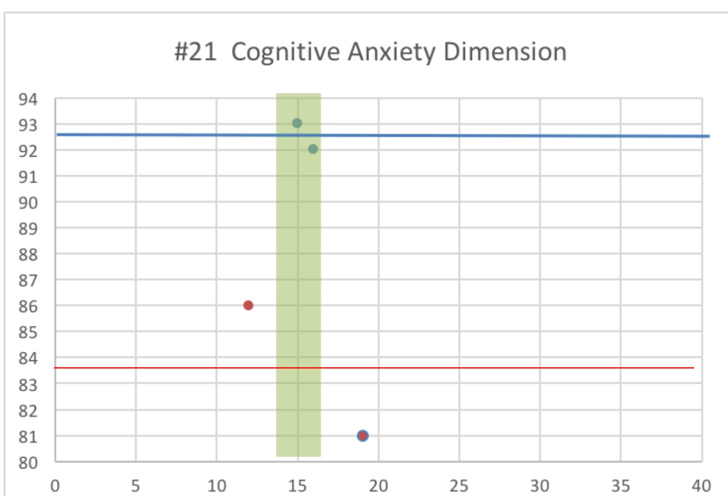
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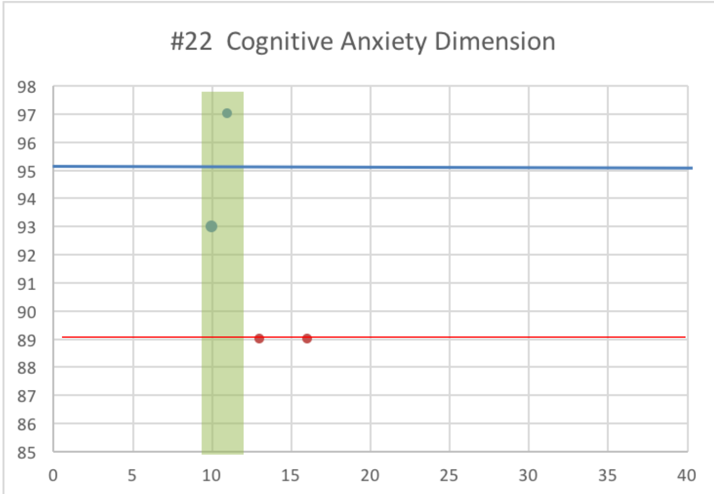
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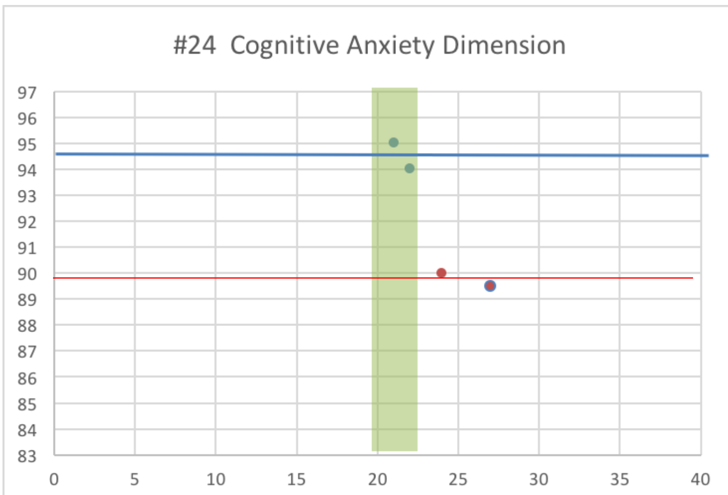
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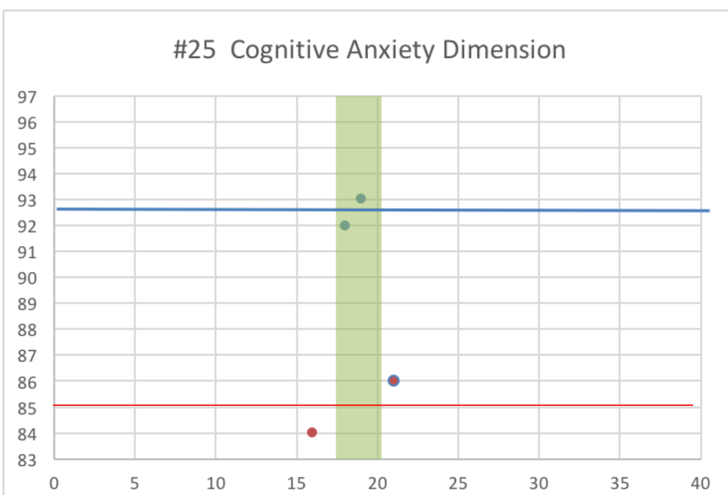
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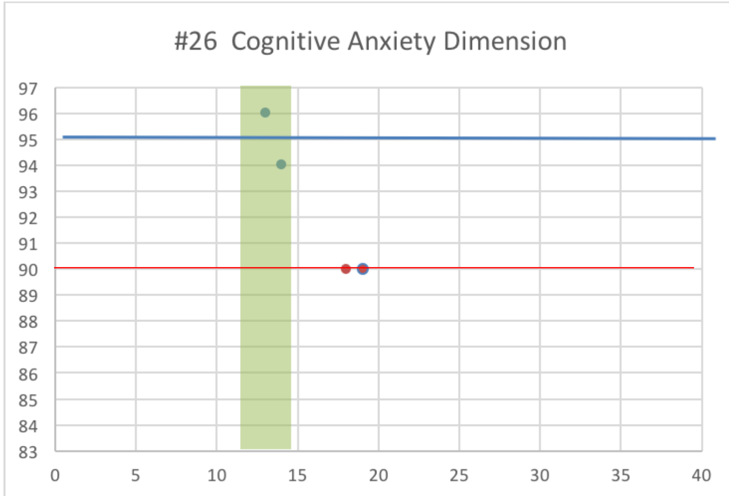
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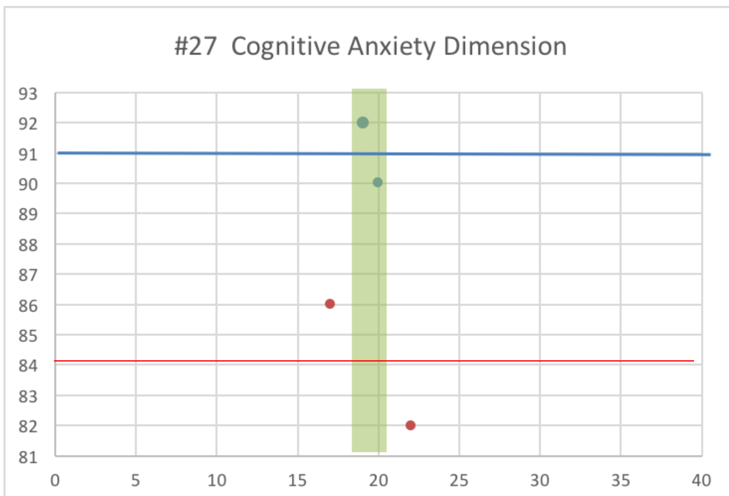
#27 Cognitive Anxiety Dimension
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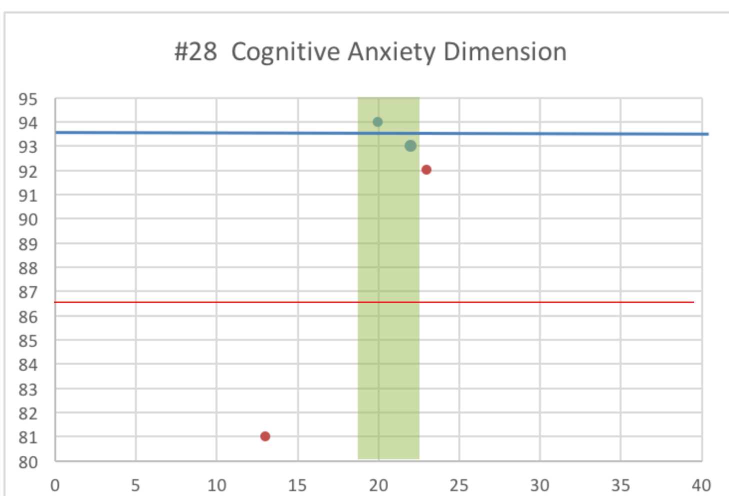
#28 Cognitive Anxiety Dimension
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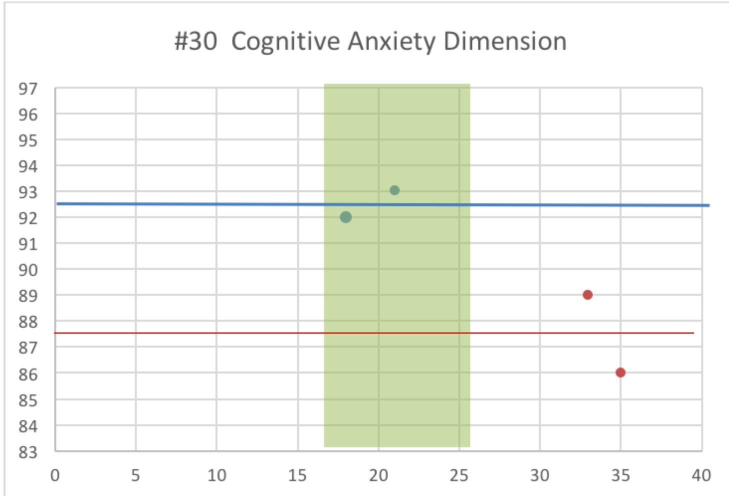
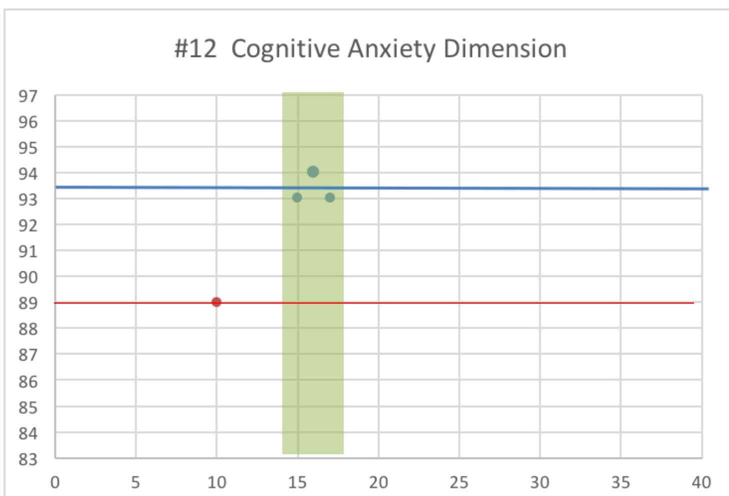
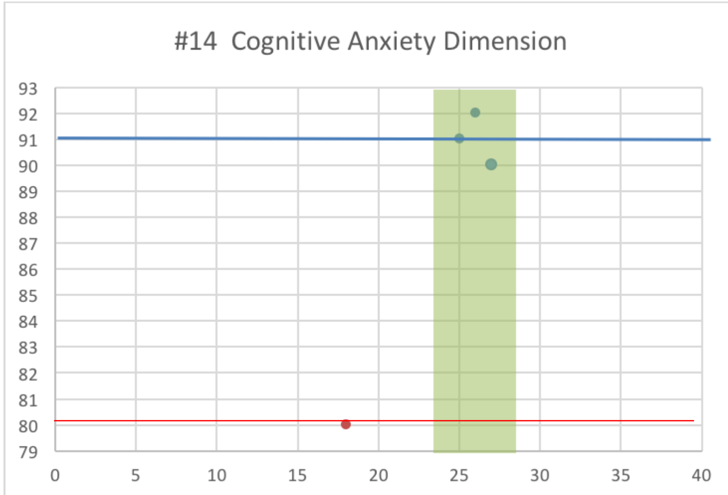


