Music Performance Anxiety and Arousal Imagery: Development of the Musician's Self-Regulation Imagery Scale

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Music performance anxiety (MPA) is a common experience for musicians regardless of their level of expertise and can have a negative impact on performance quality. Arousal imagery is a technique that has been used to help performers regulate performance anxiety in order to perform their best. There are diverging views concerning the *level* of arousal that performers should imagine to effectively deal with performance anxiety. Existing MPA research has been dominated by interventions that employ relaxation imagery. Despite positive results, methodological limitations prevent causal conclusions regarding its efficacy. Further, other arousal imagery strategies – incorporating high arousal – have helped performers in closely related high-stress performance domains, and these strategies might also benefit musicians. As well, contemporary emotion regulation models, and the best-practice guidelines for exposure treatment of anxiety disorders, raise concerns about the efficacy of relaxation imagery. In light of these issues, and the predominant use of relaxation imagery in MPA research, understanding whether and how musicians use arousal imagery in their own practice is an important, yet strikingly understudied area. We developed the Musician's Self-Regulation Imagery Scale (MSRIS) to measure musicians' intentional use of different arousal imagery strategies in three groups of musicians with varying levels of expertise. The factor analytic structure of the MSRIS suggests that it captures *mastery* and *high arousal* imagery and results indicate that musicians use imagery with varying levels of arousal. Further, results suggest that mastery imagery positively relates to MPA and auditory and visual imagery vividness, while high arousal imagery is positively associated with MPA and negatively associated with visual imagery vividness. Implications of the present study and suggestions for future research are discussed.

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Literature Review and Introduction

Music Performance Anxiety

Musicians engage in a delicate balancing act each time they perform. In order to communicate their artistic ideas to an audience, musicians must manage the technical demands of their instruments, as well as heightened emotions that can accompany performance. Indeed, music performance anxiety (MPA) can make it difficult for musicians to perform well (Papageorgi, Creech, & Welch, 2013; Wan & Huon, 2005; Wesner, Noyes, & Davis, 1990). Music performance anxiety is commonly defined as, "The experience of marked and persistent anxious apprehension related to musical performance […] manifested through combinations of affective, cognitive, somatic, and behavioural symptoms" (Kenny, 2010, p. 433). For example, musicians might experience worried thoughts about their performances (Kenny, Davis, & Oates, 2004), elevated heart-rate, pain, or dry-mouth during performances (Leaver, Harris, & Palmer, 201l; Miller, 2005). Based on the distress and impairment it causes, MPA can be diagnosed as performance only social anxiety disorder (SAD) (American Psychiatric Association, 2013), and many musicians experience clinical levels of this form of social anxiety (Barbar, de Souza Crippa, & de Lima Osório, 2014; Cox & Kenardy, 1993; Kenny, Driscoll, & Ackermann, 2014).

Even the most seasoned musicians experience MPA, and estimates suggest that it affects anywhere from 15% (Steptoe, 2001), to upwards of 70% of professional musicians (James, 1997). Further, approximately 33% of music students experience MPA (Studer, Gomez, Hildebrandt, Arial, & Danuser, 2011), and similar estimates have been reported in musicians with varying levels of expertise (Barbar et al., 2014).

Because live performances are so important for musicians, researchers have investigated a number of treatment techniques to help musicians manage MPA, such as cognitive-behavioural therapy, music therapy, and drug interventions such as beta-blockers (for a review of treatments, see Kenny, 2005).

Mental Imagery

What if there were a technique that could help musicians manage MPA *while* experiencing the balancing act of live performance, before ever setting foot onstage? In MPA treatment research, mental imagery is frequently used with other treatment components (e.g., progressive muscle relaxation) (Finch & Moscovitch, 2016). The rationale for the use of imagery is that it allows musicians to imagine and experience in-vivo performances before they actually occur, thus representing a powerful mental rehearsal technique. Indeed, it can be used to “hear,” “see,” and “feel” performances before they actually take place (Connolly & Williamon, 2004, p. 224; White & Hardy, 1998)

Several findings suggest that imagery can be used to feel emotional aspects of performance. For example, emotional centres of the brain are activated in response to both imagined and perceived stimuli (e.g., Kim et al., 2007) and imagining socially stressful situations increases anxiety more than verbally processing the same information (Holmes & Matthews, 2005). Because of the potent effect that imagery can have on emotions, it has also been used as a technique to *modulate* them, and is frequently used to treat various anxiety disorders (Hirsch & Holmes, 2007).

In addition to providing musicians with a tool to experience and manage emotions, cognitive science suggests that there is significant overlap in neurological processing between imagined and actual performances. Specifically, similar brain areas are activated in response to perceived and imagined auditory pitches (Zatorre, Evans, & Meyer, 1994), and pre-motor and supplementary motor areas are activated when musicians imagine performing (Lotze, Scheler, Tan, Braun, & Birbaumer, 2003; Zatorre & Halpern, 2005). Indeed, it is not surprising that imagery improves performance quality when used with physical practice (Driskell, Copper, & Moran, 1994; Ross, 1985). Further, the term functional equivalence has been used to highlight the similarities between actual and imagined auditory and motor processing. To this end, applied imagery frameworks recommend that performance imagery should mimic actual performances as closely as possible (Holmes & Collins, 2001).