Figure 11. Subjects who have three best performances in the CA zone, one performances out of the CA zone





In the cognitive anxiety subscales, results showed that each performance value within the somatic subscale-based optimal zone was higher than performance values outside the zone. All the blue lines were significantly higher than the red lines. Among all 30 subjects, no out-of-zone performance scores were higher than the in-zone performances. Similarly, Figures 9, 10 and 11 show width and location of the zones that vary dramatically from person to person. For instance, pianists like #5, #13 and #23 have very narrow cognitive zones, while #19 and #30 have quite wide cognitive zones. Interestingly, some pianists' zones locate at the right side of the scale, which means they need more cognitive anxiety intensity for the performance to fit into the optimal cognitive anxiety zone, such as #14, #19 and #18. This result is very different from conventional beliefs about anxiety control. On the contrary, many others need lower cognitive anxiety intensity to reach their optimal zones, such as #6, #22, #26 etc. Since the CA score ranges from 9 to 36, the medium anxiety level should be approximately 22.5. However, the results show that only a few pianists such as #30, performed better with medium cognitive anxiety intensity. Overall, pianists were more likely to perform better when they had either lower or higher cognitive anxiety. This again, is quite different from the conventional inverted U theory.

Most of the subjects' out-zone dots presented at the right side of their IZOF, including pianists #1, #5, #7, #11, #13, #17, #20, #23, #29, #2, #3, #4, #8, #9, #10, #19, #22, #24, #26, #30. The intensity of out-zone performance anxiety was higher than the upper threshold of the in-zone performance anxiety intensity. For a few subjects, namely pianists #12, #14 and #16, their dots presented at the left side of their IZOF. Therefore, their out-zone performance anxiety intensity was below the lower threshold of the in-zone performance anxiety intensity. Compared with SA dimension, most pianists would prefer to adjust their CA intensity more to the left side (lower) in order to fit into their cognitive zone. In the charts of pianists #6, #15, #18, #21, #25, #27, #28, dots were located at both sides of the IZOF. The location of the dots showed that the subjects are more likely to perform unsatisfactorily if they have cognitive anxiety intensity higher than the upper threshold of their IZOF or below the lower threshold of their IZOF.

To compare the differences between performance in the IZOF and out of the IZOF in cognitive dimension, an independent T-test was implemented (See figure 12). Significant differences ($p<0.10$) between in-zone performances and out-of-zone performances were found for 27 pianists (90%) in their cognitive anxiety (CA) dimension.

Figure 12. The comparison of mean of CA in-zone performances score and out- of-zone performance score

	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Mean (In-zone)	94	91.5	91.5	90	92	92	94	91.8	92	91
Mean (Out-of-zone)	85	86.5	87	84.5	87.3	87	88.7	82.5	85	82
Sig. (2-tailed)	0.046	0.019	0.057	0.008	0.020	0.049	0.094	0.004	0.038	0.012

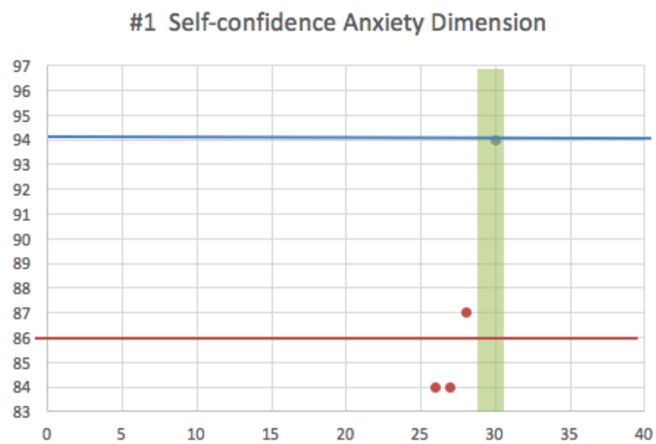
	#11	#12	#13	#14	#15	#16	#17	#18	#19	#20
Mean (In-zone)	91	93.3	90	91	91.5	92	94	91.5	91.5	94
Mean (Out-of-zone)	83.7	89	84.3	80	88	84.7	87.7	87	87	86.7
Sig. (2-tailed)	0.093	0.023	0.360	0.011	0.020	0.053	0.070	0.057	0.046	0.235

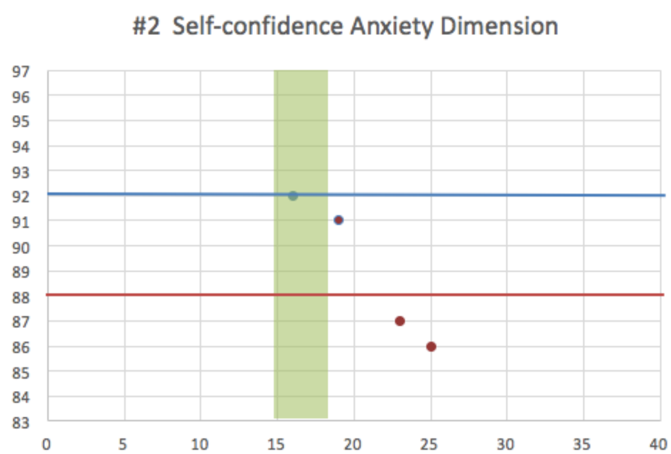
	#21	#22	#23	#24	#25	#26	#27	#28	#29	#30
Mean (In-zone)	92.5	95	91	94.5	92.5	95	91	93.5	95	92.5
Mean (Out-of-zone)	83.5	89	87.7	89.75	85	90	84	86.5	89	87.5
Sig. (2-tailed)	0.072	0.095	0.038	0.014	0.022	0.038	0.089	0.333	0.035	0.087

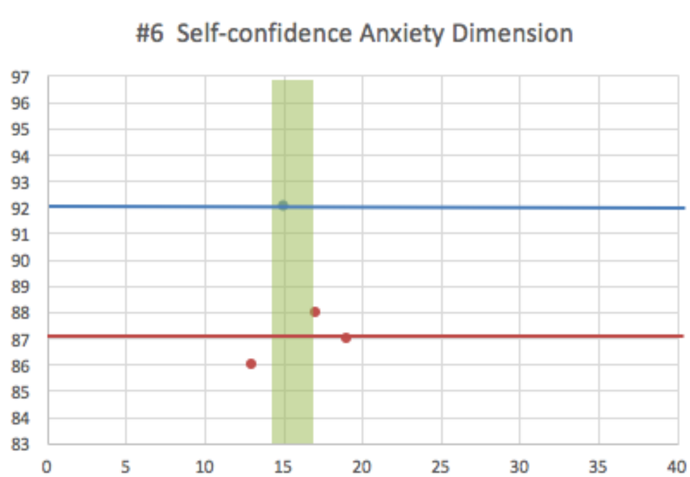
Self-confidence Dimension

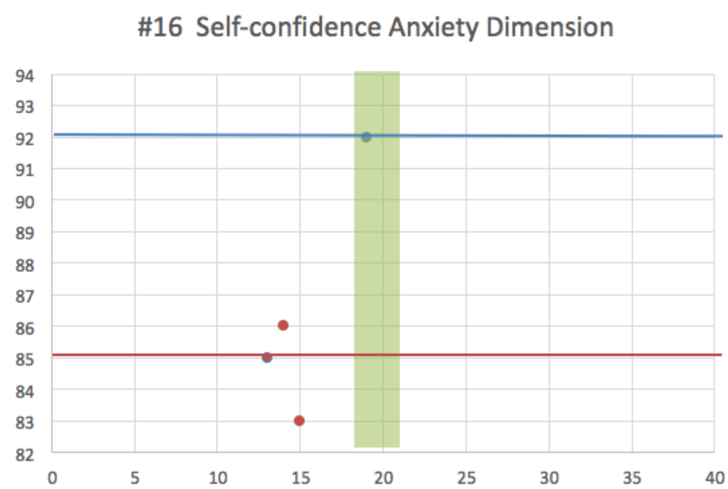
Surprisingly, results in the self-confidence subscale were not as consistent as SA dimension and CA dimension. In the self-confidence dimension, results showed that all the pianists' best performances were in their optimal functioning zones. However, not all the average performance scores (indicated as blue lines) in the zone are significantly higher than the scores (indicated as red lines) out of the zone. For some pianists, their out-of-zone performance scores were even higher than the in-zone performance score, such as #11 and #7. Four dots in the charts presented in three different situations: one best performance in the SC zone and three other performances out of the SC zone, as shown in #1, #2, #6, #16, #22, #23 (See Figure 13); two performances in the SC zone and two other performances out of the SC zone, as shown in #4, #5, #7, #8, #9, #10, #11, #13, #15, #18, #19, #20, #24, #25, #26, #27, #28. #29, #30 (See Figure 14); three performances in the SC zone and one performance out of the SC zone like #3, #12, #14, #21 (See Figure 15).

Figure 13. Subjects who have one best performance in the SC zone, three other performances out of the SC zone








#16 Self-confidence Anxiety Dimension
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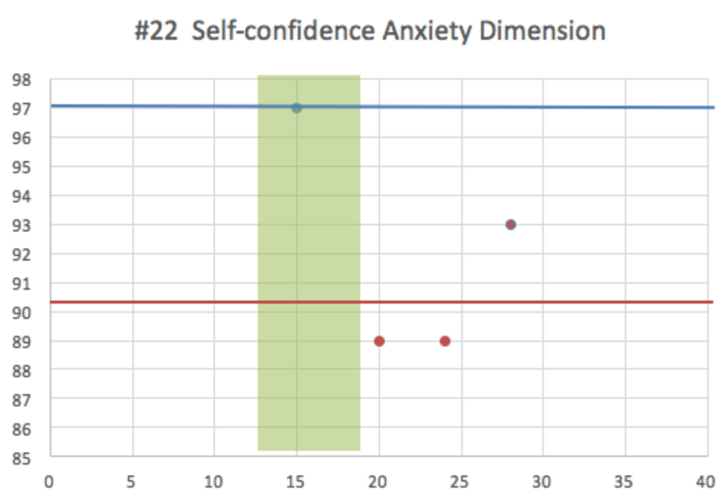
#22 Self-confidence Anxiety Dimension
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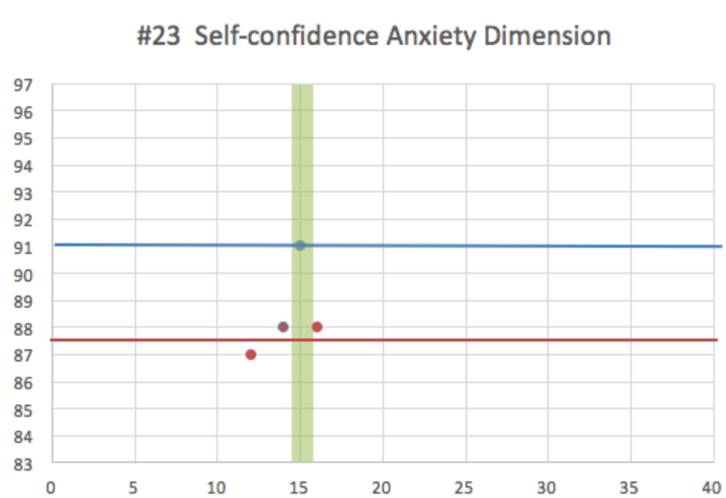
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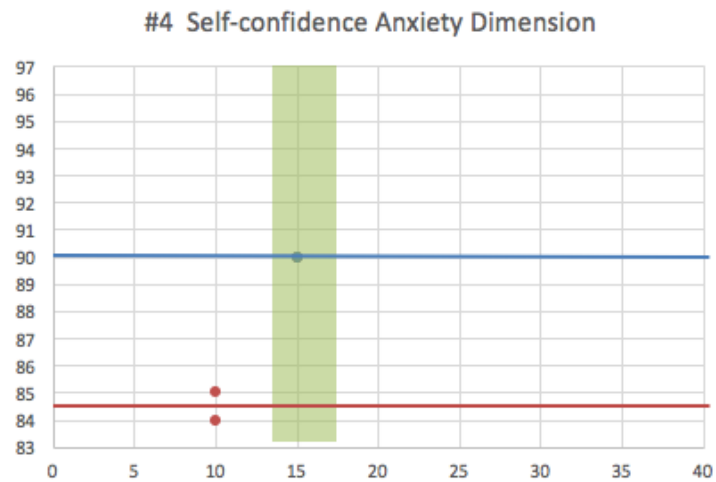
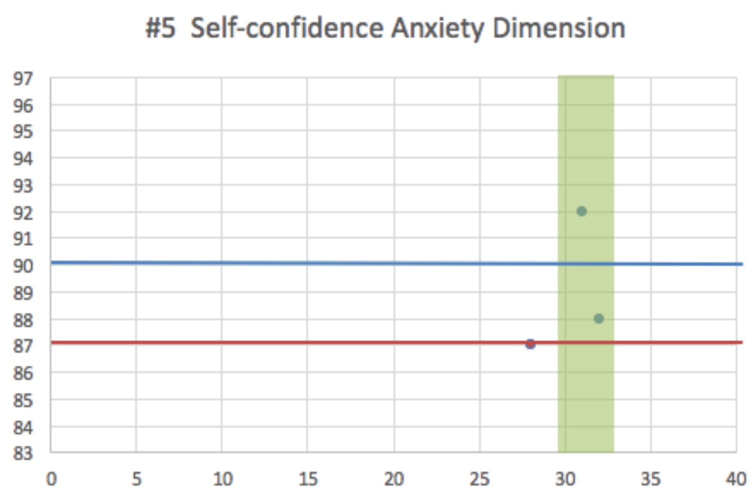
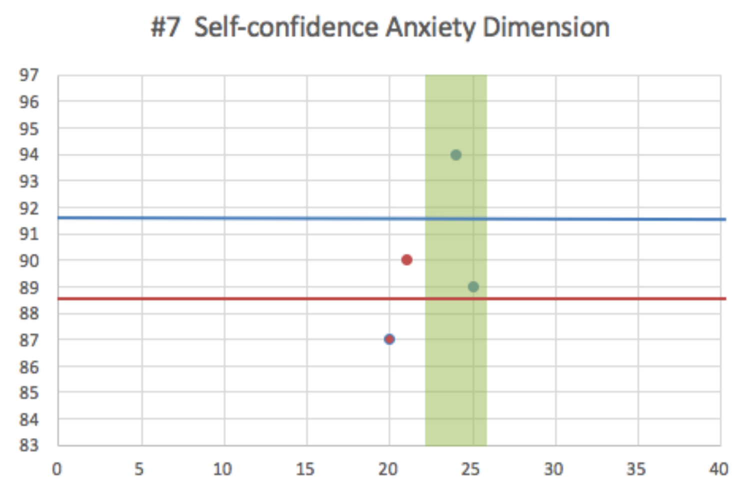
Figure 14. Subjects who have two best performances in the SC zone, two performances out of the SC zone



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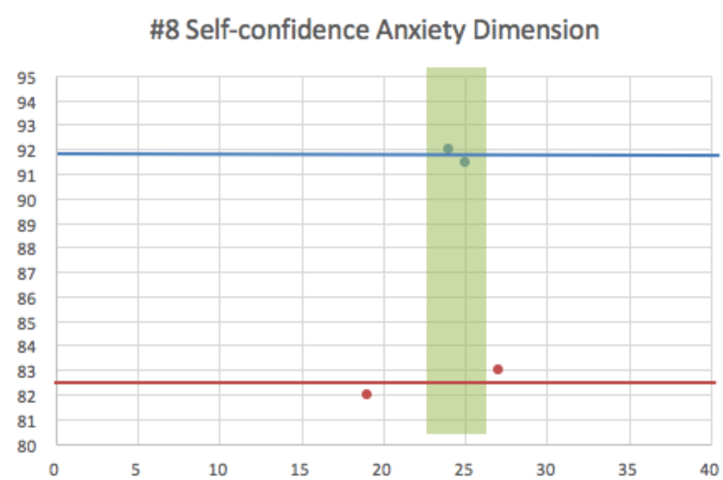
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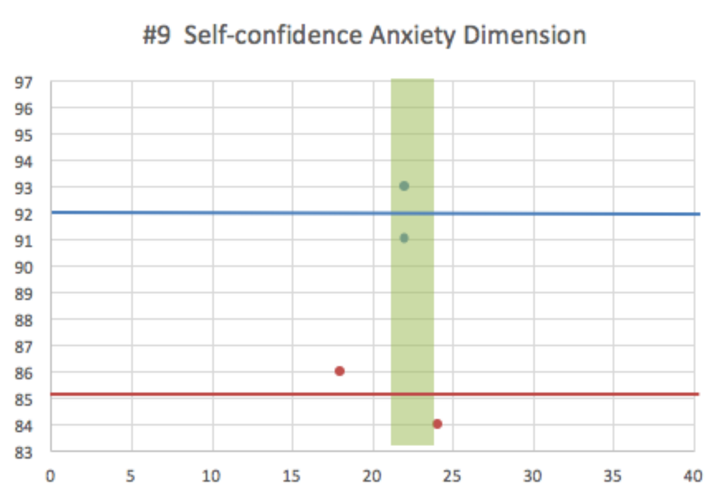
#9 Self-confidence Anxiety Dimension
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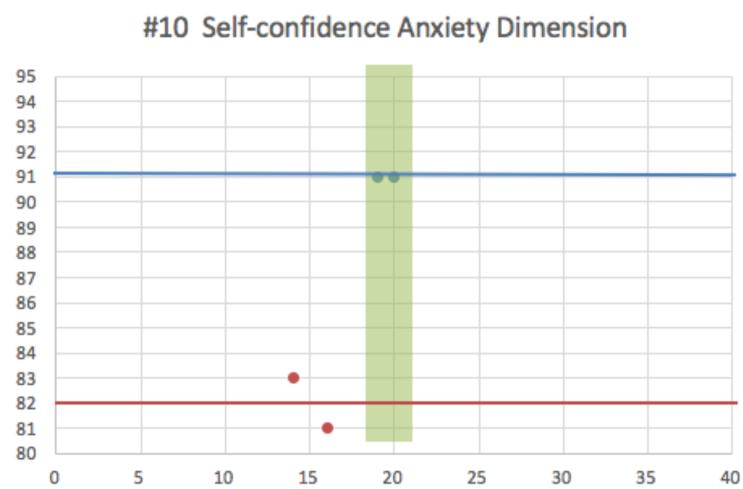
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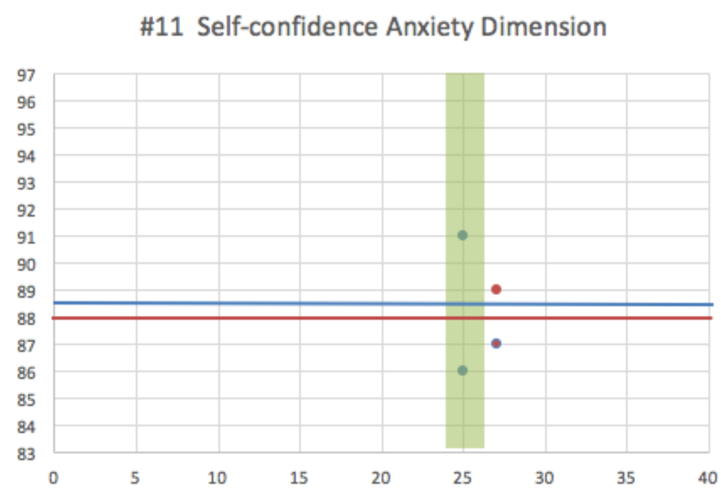
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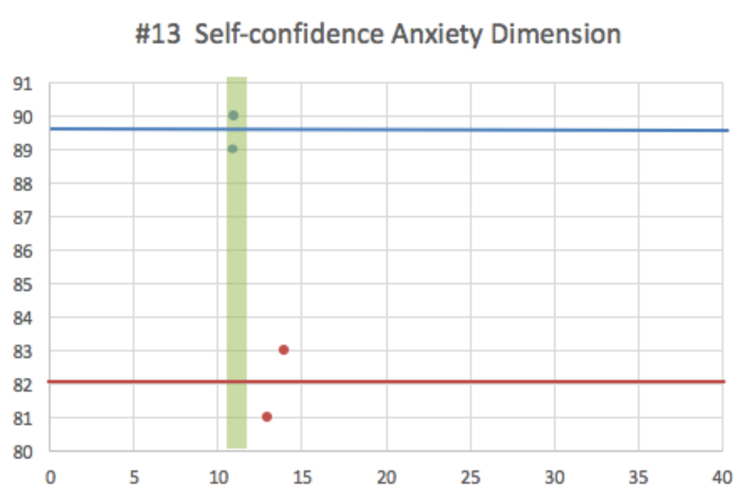
#13 Self-confidence Anxiety Dimension
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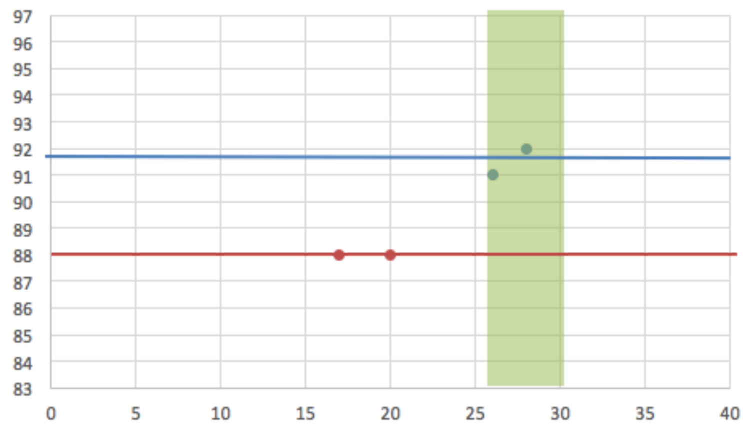
#15 Self-confidence Anxiety Dimension