In summary, mental imagery can be an immersive experience, allowing musicians to experience and manage heightened emotions related to performance as well as other aspects of their ideal performances. However, how should musicians use or approach imagery to manage MPA?

Music performance anxiety and relaxation imagery. Imagery has been used to alleviate MPA as a stand-alone treatment (Esplen, & Hodnett, 1999), and in conjunction with other treatments such as systematic desensitization (Appel, 1974), progressive muscle relaxation (Nagel, Himle, & Papsdorf, 1989), and cognitive-behavioral therapy (Brodsky & Sloboda, 1997). Although not explicitly termed *relaxation imagery* in existing research, musicians have been instructed to use performance imagery either following a relaxation induction such as progressive muscle relaxation (Appel, 1974; Sisterhen, 2005; Nagel et al., 1989; Stanton, 1994; Kim, 2008), or instructed to imagine themselves performing in a relaxed state (Appel, 1974; Sisterhen, 2005; Whitaker, 1985; Nagel et al., 1989; Stanton, 1994; Kim, 2008; Esplen & Hodnett, 1999). Additionally, although imagery has been included in mental skills training interventions, detailed information has not been reported regarding how imagery has been specifically employed to manage MPA (e.g., Gratto, 1998; Hoffman & Hanrahan, 2012) or enhance performance quality (Clark & Williamon, 2011). Thus, to date, relaxation imagery is the predominant approach in MPA research.

Despite the positive results that have been reported regarding the helpfulness of relaxation imagery used before performances (Appel, 1974; Sisterhen, 2005; Whitaker, 1985; Nagel et al., 1989; Stanton, 1994; Kim, 2008; Esplen & Hodnett, 1999), methodological limitations prevent causal conclusions about the effectiveness of relaxation imagery on MPA per se; relaxation imagery has been used in conjunction with other treatment techniques (e.g., Kim, 2008), and the only stand-alone imagery intervention did not include a control group (Esplen & Hodnett, 1999). These limitations raise important questions about whether relaxation imagery is the only or most effective approach that can be used to help musicians manage MPA.

Indeed, other closely related performance domains (e.g., sport) have utilized a variety of imagery strategies to alleviate performance anxiety. Although there are differences between sport and musical performance, athletes and musicians perform in competitive settings, perform individually and in groups, and require fine and gross motor control to perform effectively. Thus, the comparatively vast imagery-based competitive anxiety literature offers important insights for musicians.

Competitive Anxiety and Arousal Imagery

The term *arousal imagery* has been used to describe imagery that athletes can use to imagine different levels of arousal during performance imagery, ranging from low (i.e., relaxation) to high (i.e., stress and anxiety) (Martin, Moritz, & Hall, 1999). Although relaxation imagery has been used to help alleviate anxiety (Weinberg, Seabourne, & Jackson, 1981), the efficacy of relaxation strategies in general (e.g., deep breathing exercises) has been questioned because these strategies might lower physiological activation levels below an optimal level for some performers (Hanton & Jones, 1999). Thus, the helpfulness of arousal imagery strategies incorporating high arousal and anxiety has also been investigated.

To this end, imagery used to anticipate or accept heightened arousal and anxiety promotes a facilitative interpretation of competitive anxiety under certain conditions (Cumming, Olphin & Law, 2007; Mellalieu, Hanton, & Thomas, 2009). Specifically, high arousal imagery is effective when used concurrently with mastery or success imagery (Cumming, et al., 2007; Mellalieu, et al., 2009). Indeed, Jones and Hanton (2001) identified *confident coping* – wherein performers imagine performing with mastery and confidence while experiencing heightened anxiety – as an effective coping strategy that would not diminish optimal levels of arousal. Further, imagery used to reappraise or re-frame anxiety (i.e., imagining getting "psyched-up" or "revved-up" to compete) also engenders facilitative interpretations of anxiety (Cumming, et al., 2007). However, the use of high arousal imagery without these additional components is associated with increased cognitive and somatic anxiety in elite dancers (Monsma & Overby, 2004), and predicts cognitive anxiety in elite roller skaters (Vadocz, Hall, & Moritz, 1997).

Clearly, different arousal imagery strategies can be helpful under certain conditions, and impact anxiety by either lowering it (e.g., Weinberg et al., 1981), or by helping to create more facilitative interpretations (e.g., Mellalieu, et al., 2009). Due to the close relation between athletic and musical performance noted above, high arousal imagery strategies might also benefit musicians.

Additionally, sport researchers have given greater thought to how arousal imagery can be used to manage competitive anxiety in a manner that optimizes performance, as per the arousal performance relation. Indeed, few MPA studies have included actual performance quality as an outcome variable (for a review, see Finch & Moscovitch, 2016). Although an extensive review of the arousal performance relation is beyond the scope of this paper, we will briefly review it in order to further inform whether high arousal imagery might help musicians manage MPA in a manner that would also optimize performance.