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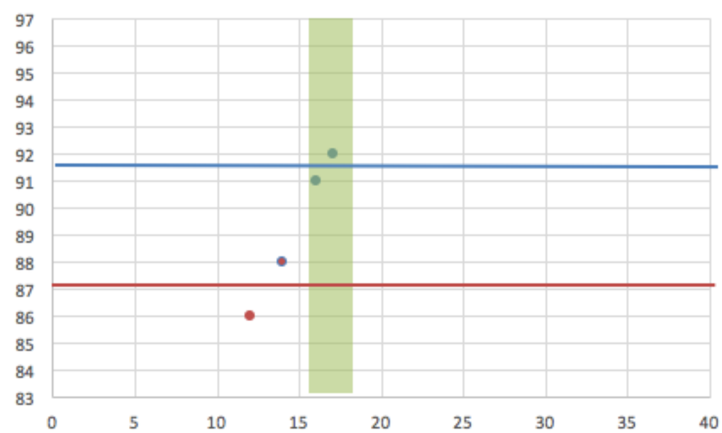
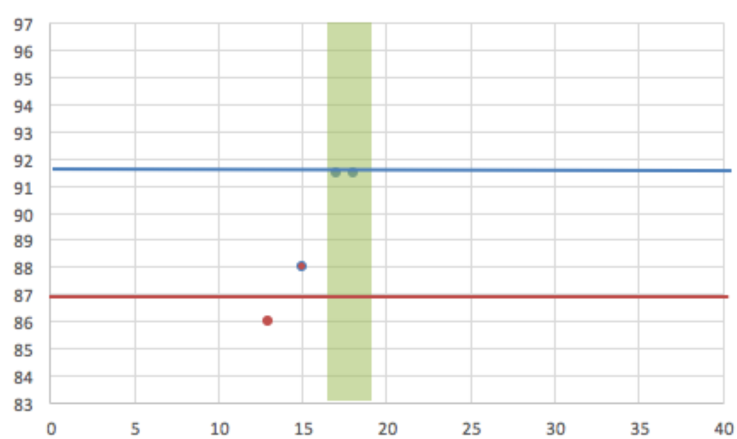
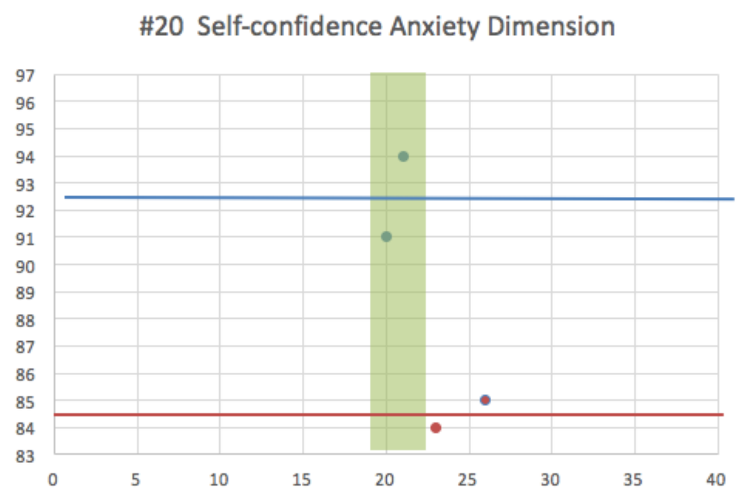


#19 Self-confidence Anxiety Dimension

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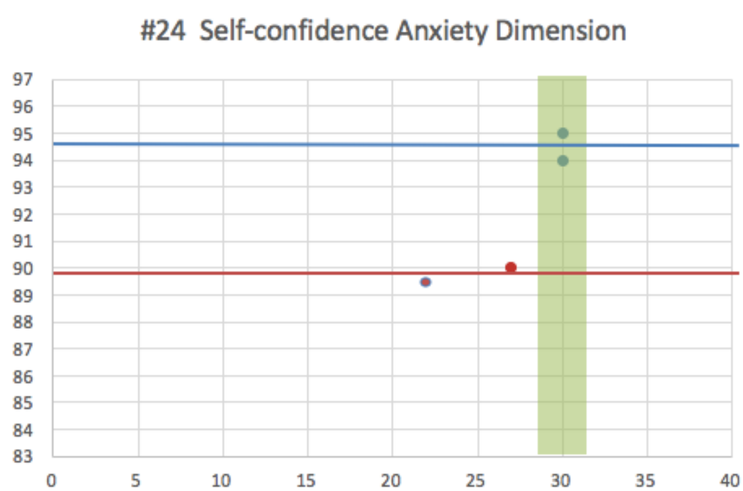
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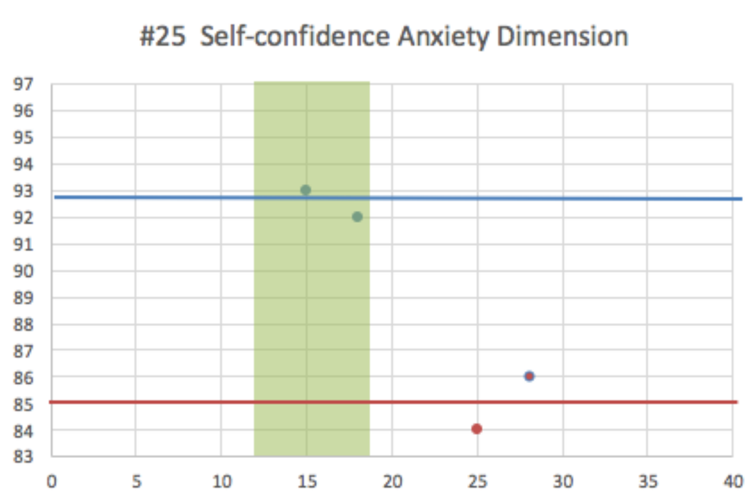
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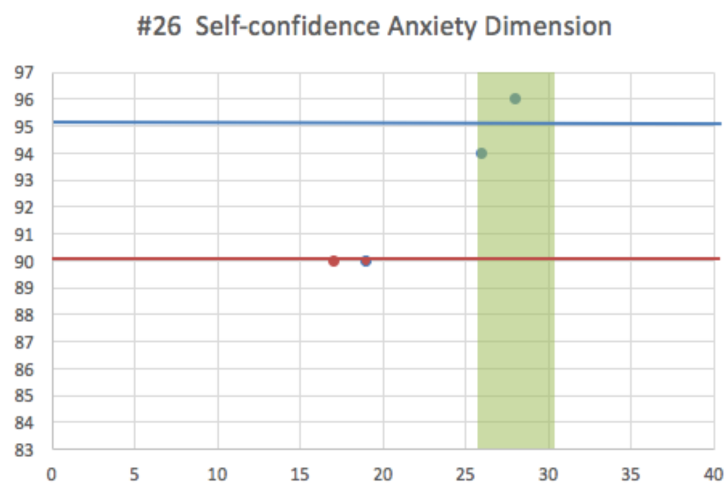
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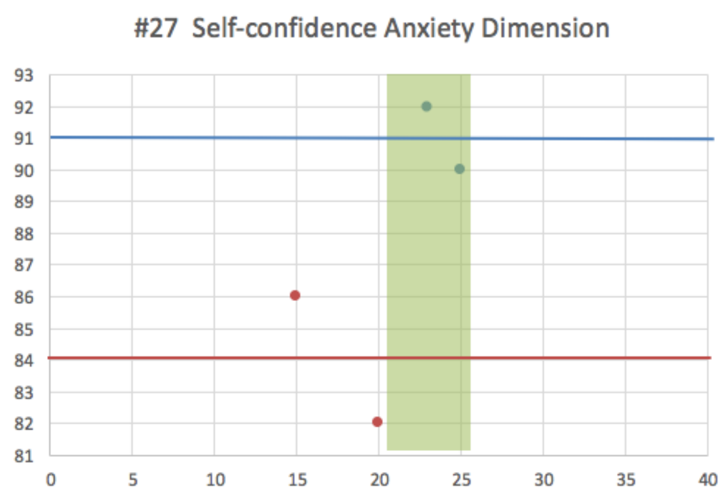
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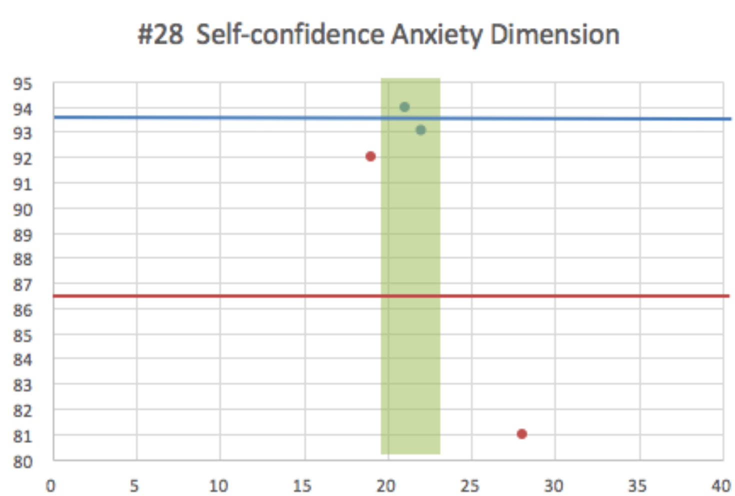
#28 Self-confidence Anxiety Dimension
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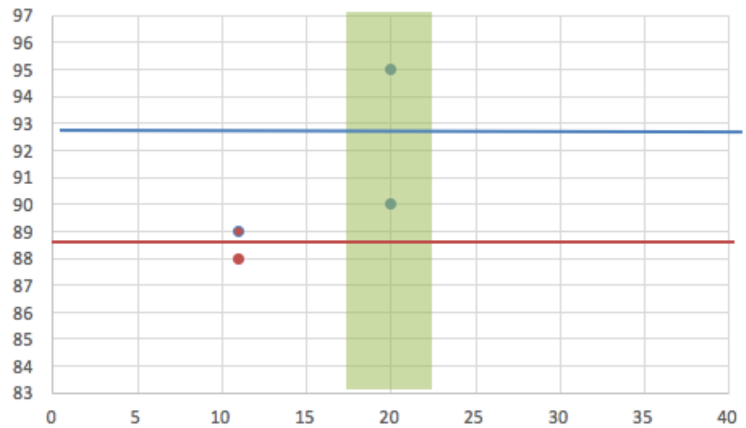
#29 Self-confidence Anxiety Dimension



#30 Self-confidence Anxiety Dimension

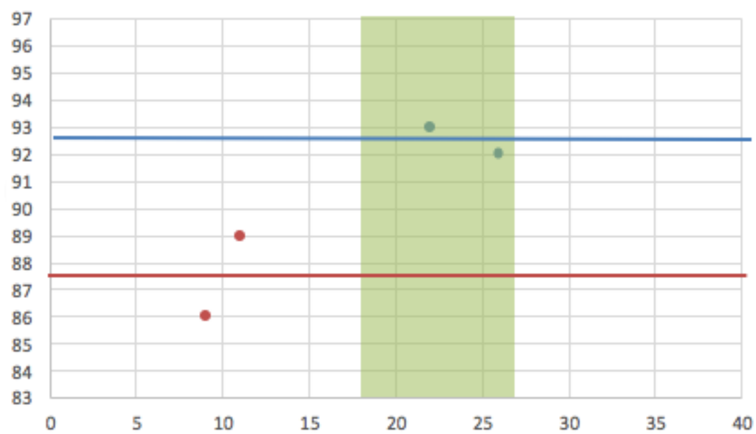
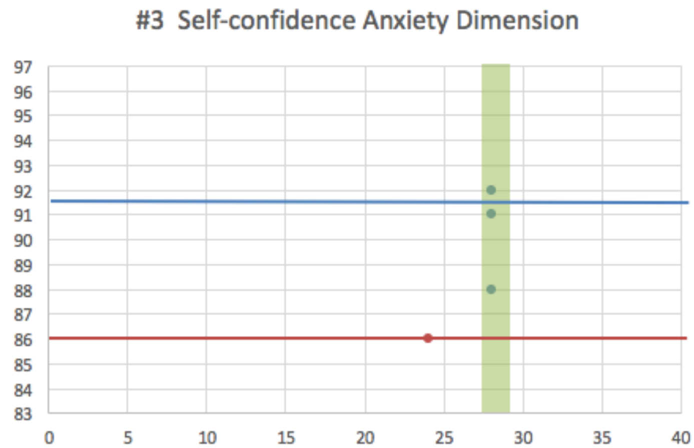
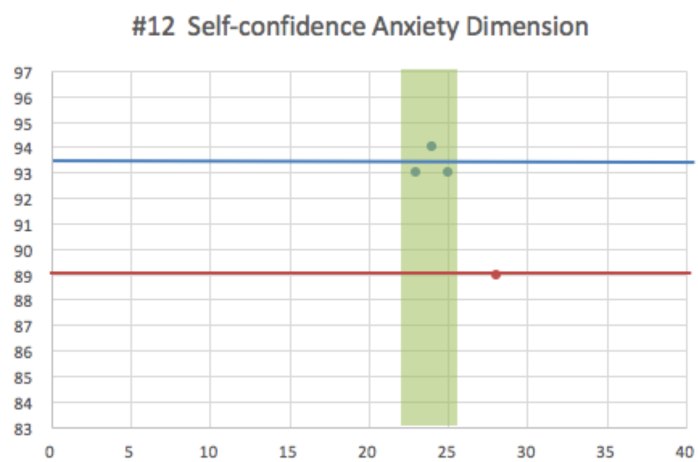
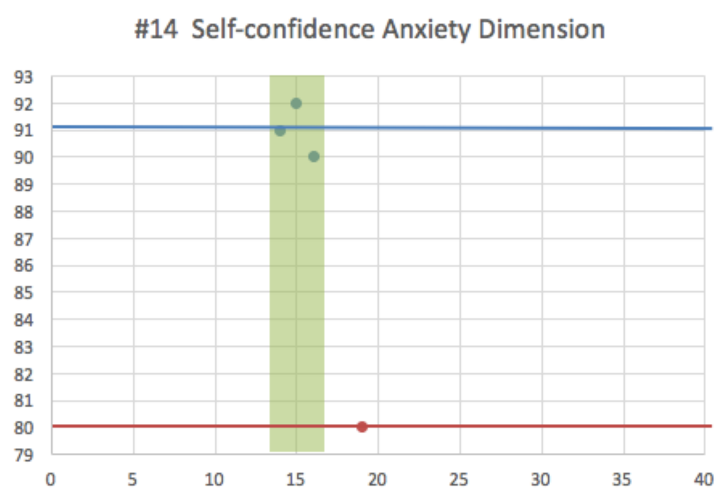
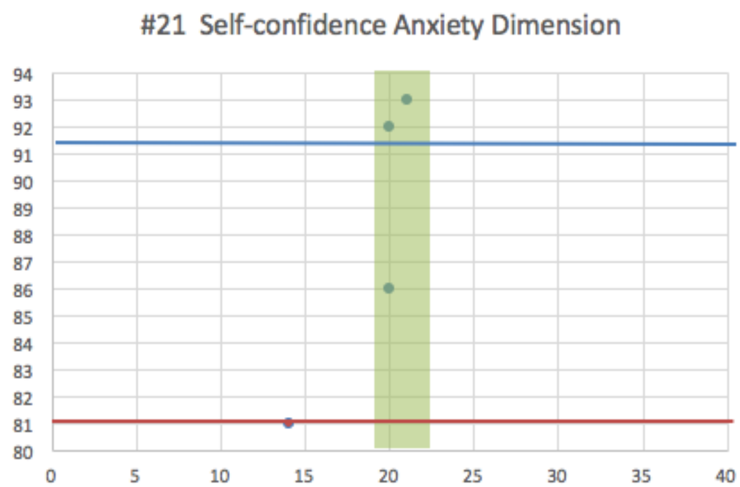


Figure 15. Subjects who have three best performances in the SC zone and one performances out of the SC zone









In self-confidence subscales, most blue lines were significantly higher than the red lines, except #11. Among all 30 subjects, two pianists' out-of-zone performance scores were higher than the in-zone performances (#7 and #11). The self-confidence of each pianist in a public performance varied dramatically. For instance, pianists like #13 and #23 showed very narrow optimal self-confidence zones, while #22, #25 and #30 have quite wide optimal self-confidence zones. Conventionally in performances, people prefer more self-confidence on stage and use positive self-talking strategies to cheer themselves up. However, the results found here demonstrate that not all pianists need high self-confidence to achieve better performance. On the contrary, more subjects' optimal self-confidence zone located at the lower side (left side) of the scale, such as #2, #6, #16, #22, #15, #4, #10, #13, #18, #19, #20, #25, which takes 40% of all the subjects. Pianists #1, #5, #7, #8, #11, #15, #24, #26, which total 26.7% of all the subjects, indicate relatively higher self-confidence. The other subjects' SC zone located in the middle of the scale. Interestingly, this result suggests that being confident may not be always helpful for every pianist.

More than half of the subjects' out-zone dots presented at the left side of their IZOF, including pianists #1, #3, #4, #5, #7, #10, #15, #16, #18, #19, #21, #24, #26, #27, #29, #30. Their out-zone performance SC intensities were below the lower threshold of the in-zone performance SC intensity. 26.7% of the subjects' dots presented at the right side of their performance SC zone, including pianists #2, #11, #12, #13, #14, #20, #22, #25. Therefore, their out-zone performance SC intensity was higher than the higher threshold of the in-zone performance SC intensity. In the chart of pianists #6, #8, #9, #23, #28, dots located at both sides of the SC zone. The location of the dots showed that the subjects are more likely to perform unsatisfactorily if they have self-confidence intensity higher than the upper threshold of the corresponding IZOF or below the lower threshold of their IZOF.

To compare the difference between performances in the IZOF and out of the IZOF in the self-confidence dimension, a two-tailed test was implemented (See figure 16). Significant differences ($p<0.10$) between in-zone performances and out-of-zone performances were found for 21 pianists (70%) in their cognitive anxiety (CA) dimension. No significant differences were found in subjects #2, #3, #5, #7, #11, #21, #22, #28, #29.

Figure 16. The comparison of mean of SC in-zone performances score and out- of-zone performance score

	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Mean (In-zone)	94	92	90.3	90	90	92	91	91.8	92	91
Mean (Out-of-zone)	85	88	86	84.5	87	87	87	82.5	85	82
Sig. (2-tailed)	0.046	0.321	0.213	0.008	0.272	0.049	0.321	0.004	0.038	0.012

	#11	#12	#13	#14	#15	#16	#17	#18	#19	#20
Mean (In-zone)	88.5	93.3	89.5	91	91.5	92	94	91.5	91.5	92.5
Mean (Out-of-zone)	82.5	89	82	80	88	84.7	87.7	87	87	84.5
Sig. (2-tailed)	0.143	0.023	0.022	0.011	0.020	0.053	0.070	0.057	0.046	0.037

	#21	#22	#23	#24	#25	#26	#27	#28	#29	#30
Mean (In-zone)	90.3	97	91	94.5	92.5	95	91	93.5	92.5	92.5
Mean (Out-of-zone)	81	90.3	87.7	89.75	85	90	84	86.5	88.5	87.5
Sig. (2-tailed)	0.166	0.130	0.038	0.014	0.022	0.038	0.089	0.333	0.257	0.087

Discussion and Summary

In medical and psychological studies, researchers usually consider statistical significance with 2-sided $p<0.05$. However, the scores did not show great fluctuation for advanced performing musicians. As shown in charts (figure 5, 6, 7, 9, 10, 11, 13, 14 and 15), the highest score was 96 and the lowest score was 81 among 30 subjects. As these subjects were all very well trained pianists in the conservatory, their performances were more consistent than non-professionals. Therefore, the performance scoring differences for each person were even more subtle. Moreover, unlike sports competitions, researchers have more samples of sports tests or competitions. Compared with athletes, pianists have fewer opportunities to be tested and evaluated. College piano students only experience two regular juries in each semester. Having only four events to recall increased the difficulty of defining the zone accurately. Therefore, in this large sample study all tests were considered statistically significant with 2-sided $p < 0.10$.

In summary, in the first study, the IZOFs of 30 pianists in three different dimensions had been located, hence, support was found for Hanin's IZOF theory. The result verified the individual nature of each pianist in respect to each subscale as well as the zone's efficiency for describing relationship between MPA and optimal performance.