Anxiety-Performance Relation

The Yerkes-Dodson law (1908) is often cited to account for the arousal-performance relation and states that moderate levels of arousal facilitate peak performance. However, since it was first articulated, the terms arousal and anxiety have been used interchangeably (e.g., Kokotsaki & Davidson, 2003; Wilson & Roland, 2002), despite arguments that arousal is a non-directive state of physiological activation (i.e., not inherently negative or positive), whereas anxiety is a negative emotion (Arent & Landers, 2003). Nevertheless, MPA research has investigated the *anxiety*-performance relation.

In line with the Yerkes-Dodson law, early studies in musicians found that peak performance occurred at moderate levels of anxiety (e.g., Steptoe, 1983). Wilson (2002) extended the Yerkes-Dodson law and suggested that MPA hinders or helps performance based on an interplay between trait anxiety, situational stress, and task mastery. Indeed, trait anxiety is strongly associated with MPA (Cox & Kennardy, 1993; Osborne & Kenny, 2005), solo performance situations are associated with the highest levels of MPA (Cox & Kennardy, 1993; Fehm & Schmidt, 2006; Papageorgi et al., 2013), and some research suggests that MPA declines with experience (Biasutti & Concina, 2014; Osborne & Franklin, 2002; although see Barbar et al., 2014; Cox and Kenardy, 1993; Kenny et al., 2011; Rae & McCambridge, 2004).

Contemporary performance theory originally developed in sport research has also been investigated in musicians and further delineates the relation between anxiety and performance. For instance, multidimensional anxiety theory (MAT) suggests that cognitive anxiety has a negative linear relation with performance, while somatic anxiety has a curvilinear relation with performance (Martens, Burton, Vealey, Bump, & Smith, 1990). Self-confidence has also been included in revisions to MAT, and is theorized to have a positive linear relation with performance (Martens et al., 1990). Adding to this theory, Jones and Swain (1992) argued that performers' *interpretations* of cognitive and somatic anxiety as either hindering or helping performance should be measured, to allow for the fact that not all athletes perceive anxiety as debilitative to performance (e.g., Jones, Hanton, & Swain, 1994; Mellalieu et al., 2009).

In an investigation of MAT in musicians, Yoshi et al. (2009) found self-confidence was a significant predictor of global performance quality, that cognitive anxiety interpretation significantly positively predicted perceived performance quality, and that cognitive anxiety intensity negatively predicted technical accuracy, a specific component of performance quality. Thus, MAT suggests that the relation between different components of anxiety as well as their interpretation as hindering or helping performance is nuanced. Further, not all musicians who experience heightened physiological arousal (e.g., Craske & Craig, 1984) or anxiety (Kokotsaki & Davidson, 2003) interpret it as hindering their performance, and levels of physiological arousal are similar in those with low and high cognitive anxiety (e.g., Studer et al., 2014). Additionally, Hamann and Sobaje (1983) found that anxiety can facilitate performance in those with high task mastery.

In summary, there is a complicated relation between different aspects of anxiety (e.g., cognitive and somatic), their interpretation as hindering or helping performance, and performance outcome. Yet, existing MPA treatment interventions utilizing imagery have been predominantly aimed at helping musicians reduce physiological arousal and anxiety, instead of managing or reframing cognitive interpretations of anxiety. As reviewed above, this approach might not optimize performance and actual performance outcomes are rarely measured. Because the anxiety-performance relation suggests that certain kinds of anxiety can facilitate performance under certain conditions, the efficacy of high arousal imagery strategies – which may help musicians view anxiety in a more facilitative manner – should be investigated as these might also help to optimize performance quality.

Imaginal Exposure and Emotional Suppression

Because performance imagery allows musicians to engage in mental concerts, it can be viewed as a form of imaginal exposure, whereby musicians are exposed to imagined anxiety provoking performance situations before they take place (Finch & Moscovitch, 2016). Current best-practice guidelines for exposure therapy suggest that the use of anxiety control strategies (e.g., suppression) be avoided (Barlow, 2008), so that individuals can fully engage with all aspects of their feared stimuli (Foa & Kozak, 1986). Further, emotion regulation research suggests that anxiety control strategies such as suppression increase anxiety in clinical populations (Campbell-Sills, Barlow, Brown, & Hofmann, 2006a; Campbell-Sills, Barlow, Brown and Hofmann, 2006b), and that such strategies are used more often by those who struggle with problematic anxiety (Gross & John, 2003). Thus, for musicians who are *not* relaxed during performances, relaxation imagery might not be the most beneficial arousal imagery strategy and the above review suggests that it could be harmful for highly performance anxious musicians if used to suppress the experience and expression of MPA.