The average scores of the in-zone performances were significantly better than the average score of the out-of-zone performances, except for a few exceptions. Significant differences ($p<0.10$) between in-zone performances and out-of-zone performances were found for 28 pianists (93.3%) in their somatic anxiety (SA) dimension. Significant differences ($p<0.10$) between in-zone performances and out-of-zone performances were found for 27 pianists (90%) in their cognitive anxiety (CA) dimension. Significant differences ($p<0.10$) between in-zone performances and out-of-zone performances were found for 21 pianists (70%) in their self-confidence (SC) dimension.

Results of this study are limited by the inherent biases of retrospective recollection. Additionally, the study lacks long-term data since four juries span only one year of tracking. Long-term data collection (more juries) might increase the accuracy of defining the IZOFs. Further studies with more pianists and longer follow-up are required to confirm the results of the present study.

CHAPTER 4. STUDY 2 PERFORMANCE PREDICTING

Study Design

Method and Procedure

With the zone as identified in Chapter three, predictions can be projected for each subject based on their answers to the CSAI-2 before juries. In the second phase of study, the IZOF theory was used for performance predicting and analysis. Unlike the retrospective study, the second phase of study was an apagogic test. The second study takes advantage of the IZOFs calculated in the first phase of study. All the subjects answered the CSAI-2 one day before their final jury. Anxiety intensity from three dimensions (somatic/cognitive/self-confidence) were compared with their corresponding zones' upper and lower thresholds to see if the subjects' performances fell within in their individual zones. One week after the final jury, performance evaluations had been made and collected by the same group of judges with the same method. Data were collected to examine the hypothesis that the IZOF model can help to predict the upcoming performance and be fully applied in piano performance anxiety description, explanation, assessment and performance prediction.

30 piano major students were asked to fill the CSAI-2 based on their current feelings one day before their jury performances. Each pianist took approximately five minutes to complete the form.

Seven judges made their assessments immediately after the piano final jury. Data were collected for statistical analysis.

Participants and Instruments

As in the first phase of study, subjects were coded with numbers so as to maintain confidentiality. Participants memorized their code numbers. Therefore, in the second phase of the study, 30 coded inventories of CSAI-2 were sent out for each corresponding subject and 30 inventories were returned for statistical analysis. There were 7 males and 23 female advanced pianists from a conservatory in Beijing. They had all participated in the first study and their average age was 21.07.

Their pre-performance anxiety intensities were evaluated by the CSAI-2 (Martens et al., 1990). They were asked to complete the form one day ahead of their final jury based on their current feelings. The performances were evaluated by the same group of professional college piano teachers as in the first study. Each of them evaluated performances on a 1-100 scale, where 1 = worst possible performance and 100 = best possible performance. Judges were told to score based on the same standard as they did before and all transcripts were collected one week after the jury performance.

Results

Predicted Performance Results

Anxiety intensities in three dimensions were tested before performance. In the somatic anxiety subscale, 18 pianists' upcoming performances were predicted to be in the optimal somatic anxiety zone and 12 other pianists' upcoming performances were predicted to be out of zone. In the cognitive anxiety subscale, 17 pianists' upcoming performances were predicted to be in the optimal cognitive anxiety zone and 13 other pianists' upcoming performances were predicted to be out of the zone. In the self-confidence subscale, 18 pianists' upcoming performances were predicted to be in the optimal self-confidence zone and 12 other pianists' upcoming performances were predicted to be out of the zone.

Figure 17. In/out zone state of three dimensions

	SA	CA	SC	General Performance
#1	in	in	out	in
#2	in	in	in	in
#3	out	out	out	out
#4	in	in	in	in
#5	out	out	out	out
#6	in	in	in	in
#7	in	in	in	in
#8	in	in	in	in
#9	out	out	out	out
#10	in	out	in	in
#11	out	out	out	out
#12	in	in	in	in
#13	in	out	in	in
#14	out	out	out	out
#15	in	in	in	in

#16	in	in	in	in
#17	in	in	in	in
#18	in	in	in	in
#19	in	in	in	in
#20	out	out	out	out
#21	out	out	out	out
#22	out	out	out	out
#23	out	out	out	out
#24	in	out	out	out
#25	out	out	out	out
#26	in	in	in	in
#27	out	in	in	in
#28	out	out	in	out
#29	in	in	in	in
#30	in	in	in	in

Actual Performance Results

After the subjects completed the CSAI-2 inventory, they attended the final jury the second day. Their performance results were collected as below.

Figure 18. Performance prediction and performance score

	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
SA score	13	19	19	16	20	18	16	20	22	14
In or out	in	in	out	in	out	in	in	in	out	in
Performance score	95	93	87	91	86	93	94	92	84.5	93
Sig. (2-tailed)	0.038	0.243	0.121	0.084	--	0.035	0.094	0.058	0.144	0.099

	#11	#12	#13	#14	#15	#16	#17	#18	#19	#20
SA score	27	15	18	16	13	27	24	22	26	24
In or out	out	in	in	out	in	in	in	in	in	out
Performance score	86	94	91	84	92	91	94.5	93	95	86
Sig. (2-tailed)	--	0.474	0.121	0.026	--	0.070	0.061	0.179	0.136	0.242

	#21	#22	#23	#24	#25	#26	#27	#28	#29	#30
SA score	23	17	12	15	20	10	15	28	16	26
In or out	out	out	out	in	out	in	out	out	in	in

Performance score	85	88	88	96	87	96	90	88	95	94.5
Sig. (2-tailed)	0.073	0.293	--	0.044	0.099	0.222	0.667	0.212	0.035	0.226

	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
CA score	16	23	21	17	22	14	15	16	25	16
In or out	in	in	out	in	out	in	in	in	out	out
Performance score	95	93	87	91	86	93	94	92	84.5	93
Sig. (2-tailed)	0.038	0.084	0.121	0.084	--	0.035	0.094	0.058	0.144	--

	#11	#12	#13	#14	#15	#16	#17	#18	#19	#20
CA score	26	17	15	13	15	25	16	33	26	28
In or out	out	in	out	out	in	in	in	in	in	out
Performance score	86	94	91	84	92	91	94.5	93	95	86
Sig. (2-tailed)	--	--	--	0.026	--	0.070	0.061	0.179	0.136	--

	#21	#22	#23	#24	#25	#26	#27	#28	#29	#30
CA score	25	20	14	19	22	12	19	25	14	24
In or out	out	out	out	out	out	in	in	out	in	in
Performance score	85	88	88	96	87	96	90	88	95	94.5
Sig. (2-tailed)	0.073	0.293	--	0.044	0.099	--	0.333	0.099	0.035	0.226

	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
SC score	28	15	19	16	24	16	23	24	19	19
In or out	out	in	out	in	out	in	in	in	out	in
Performance score	95	93	87	91	86	93	94	92	84.5	93
Sig. (2-tailed)	--	0.243	0.300	0.084	0.454	0.035	0.281	0.058	0.144	0.099

	#11	#12	#13	#14	#15	#16	#17	#18	#19	#20
SC score	24	24	11	20	28	20	15	16	19	27
In or out	out	in	in	out	in	in	in	in	in	out
Performance score	86	94	91	84	92	91	94.5	93	95	86
Sig. (2-tailed)	0.667	--	0.121	0.026	--	0.070	0.061	0.179	0.136	0.242

	#21	#22	#23	#24	#25	#26	#27	#28	#29	#30
SC score	23	25	20	28	23	29	24	22	22	18
In or out	out	out	out	out	out	in	in	in	in	in
Performance score	85	88	88	96	87	96	90	88	95	94.5
Sig. (2-tailed)	0.347	--	--	0.333	0.099	--	0.333	0.901	0.084	0.226

Statistically speaking, in the somatic anxiety subscale, the p value of 56.7% of the subjects showed that the subjects' in-zone performances were significantly (p<0.10) better than the out-zone performances. In the cognitive anxiety subscale, the p value of 73.3% of the subjects showed that their in-zone performances were significantly (p<0.10) better than the out-zone performances. In the self-confidence subscale, the p value of 50% of the subjects showed that their in-zone performances were significantly (p<0.10) better than the out-zone performances. However, there were several pianists such as #13 who received high performance scores even when their CSAI-2 subscale scores located out of their IZOFs; in this case, their subscale scores were all located very close to the upper or lower threshold of their IZOFs. Moreover, regardless of the subscale, all subjects' in-zone performance scores were higher than the mean of out-zone performance scores and all subjects' out-zone performance scores were lower than the mean of in-zone performance scores. Compared with the general predictive results in figure 17, 96.7% of the actual performance results were consistent with the prediction. The only exception was #24, who had a successful jury performance with an evaluative score of 96, though her predictive performance result located out of her optimal zone. In figure 18, her cognitive anxiety subscale score was 19 and self-confidence subscale score was 28, which were very close the lower thresholds of the optimal cognitive anxiety zone (19.68) and the lower thresholds of the optimal self-confidence zone (28.11). The contradictive result for #24 could be the inaccuracy of the width of the zone.

Figure 19. Predictive in-zone performance and actual performance score

	#1	#2	#4	#6	#7	#8	#10	#12	#13	#15	#16	#17	#18	#19	#26	#27	#29	#30
Actual score	95	93	91	93	94	92	93	94	91	92	91	94.5	93	95	96	90	95	94.5

Figure 20. Predictive out-zone performance and actual performance score

	#3	#5	#9	#11	#14	#20	#21	#22	#23	#24	#25	#28
Actual score	87	86	84.5	86	84	86	85	88	88	96	87	88

Discussion and Summary

In this chapter, the IZOF theory was used for pre-performance anxiety analysis and performance predicting. As the first study identified an individual state of anxiety intensity for optimal piano performance, the second phase of this study can help both piano performers and teachers predict the success of an upcoming performance and better prepare for it. The research process showed that it is essential to know each pianist's individual zone of optimal functioning since it varied dramatically from person to person. That zone helps determine how to predict the pianist's next performance and how to guide his/her training. The second study set a theoretical foundation for the further study of intervention and fulfill the verification that the IZOF model may be fully applied to guide piano performance and teaching.

Predicting performance results also indicate that somatic, cognitive anxiety and self-confidence intensities are all vital determining factors for distinguishing a successful and unsuccessful performance. Meanwhile, the zone's location and width determined the accuracy of the prediction. The IZOF would be more reliable with a longer-term data collecting process (more juries). With more accurate zones, the differences between in-zone performances and out-zone performances may be significant. Moreover, the predictive results may be more consistent with the actual performance results.