Integrative Summary and Future Directions

MPA is a pervasive problem amongst musicians and relaxation imagery has been used in applied research to help musicians ameliorate MPA, yet methodological limitations preclude causal conclusions about its effects. This is particularly concerning in light of emotion regulation research which suggests that relaxation imagery might lead to a suppressive increase in MPA for highly performance anxious musicians (Campbell-Sills et al., 2006a; Campbell-Sills et al., 2006b). Further, strategies used to suppress anxiety – such as relaxation – are inconsistent with best-practice guidelines for exposure treatment (Barlow, 2008). However, even if relaxation imagery has its intended effect and decreases MPA, the above review suggests that an important question has not been adequately addressed in existing research: Do strategies that ameliorate MPA also increase performance quality? Anxiety-performance theory suggests that different aspects of anxiety (e.g., cognitive or somatic) and their interpretation as hindering or helping performance quality are differentially related to performance outcomes (e.g., Martens et al., 1990). Yet, the primary aim of relaxation imagery has been to reduce MPA, and many of the measures used to assess MPA in existing research do not distinguish between different components of MPA (e.g., Nagel et al., 1989). However, alternative strategies have been examined in sport which integrate anxiety-performance theory and are in line with adaptive emotion regulation theory. Further, high arousal strategies might be more effective for musicians with high MPA as they closely resemble actual performance conditions, and are thus consistent with practical guidelines derived from performance imagery frameworks (e.g., Holmes & Collins, 2001). Clearly, further MPA imagery research is required. Specifically, the literature would benefit from randomized controlled trials conducted to investigate the effectiveness of different arousal imagery strategies (e.g., relaxation, vs. psyching-up, confident coping, etc.) in order to provide performance anxious musicians with a larger arsenal of evidence-based techniques, both in terms of managing anxiety and improving performance quality.

However, there are also important preliminary questions relating to such work that have not yet been addressed. For example, although musicians use imagery in their own practice

(Clark, Williamon, & Lisboa, 2007; Gregg, Clark, & Hall, 2008; Holmes; 2005; Lotze et al., 2003), little is know about whether and how musicians use arousal imagery in their day-to-day practice and rehearsal. Clark et al. (2007) found that musicians use imagery to “deal with nerves” but the specific approaches or strategies used by musicians were not detailed. Further, to our knowledge, only one measure has been developed to capture musicians’ use of performance imagery. Gregg et al. (2008) modeled the Functions of Imagery in Music Questionnaire (FIMQ) on the Sport Imagery Questionnaire (Hall et al., 2008) which was designed to measure different aspects of athlete’s use of imagery based on Paivio’s Analytic Framework of Imagery Effects (1985). This framework suggests that performance imagery can be used for cognitive (e.g., skill or strategy rehearsal) and motivational (e.g., skill mastery, arousal regulation, and goal setting) purposes (Gregg et al., 2008). Although Gregg et al. (2008) found that musicians use imagery for both cognitive and motivational purposes, the specific subscale intended to measure arousal regulation was not included in their analyses due to its poor psychometric properties. Thus, we know very little about musicians’ intentional use of arousal imagery and whether it might be used to imagine varying levels of arousal or anxiety.

It is possible that due to the predominance of relaxation-based strategies in the MPA literature, performance anxious musicians might be employing imagery in a manner that is inconsistent with “best-practice” exposure guidelines (Finch & Moscovitch, 2016), which may lead to a suppressive increase in anxiety, as per emotion regulation research (Campbell-Sills et al., 2006a; Campbell-Sills et al., 2006b). Although the use of relaxation imagery with other treatment components in existing intervention research may have helped to counteract potentially suppressive effects, used on its own, relaxation imagery may be detrimental to some musicians.

Conversely, it is also possible that, similar to athletes, musicians use high arousal imagery strategies that might help to facilitate levels of arousal and anxiety which also optimize performance (e.g., confident coping), as per the anxiety-performance relation. Alternatively, musicians might use purely high arousal imagery strategies (e.g., anxiety imagery) which increase (Monsma & Overby, 2004) and are predictive of anxiety (Vadocz et al., 1997) in dancers and athletes, respectively. Clearly, research must address whether and how musicians use arousal imagery.

Current Research

The current research was designed to address two objectives. In Part A, we developed a self-report measure, the Musician's Self-Regulation Imagery Scale (MSRIS), to measure four distinct arousal imagery strategies that have been detailed in existing MPA and competitive anxiety research including relaxation, psyching-up, anxiety, and confident coping. We sought to examine the factorial validity of our measure and hypothesized that the MSRIS would have a four-factor solution.

In Part B, we aimed to investigate the psychometrics of the MSRIS, as well as the relation of its subscales with MPA, expertise, imagery vividness, and other forms of performance imagery. In line with emotion regulation research, we hypothesized that musicians with higher MPA would more frequently use relaxation imagery. Conversely, we predicted that those with lower MPA as well as those who interpret anxiety in a facilitative direction, would more frequently use strategies which incorporate arousal or anxiety (e.g., psyching-up). Further, we were interested in discovering whether and how musical expertise (e.g., training, experience, and skill level) and imagery vividness relate to the MSRIS subscales. Although expert musicians do not necessarily experience less MPA, it is possible that due to their expertise, they have different tools at their disposal to deal with MPA, and thus might prefer different arousal imagery strategies than musicians with less expertise (Finch & Moscovitch, 2016). Further, some evidence suggests that imagery vividness is higher in professional musicians compared to amateurs (Lotze et al., 2003), yet little is known about whether imagery vividness itself might relate to different arousal imagery strategies. Last, we were interested in discovering whether and how arousal imagery is associated with imagery that musicians use for other aspects related to performance (e.g., cognitive imagery of technical skills), measured by the Functions of Imagery in Music Questionnaire (FIMQ; Gregg et al. 2008).