CHAPTER 5. CONCLUSION

Knowing MPA Vs. Knowing the IZOF

MPA has been observed from different angles and studied with countless methods for many years, and researchers will keep studying this area with the help of the development of cognitive and psychological science. However, no matter how deeply this area has been studied, we can not deny individual differences in reaction to performance anxiety issues, especially for musicians. Music interpretation is based in technique, but is an emotion-supported performance activity. It involves a great deal of personal and emotional investment, which increases uncertainty and contributes to anxiety. Individual reactions to MPA vary widely among college level pianists. In China, students who have been admitted to music conservatories have already achieved an advanced level of piano performance proficiency. However, not all of them are aware of their optimal zone for performance and master every public performance consistently. As a result, even after years of training, only a few piano majors end up with a career in professional piano performance. With the application of the IZOF model, young pianists can become aware of other dimensions that impact their performances besides technical skills and overall abilities. In fact, whether in conservatories or in the context of amateur piano learning, one pianist may perform better than another due to many factors. However, if a pianist can constantly perform in the zone of optimal functioning, he may still enjoy the performance and feel satisfied. Knowing the IZOF helps to enhance the performance and improve personal satisfaction.

Therefore, the key viewpoint of this study is that pianists (and their teachers) should identify their IZOFs. It is even more important than deciding whether one should continue a performance career simply based on their issues managing MPA. For both piano teachers and pianists, knowing the IZOF helps them to be more aware of their psychological and physical functions, to describe and explain their anxiety intensity and to review and predict their performances.

In-zone Performances Vs. Out-zones Performances

The foremost purpose of this research was to examine the hypothesis that pianists have IZOFs and that the IZOF model may be fully applied in describing, explaining, accessing and predicting piano performance. As a result, the pianist's zone exists and can be calculated and then communicated to the performer and piano teacher. While information gathered through experiential and anecdotal evidence is invaluable, quantitative and qualitative analysis enhance our understanding of optimal performance.

As summarized in the first study, support was found for Hanin's IZOF theory. In the SA subscale, CA subscale and SC subscale, the average score of in-zone performances were higher than the out-zone performances. Significant differences ($p<0.10$) in three dimensions were found regardless of subjects' gender, grade and birth place. Regarding the dimensions like the SA subscale and CA subscale, the percentage could be as high as over 90%.

In the predicting procedure, no matter the subscale, all subjects' in-zone performance scores were higher than the mean of out-zone performance scores and all subjects' out-zone performance scores were lower than the mean of in-zone performance scores. Compared with the general predictive results, 96.7% of the actual performance results were consistent with the predictions.

However, the research has its limitations regarding inherent bias of retrospective recollection and the lack of long-term data collection. Defining a pianist's IZOF requires a lengthy process of collecting follow-up data. Ideally, the pianist needs to record his anxiety intensity right after or before every performance. The performance scoring can be done by the pianist himself or the piano teacher. Additionally, more performances will increase the accuracy of identifying the zone.

"Wider" Zones Vs. "Narrower" Zones

In the first study, results revealed significant differences in the width of each pianist's IZOF. Some pianists had narrow zones, which indicted that once their anxiety intensity fluctuated more wildly, the in-zone performance could easily move to the out-zone space. On the contrary, if the pianist had a wider zone, the anxiety intensity fluctuation was less likely to harm his/her performance; in other words, the anxiety intensity during performance could still fit in their optimal zone. Therefore, the width of the zone indicates the vulnerability of pianist's anxiety intensity, which in turn determines the result of the performance.

Based on these results, future studies can be conducted to determine the factors that can help to distinguish the narrower or wider nature of the pianists' IZOFs. Single factor analysis (SFA) may help determine which factors contribute to different widths of the IZOFs. Some factors are related to pianists' subjective experience of anxiety, which is a normal part of the learning process and performing experience. For instance, early on in the learning process, influencing factors include parental empathy and early experience with piano teachers (Kenny, 2011). Additionally, pianists' proximal performance concerns that may affect the intensity of anxiety may include memory reliability and quality of sleep prior to performance. Past experiences with learning and performing piano music may also contribute to an individual's reaction to anxiety. In other words, the subjective experience of anxiety in piano learning and performing history may determine the width or location of their IZOFs. That is the future mission of this research.

This study reveals the regulation and relationship between individual's anxiety intensity and piano performance results. It emphasizes that each individual has his/her own optimal level of anxiety resulting in good or poor performance. With the help of the IZOF model, the study defined the zone in a quantifiable way, which is more accurate and convincing than experientialism or anecdotal evidence. With this research as a theoretical foundation, more SFA studies can be done to observe factors that may affect the width of the IZOF. In addition, more personalized MPA intervention can be conducted to regulate pianists' performance-related psycho-bio-social states.

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APPENDIX A

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

APPENDIX B

竞技焦虑测评 (CSAI-2) （I 卷）

填写指南：请您回忆过去两年里印象深刻的四次期中或期末考试，尽可能地将自己处于当时的情状之中，将每次考试状态分别记录在 A 卷、B 卷、C 卷以及 D 卷中，完成以下选择题（划勾即可）。选项里没有正确与错误，无需在每一题上思考过长时间。选择题做完后也请回答问卷后的几个问题。

考试年月：		一点也不	有一点	中等程度	非常强烈
1.	我对这次演奏感到担心				
2.	我感到紧张				
3.	我感到轻松				
4.	我怀疑自己				
5.	我战战兢兢，心神不宁				
6.	我感到身体舒适				
7.	我担心在考试中不能发挥出应有的水平				
8.	我的身体感到紧绷				
9.	我感到对这次演奏有自信				
10．	我担心这次考试演奏失败				
11.	我感到胃部发紧				
12.	我感到很放心有安全感				
13.	我担心压力让我喘不上气				
14．	我的身体感到放松				
15.	我有信心面对这次挑战				
16．	我怕弹得很糟				
17．	我的心跳在加速				

18.	我有信心能有出色表演				
19.	我很担心达不到预期目标				
20.	我感到心情沮丧				
21.	我精神上感到放松				
22.	我担心有人会对我的演奏失望				
23.	我的手会又湿又凉				
24.	我自信因为我在脑海里想象自己可以很好地完成目标				
25.	我担心注意力不能集中				
26.	我的身体感到很僵硬				
27.	我相信自己能够克服紧张压力				

谢谢您的配合，请继续完成以下问题

年龄：　　性别：　　民族：　　年级：

本次考试的曲目为：

1.	2.	3.
4.	5.	6.

本次考试的最终成绩为：

____

本次考试曲目练习准备的时长（划勾即可）

1 个月以内	1-2 个月	2-3 个月	3-4 个月	4 个月到半年	半年-一年	其他答案：

Competitive State Anxiety Inventory-2 (Questionnaire No.1)

Instructions: Please recall four most impressive (in a good way or a bad way) midterm/final jury performance experiences in the past two years. Try your best to put yourself back in the situation at the time. Take down how you feel at that moment in the juries and complete the questionnaire A, B, C and D by ticking the single choice. There are no right or wrong answers. Do not spend too much time on any one statement. Please also answer the following questions after the inventory.

When:		Not at all	Somewhat	Moderately so	Very much so
1.	I am concerned about this jury.				
2.	I feel nervous.				
3.	I feel at ease.				
4.	I have self-doubts.				
5.	I feel jittery.				
6.	I feel comfortable physically.				
7.	I am concerned I may not do as well in this jury as I could.				
8.	My body feels tense.				
9.	I feel self-confident.				
10.	I am concerned about losing.				
11.	I feel tense in my stomach.				
12.	I feel secure.				
13.	I am concerned about choking under pressure				
14.	My body feels relaxed.				
15.	I am confident I can meet the challenge.				
16.	I am concerned about performing poorly.				
17.	My heart is racing.				
18.	I am confident about performing well.				
19.	I am worried about reaching my goal.				
20.	I feel my stomach sinking.				

21.	I feel mentally relaxed.				
22.	I am concerned that others will be disappointed with my performance.				
23.	My hands are clammy.				
24.	I am confident because I mentally picture myself reaching my goal.				
25.	I am concerned I will not be able to concentrate.				
26.	My body feels tight.				
27.	I am confident of coming through under pressure.				

Thanks for your cooperation. Please continue to the following questions.

Age: Gender: Nationality: Grade:

Repertoires for this jury:

1.	2.	3.
4.	5.	6.

Performance score of this jury:

____

How long did you prepare for this jury?

Within 1 month	1-2months	2-3months	3-4 months	4-6 months	6-12 months	other

APPENDIX C

Anxiety intensity and the upper and lower threshold of the zone in three dimensions

Somatic Anxiety Subscale	#1	#2	#3	#4	#5
1	18	18	13	16	13
2	12	16	12	16	13
3	15	22	12	20	11
4	20	20	13	17	12
SD	3.5	2.5819889	0.57735027	1.89296945	0.95742711
Zone upper	13.75	19.2909944	12.2886751	16.9464847	11.4787136
zone lower	10.25	16.7090056	11.7113249	15.0535153	10.5212864

Cognitive Anxiety Subscale					
1	20	23	17	17	18
2	16	23	13	17	18
3	18	24	13	21	16
4	18	25	15	18	17
SD	1.63299316	0.95742711	1.91485422	1.89296945	0.95742711
Zone upper	16.8164966	23.4787136	13.9574271	17.9464847	16.4787136
zone lower	15.1835034	22.5212864	12.0425729	16.0535153	15.5212864

Self-confidence Subscale					
1	27	16	24	15	28
2	30	19	28	15	28
3	28	23	28	10	31
4	26	25	28	10	32
SD	1.70782513	4.03112887	2	2.88675135	2.06155281
Zone upper	30.8539126	18.0155644	29	16.4433757	32.0307764
zone lower	29.1460874	13.9844356	27	13.5566243	29.9692236

Somatic Anxiety Subscale

	#6	#7	#8	#9	#10
1	21	13	20	16	13
2	19	17	17	16	19
3	16	19	21	14	16
4	14	15	17	15	14
SD	3.10912635	2.5819889	2.06155281	0.95742711	2.64575131
Zone upper	20.5545632	16.2909944	22.0307764	16.4787136	15.3228757
zone lower	17.4454368	13.7090056	19.9692236	15.5212864	12.6771243

Cognitive Anxiety Subscale

1	16	19	18	18	18
2	13	16	20	18	19
3	15	16	17	20	19
4	10	15	22	24	18
SD	2.64575131	1.73205081	2.21735578	2.82842712	0.57735027
Zone upper	14.3228757	15.8660254	18.1086779	19.4142136	18.2886751
zone lower	11.6771243	14.1339746	15.8913221	16.5857864	17.7113249

Self-confidence Subscale

1	17	25	25	22	20
2	15	20	27	22	16
3	13	21	24	18	14
4	19	24	19	24	19
SD	2.5819889	2.38047614	3.40342964	2.51661148	2.75378527
Zone upper	16.2909944	25.1902381	25.7017148	23.2583057	20.3768926
zone lower	13.7090056	22.8097619	22.2982852	20.7416943	17.6231074

Somatic Anxiety Subscale		#11	#12	#13	#14	#15
	1	22	14	20	24	17
	2	24	15	17	24	13
	3	23	14	15	25	13
	4	21	12	17	18	15
SD		1.29099445	1.25830574	2.06155281	3.20156212	1.91485422
Zone upper		22.6454972	15.6291529	18.0307764	26.6007811	13.9574271
zone lower		21.3545028	14.3708471	15.9692236	23.3992189	12.0425729