Part A

Initial Development of the Musician's Self-Regulation Imagery Scale

In order to measure musicians' intentional use of arousal imagery, we developed the Musician's Self-Regulation Imagery Scale (MSRIS) and considered several limitations of existing work when designing our measure. Although the Functions of Imagery in Music Questionnaire (FIMQ; Gregg et al., 2008) instructs participants to respond to how frequently they use imagery for different purposes, and some items on the arousal regulation subscale are clearly worded in this manner (e.g., "I imagine the anxiety associated with performing"), additional items ask musicians about their emotional experience in *response* to imagery (e.g., "When I imagine a performance or competition, I feel myself getting emotionally excited"). We sought to clarify this distinction by asking participants how they intentionally *use* imagery, rather than focusing on emotions experienced in response to imagery.

Additionally, the arousal regulation subscale of the FIMQ, and the Sport Imagery Questionnaire (Hall et al., 1998) on which it is based, includes items with varying levels of arousal (e.g., calmness, stress, anxiety, and excitement). Despite the fact that the arousal regulation subscale of the FIMQ was not used in analyses by Gregg et al. (2008) due to its poor psychometrics, the structure of this subscale would have precluded a detailed analysis of whether and how different arousal imagery strategies (e.g., relaxation or psyching-up) relate to variables such as MPA and imagery vividness. Thus, we sought to create subscales designed to capture the use of different strategies which have been detailed in MPA and competitive anxiety research.

Because relaxation imagery is the predominant approach in applied MPA research, we included a relaxation subscale. Additionally, high arousal strategies have been used in existing competitive anxiety literature in different ways, and we included three additional subscales to capture these strategies. Specifically, in light of different psyching-up and anxiety imagery scripts used in previous competitive anxiety research (Cumming et al., 2007), we included separate subscales to capture these approaches. Although we questioned whether musicians would intentionally use anxiety imagery as a practice or rehearsal *strategy*, we considered that some musicians might use anxiety imagery to help expose themselves to what they typically experience in performance situations and sought to include as many strategies as possible during measure development. Last, we included a confident coping subscale to capture imagery that musicians might use to imagine performing with control and mastery in the presence of anxiety similar to that used in competitive anxiety intervention research (Cumming et al., 2007; Mellalieu, Hanton, & Thomas, 2009).

In order to generate items for the different subscales, we incorporated elements of some of the arousal regulation items from the Functions of Imagery in Music Questionnaire (FIMQ; Gregg et al., 2008), elements of imagery scripts detailed in MPA and competitive anxiety research, as well as elements of qualitative research outlining how athletes use arousal imagery (White & Hardy, 1998). Relaxation imagery scripts that have been used in existing intervention research emphasize both mental (e.g., being free from worried thoughts) and physical (e.g., breathing slowly) relaxation (e.g., Esplen & Hodnett, 1999; Cumming et al., 2007) and the relaxation subscale items were intended to capture these elements. Psyching-up imagery used by athletes prior to competitions (e.g., White & Hardy, 1998) and in intervention research focuses on imagining the excitement and energy associated with performing (e.g., imagining blood "pumping" through your veins) (Cumming et al., 2007) and the psyching-up subscale items incorporate these approaches. Anxiety subscale items were based on the anxiety script used in Cumming et al. (2007) and elements of the FIMQ arousal regulation items (Gregg et al., 2008), which include imagining tight muscles and a racing heart. Last, confident coping imagery scripts in extant research (Cumming et al., 2007; Mellalieu, Hanton, & Thomas, 2009) combine imagery used to imagine performing well and with confidence while experiencing aspects of performance anxiety (e.g., heart racing, worried thoughts), and the confident coping subscale items aimed to capture these elements. Participants rated the frequency with which they intentionally used each item on a scale from 1 (*never*) to 7 (*always*), and each subscale included five items.

Method

Participants

Participants included three groups of professional, student, and amateur musicians who reported actively performing over the 24 months preceding the online study. Participants in Groups 1 and 2 were recruited through Amazon Mechanical Turk (MTurk), while participants in Group 3 were recruited through the University of Waterloo Research Experiences Group (REG), Wilfrid Laurier University's Faculty of Music, as well as from Canadian symphonic orchestras, and community music groups in the Greater Toronto Area.

Self-Report Measures

Background questionnaire. Participants completed a background questionnaire concerning demographic information as well as their musical backgrounds (e.g., skill level, years of training and experience) (see Appendix A).

Arousal Imagery. All three groups of participants also completed the Musician's Self-Regulation Imagery Scale (MSRIS) to allow us to investigate its factorial validity in multiple samples (see Appendix B).

Data Screening

In order to ensure the integrity of our data, participants were excluded from the analyses if they responded incorrectly to more than three data validation questions (e.g., "Please respond *always* to this question"), for failing to meet the pre-specified performance frequency criteria (i.e., over the past 24 months), and for completing the study in less than 2 seconds per question (as per Huang, Curran, Keeney, Poposki, & DeShon, 2012).

Group 1. Based on the data validation questions, performance frequency criteria, and time analysis, 39 participants (25% of the total sample) were screened and not included in the analyses. After screening, Group 1 included 117 participants who were recruited through MTurk. The average age of participants was 32.69 (*SD* = 10.81), ranging from 18 to 70, and 59% of the sample was female. Participants were from a variety of ethnic backgrounds. Participants included musicians from different instrument families, 91.5% reported having a primary instrument while 8.5% reported playing multiple instruments.

Participants also performed a variety of musical genres including classical (21.4%), popular (17.9%), variety/multiple genres (12.8%), religious (12%), rock (12%), jazz (6.8%), and other (17.1%). Of note, 11.1% of the sample were professional musicians and an additional 18.8% were student musicians.

Of those reporting playing a primary instrument, mean years of experience was 15.15 (*SD* = 11.14), ranging from 1 to 59 years, mean training was 5.97 (*SD* = 4.14), ranging from 0 to 20 years. Primary instrument families included plucked strings (34.0%), keyboard (20.8%), voice (17.0%), woodwind (13.2%), strings (7.5%), brass (5.7%), and percussion (1.9%).

Participants who reported playing multiple instruments included a variety of musical families.

Group 2. Based on the same criteria used in Group 1, 68 participants (33% of the total sample) were screened and not included in the analyses. After screening, Group 2 included 137 participants who were recruited through MTurk. The average age of participants was 32.80 (*SD* = 8.82), ranging from 18 to 68, and 49.6% of the sample was female. Participants were from a variety of ethnic backgrounds. Participants also performed a variety of musical genres including classical (25.5%), rock (16.1%), popular (12.4%), religious (10.9%), variety/multiple genres (10.2%), jazz (5.8%), metal (5.8%), and other (13.3%). Of note, 15.3% of the sample were professional musicians and an additional 20.4% were student musicians.

Participants included musicians from different instrument families, and 85.4% reported having a primary instrument (i.e., one they play the most), while 11.7% reported playing multiple instruments, and 2.9% did not specify an instrument (primary or secondary).

Of those reporting playing a primary instrument mean years of experience was 14.8 (*SD* = 10.52), ranging from 1 to 40 years, mean training was 5.75 (*SD* = 4.70), ranging from 1 to 22 years. Primary instrument families included plucked strings (30.8%), keyboard (24.8%), voice (17.9%), woodwind (11.1%), strings (6.0%), and brass (3.4%).

Participants who reported playing multiple instruments included a variety of musical families.

Group 3. Based on the same criteria used in Group 1, 75 participants (21% of the total sample) were screened based on the same criteria used in Group 1. After screening, Group 3 included 288 participants recruited through the University of Waterloo, Wilfrid Laurier University, as well as through Canadian symphonic and vocal groups. For participants who were recruited through the University of Waterloo, age data was collected in ranges (e.g., 17 – 22 years) and is thus reported in ranges for all of Group 3. Age ranged from 17 – 75 years and the percentages of participants in each range were: 17 – 22 (41.5%), 23 – 28 (18.5%), 29 – 34 (15.3%), 35 – 40 (9.6%), 41 – 46 (5.3%), 47 – 52 (2.6%), 53 – 58 (1.7%), 59 - 64 (3.4%), 65 – 70 (1.7%), and 71 – 75 (.4%). The sample was 33.8% female. Participants were from a variety of ethnic backgrounds. Participants included musicians from different instrument families, and 91.3% reported having a primary instrument (i.e., one they play the most), while 6.6% reported playing multiple instruments, and 2.1% did not specify an instrument (primary or secondary).

Participants also performed a variety of musical genres including, classical (52.4%), variety/multiple (24%), popular (11.8%), religious (2.4%), rock (2.4%), jazz (1%), and other

(6%). Of note, 12.5% of the sample were professional musicians and an additional 12.5% were student musicians.

Of those reporting playing a primary instrument mean years of experience was 15.73 (*SD* = 13.38), ranging from 1 to 65 years, mean training was 8.07 (*SD* = 5.49), ranging from 1 to 42 years. Primary instrument families included keyboard (26.6%), strings (21.7%), voice (16.3%), woodwind (13.3%), plucked string (9.9%), brass (7.2%), and percussion (4.9%).

Participants who reported playing multiple instruments included a variety of musical families. See Table 1 for participant demographics for Groups 1, 2, and 3.

Table 1 *Demographic data*

	Group 1 (*N* = 117)	Group 2 (*N* = 137)	Group 3 (*N* = 288)	X^2	*df*	*p*
Demographic Data						
Age M (SD)	32.69 (10.80)	32.80 (8.82)				
Gender				8.62[1]	2	.013
Female	39.3%	48.9%	33.8%			
Male	59.0%	49.6%	64.1%			
Other	1.7%	1.5%	1.4%			
Choose not to respond			.7%			
Ethnicity				79.18[2]	22	< .00
Aboriginal (First Nations)	.9%		.4%			
Black/African	6.0%	8.8%	1.8%			
East Asian (e.g., Chinese, Japanese, Korean)	7.7%	7.3%	24.2%			
Southeast Asian (e.g., Filipino, Vietnamese, Indonesian)	3.4%	3.6%	5.7%			
South Asian (e.g., Pakistani, Indian)	2.6%	.7%	7.1%			
Hispanic	5.1%	8.0%	.4%			
Middle Eastern	.9%		.7%			
White/Caucasian	71.8%	70.1%	55.9%			
West Indian/Caribbean		.7%	.7%			
Other	.9%	.7%	1.1%			
Prefer not to respond	.9%					

[1] The chi-square statistic is underpowered when there are fewer than 5 cases per cell (Field, 2009). Because there were fewer participants per cell in the "other" and "choose not to respond" categories than recommended, only males and females were included in the reported analysis. The following result includes the "other" and "choose not to respond" categories, $X^2 = 10.50$, (6, $N = 535$), $p = .105$.

[2] Although this test was underpowered as some cells did not have 5 cases (Field, 2009), the significant result suggested that further steps (e.g., collapsing across response categories) were unnecessary.

Results

Factor Structure of the MSRIS

In order to determine the factorial validity of our measure, we conducted principal components analyses in Groups 1 and 2, a parallel analysis on combined Group 1 and 2 data, and a confirmatory factor analysis in Group 3.

Group 1. A principal components analysis was conducted with an orthogonal rotation (varimax) on the 20-item MSRIS in Group 1. The Kaiser-Meyer-Olkin measure indicated that there was sampling adequacy for the analysis, KMO = .877, with individual KMO measures all greater than 0.81, classifications of 'meritorious' to 'marvelous' according to Kaiser (1974). Bartlett's test of sphericity χ^2 (190) = 1449.56, $p < .001$, indicated that the magnitude between the correlations between MSRIS items were sufficient to perform this analysis.

In order to determine how many components to extract, we considered Kaiser's (1960) eigenvalue-greater-than-one criterion, Cattell's Scree Test (1966) (see Figure 1), and the interpretability of the component solution. These guidelines suggested a two-component structure. The rotated solution explained 57.24% of the total variability.

The first rotated component accounted for 29.29% of the variability in the MSRIS. Both the relaxation and confident coping items loaded onto this component. In order to name it, we considered that both relaxation and confident coping items – although differing in their level of arousal – suggest an element of mastery in relation to one's performance, and this component was thus named *mastery*.

The second rotated component accounted for 28.04% of the variability. The anxiety and psyching-up items loaded onto this component. In order to name this component, we considered that these items include elevated arousal and thus named it *high arousal*.

Of note, psyching-up items 3 ("*Being revved-up*") and 5 ("*Myself in an excited state*") cross-loaded onto the mastery and arousal components. However, as this analysis was exploratory and these items can be viewed as theoretically important to high arousal imagery, they were retained for analysis in Group 2. See Table 2 for loadings and communalities.

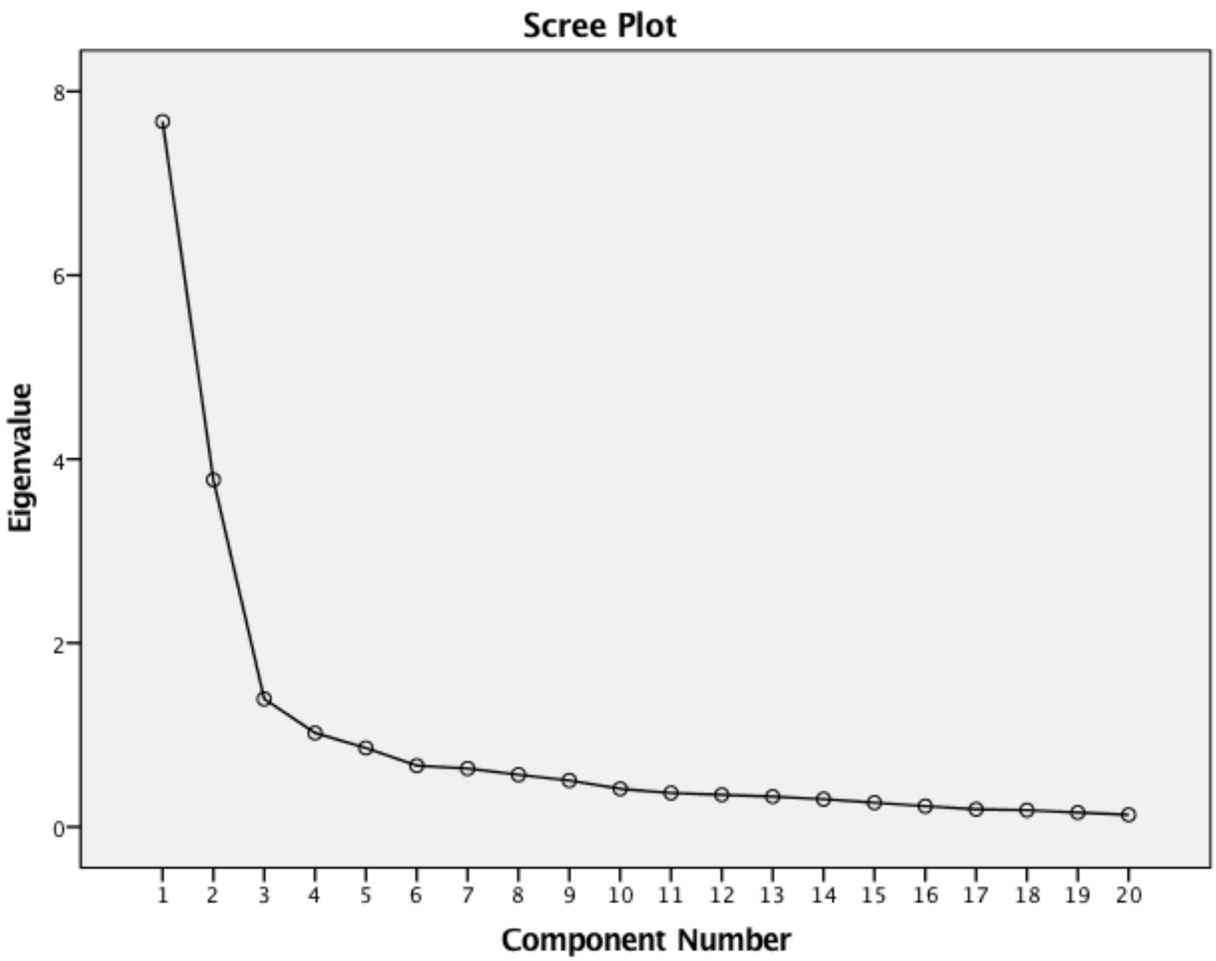

Figure 1. Principal component analysis scree plot for the MSRIS for Group 1

Table 2

Principal component analysis for the MSRIS for Group 1

Item	Rotated Component Loadings		
	Mastery	High Arousal	Communalities
R1. Feeling free from any worried thoughts about my performance	**0.779**	-0.028	0.607
R2. Feeling free from any physical tension	**0.745**	0.065	0.560
R3. Maintaining a slow/resting heart rate	**0.633**	0.142	0.420
R4. Myself breathing slowly	**0.594**	0.196	0.391
R5. Myself in a calm emotional state	**0.682**	-0.106	0.476
CC1. Handling the stress of a performance	**0.803**	0.047	0.646
CC2. Remaining confident even though I can feel my heart racing with anxiety	**0.825**	0.156	0.704
CC3. Maintaining control even though my muscles are tense	**0.775**	0.241	0.659
CC4. Staying focused even though I am worried about making mistakes	**0.721**	0.157	0.545
CC5. Coping with anxious thoughts	**0.619**	0.314	0.482
A1. My heart racing with anxiety	0.018	**0.847**	0.717
A2. Blood rushing through my veins with anxiety	0.105	**0.862**	0.754
A3. Being out of control	0.020	**0.726**	0.527
A4. Feeling sick to my stomach	0.012	**0.835**	0.697
A5. Myself in an anxious state	0.048	**0.798**	0.638
P1. My heart beating quickly with excitement	0.290	**0.724**	0.608
P2. Blood pumping through my veins with excitement	0.448	**0.628**	0.595
P3. Being “revved-up”	0.352	**0.470**	0.345
P4. Feeling “butterflies” in my stomach	0.088	**0.778**	0.613
P5. Myself in an excited state	0.450	**0.512**	0.464

Group 2. A principal component analysis was also conducted with an orthogonal rotation (varimax) on the 20-item MSRIS in Group 2. The Kaiser-Meyer-Olkin measure indicated that there was sampling adequacy for the analysis, KMO = .899, with individual KMO measures all greater than .84, classifications of 'meritorious' to 'marvelous' according to Kaiser (1974). Bartlett's test of sphericity χ^2 (190) = 1501.35, $p < .001$, indicated that the magnitude between the correlations between MSRIS items were sufficient for this analysis.

We considered the same extraction guidelines as in the Group 1 analysis (e.g., Kaiser's (1960) eigenvalue-greater-than-one criterion). The rotated solution suggested a two-component solution and explained 56.95% of the total variability. The *high arousal* component accounted for 30.32% of the variability, while the *mastery* component accounted for 26.63% of the variability. Similar to the loadings in Group 1, psyching-up item 5 ("*Myself in an excited state*"), cross-loaded onto both components.

Parallel analysis. Because concerns have been raised about commonly used methods for determining the number of factors or components to be retained in exploratory analyses (e.g., inspection of scree-plots and the eigenvalue-greater-than-one criterion), we conducted a parallel analysis (on combined Group 1 and 2 data) on random data and permutations of our data, which can minimize the over-identification of factors (Wood et al., 2015). Using O'Connor's (2000) syntax for SPSS, results suggest a two-factor structure based on both random and permutation data as only the eigenvalues for the first two factors exceeded 95th percentile values and are thus unlikely to be attributable to chance. See Table 3 for a comparison of actual and random eigenvalues, and Figure 2 for permutation results.

Table 3

Actual and random eigenvalues for first 10 eigenvalues of combined Group 1 and 2 data

Actual Eigenvalue	Average Eigenvalue	95^{th} Percentile Eigenvalue
7.663	1.561	1.664
3.781