Cognitive Anxiety Subscale						
	1	17	17	18	25	20
	2	19	16	17	27	14
	3	20	15	19	26	14
	4	22	10	16	18	12
SD		2.081666	3.10912635	1.29099445	4.0824829	3.46410162
Zone upper		18.040833	17.5545632	16.6454972	28.0412415	15.7320508
zone lower		15.959167	14.4454368	15.3545028	23.9587585	12.2679492

Self-confidence Subscale						
	1	25	25	13	14	17
	2	27	24	11	16	26
	3	27	23	14	15	28
	4	25	28	11	19	20
SD		1.15470054	2.1602469	1.5	2.1602469	5.12347538
Zone upper		25.5773503	25.0801234	11.75	16.0801234	30.5617377
zone lower		24.4226497	22.9198766	10.25	13.9198766	25.4382623

Somatic Anxiety Subscale

	#16	#17	#18	#19	#20
1	33	19	22	36	12
2	30	27	25	34	20
3	28	24	26	22	13
4	26	20	21	20	16
SD	2.98607881	3.6968455	2.38047614	8.16496581	3.59397644
Zone upper	27.4930394	25.8484228	22.1902381	26.0824829	14.7969882
zone lower	24.5069606	22.1515772	19.8097619	17.9175171	11.2030118

Cognitive Anxiety Subscale

1	19	17	34	36	15
2	18	19	31	29	17
3	20	15	36	25	14
4	24	20	34	26	18
SD	2.62995564	2.21735578	2.06155281	4.96655481	1.82574186
Zone upper	25.3149778	16.1086779	35.0307764	28.4832774	14.9128709
zone lower	22.6850222	13.8913221	32.9692236	23.5167226	13.0871291

Self-confidence Subscale

1	15	13	16	13	20
2	13	11	14	15	26
3	14	15	12	17	21
4	19	12	17	18	23
SD	2.62995564	1.70782513	2.21735578	2.21735578	2.64575131
Zone upper	20.3149778	15.8539126	18.1086779	19.1086779	22.3228757
zone lower	17.6850222	14.1460874	15.8913221	16.8913221	19.6771243

Somatic Anxiety Subscale	#21	#22	#23	#24	#25
1	14	14	22	16	11
2	16	11	20	11	13
3	12	13	22	13	15
4	11	11	21	15	16
SD	2.21735578	1.5	0.95742711	2.21735578	2.21735578
Zone upper	12.1086779	11.75	21.4787136	17.1086779	17.1086779
zone lower	9.89132211	10.25	20.5212864	14.8913221	14.8913221

Cognitive Anxiety Subscale					
1	12	16	21	21	16
2	19	10	20	27	21
3	16	13	20	24	18
4	15	11	19	22	19
SD	2.88675135	2.64575131	0.81649658	2.64575131	2.081666
Zone upper	16.4433757	12.3228757	19.4082483	22.3228757	20.040833
zone lower	13.5566243	9.67712434	18.5917517	19.6771243	17.959167

Self-confidence Subscale					
1	20	20	16	30	25
2	14	28	14	22	28
3	20	24	12	27	18
4	21	15	15	30	15
SD	3.20156212	5.56027577	1.70782513	3.77491722	6.02771377
Zone upper	22.6007811	17.7801379	15.8539126	31.8874586	18.0138569
zone lower	19.3992189	12.2198621	14.1460874	28.1125414	11.9861431

Somatic Anxiety Subscale	#26	#27	#28	#29	#30
1	11	16	26	23	35
2	17	16	25	23	26
3	13	17	24	20	24
4	15	15	26	17	35
SD	2.5819889	0.81649658	0.95742711	2.87228132	5.83095189
Zone upper	12.2909944	16.4082483	26.4787136	18.4361407	26.9154759
zone lower	9.70900555	15.5917517	25.5212864	15.5638593	21.0845241

Cognitive Anxiety Subscale					
1	13	20	23	19	35
2	19	19	22	20	18
3	14	22	13	17	21
4	18	17	20	13	33
SD	2.94392029	2.081666	4.50924975	3.09569594	8.5
Zone upper	14.4719601	20.040833	22.2546249	14.547848	25.25
zone lower	11.5280399	17.959167	17.7453751	11.452152	16.75

Self-confidence Subscale					
1	28	25	19	11	9
2	19	23	22	11	26
3	26	20	28	20	22
4	17	15	21	20	11
SD	5.32290647	4.34932945	3.87298335	5.19615242	8.28653526
Zone upper	30.6614532	25.1746647	22.9364917	22.5980762	26.1432676
zone lower	25.3385468	20.8253353	19.0635083	17.4019238	17.8567324

APPENDIX D

t value and *p* value for each subjects

	In-zone Scores	Out-of-zone scores	t value	*p* value
#1				
Somatic				
Cognitive	94±0.0	85±1.73	4.5	0.046
Self-confidence				
#2				
Somatic	91.5±0.71	86.5±0.71	7.1	0.019
Cognitive				
Self-confidence	92±0.0	88±2.65	1.3	0.32
#3				
Somatic	91.5±0.71	87±1.41	4.0	0.057
Cognitive				
Self-confidence	90.3±2.10	86±0.0	1.8	0.21
#4				
Somatic				
Cognitive	90±0.0	84.5±0.71	11.0	0.008
Self-confidence				
#5				
Somatic	92±0.0	87.3±0.58	7.0	0.02
Cognitive				
Self-confidence	90±2.83	87±0.0	1.5	0.27
#6				
Somatic				
Cognitive	92±0.0	87±1.0	4.3	0.049
Self-confidence				
#7				
Somatic	94±0.0	88.7±1.53	3.0	0.094
Cognitive				
Self-confidence	91±2.65	87±0.0	1.3	0.321
#8				
Somatic				
Cognitive	91.8±0.35	82.5±0.71	16.5	0.004
Self-confidence				
#9				
Somatic				
Cognitive	92±1.41	85±1.41	5.0	0.038
Self-confidence				
#10				
Somatic	91±0.0	82±1.41	9.0	0.012
Cognitive				

Self-confidence				
#11				
Somatic	91±0. 0	83.7±2. 08	3.1	0.093
Cognitive				
Self-confidence	88.5±3. 54	82.5±0. 71	2.4	0.143
#12				
Somatic	94±0. 0	91.7±2. 31	0.9	0.474
Cognitive	93.3±0. 58	89	6.5	0.023
Self-confidence				
#13				
Somatic	89.5±0. 71	82±1. 41	6.7	0.022
Cognitive	90±0.0	84.3 ±4. 16	1.2	0.36
Self-confidence	89.5±0. 71	82±1. 41	6.7	0.022
#14				
Somatic	91±1. 0	80±0. 0	9.5	0.011
Cognitive				
Self-confidence				
#15				
Somatic	91.5±0. 71	88±0. 0	7.0	0.02
Cognitive				
Self-confidence				
#16				
Somatic	92±0. 0	84.7±1. 53	4.2	0.053
Cognitive				
Self-confidence				
#17				
Somatic	94±0. 0	87.7±1. 53	3.6	0.07
Cognitive				
Self-confidence				
#18				
Somatic	91.5±0. 71	87±1. 41	4.0	0.057
Cognitive				
Self-confidence				
#19				
Somatic	91.5±0. 0	87±1. 41	4.5	0.046
Cognitive				
Self-confidence				
#20				
Somatic	92.5±2. 12	84.5±0. 71	5.1	0.037
Cognitive	94	86.7±3. 79	1.7	0.235
Self-confidence	92.5±2. 12	84.5±0. 71	5.1	0.037
#21				
Somatic	92.5±0. 71	83.5±3. 54	3.5	0.072
Cognitive				
Self-confidence	90.3±3. 79	81±0. 0	2.1	0.166

#22				
Somatic	95±2.83	89	3.0	0.095
Cognitive				
Self-confidence	97	90.3±2.31	2.5	0.13
#23				
Somatic	91±0.0	87.7±0.58	5.0	0.038
Cognitive				
Self-confidence				
#24				
Somatic	94.5±0.71	89.8±0.35	8.5	0.014
Cognitive				
Self-confidence				
#25				
Somatic	92.5±0.71	85±1.41	6.7	0.022
Cognitive				
Self-confidence				
#26				
Somatic	95±1.41	90	5.0	0.038
Cognitive				
Self-confidence				
#27				
Somatic	91±1.41	84±2.83	3.1	0.089
Cognitive				
Self-confidence				
#28				
Somatic	93±1.41	87±8.49	1.0	0.428
Cognitive	93.5±0.71	86.5±7.78	1.3	0.333
Self-confidence				
#29				
Somatic	95±0.0	89±1.0	5.2	0.035
Cognitive				
Self-confidence	92.5±3.54	88.5±0.71	1.6	0.257
#30				
Somatic	92.5±0.71	87.5±2.12	3.2	0.087
Cognitive				
Self-confidence				

APPENDIX E

This study had gone through the Education and Social/Behavioral Science IRB (Submission ID Number: 2015-0557). It qualified for exemption under category of 45 CFR 46.101(b)(2): Research involving the use of educational tests, surveys, interviews. The research was conducted in accordance with the highest ethical standards/Belmont Report.

THE UNIVERSITY of WISCONSIN MADISON

Education and Social/Behavioral Science IRB

Submission ID number:	2015-0557
Title:	Anxiety and Optimal Piano Performance
Principal Investigator:	Jessica Johnson
Point-of-contact:	Jessica Johnson and Zijin Yao
IRB Staff Reviewer:	Casey Pellien
Date of Determination:	7/10/15

The IRB has reviewed the study indicated above. Please review the determination indicated below and any additional guidance provided by the IRB. If you have questions about this determination, please contact the staff reviewer listed above. For additional information about this application, please log into your ARROW account at arrow.wisc.edu.

Determination

☐ IRB review is not required because, in accordance with federal regulations, your project does not:
- ☐ constitute research as defined under 45 CFR 46.102 (d)
- ☐ involve human subjects as defined under 45 CFR 46.102 (f)

Additional information:

☒ Your study qualifies for exemption under category:
- ☐ 45 CFR 46.101(b)(1): Research in educational settings
- ☒ 45 CFR 46.101(b)(2): Research involving the use of educational tests, surveys, interviews
- ☐ 45 CFR 46.101(b)(3): Research involving the use of educational tests, surveys, interviews with public officials or required by federal statute
- ☐ 45 CFR 46.101(b)(4): Research involving existing data or specimens
- ☐ 45 CFR 46.101(b)(5): Demonstration projects
- ☐ 45 CFR 46.101(b)(6) Taste and food quality evaluation

Although your study is exempt from federal regulations, UW-Madison Human Research Protection Program policy requires that all human subjects research be conducted in accordance with the highest ethical standards/Belmont Report.

Additional information: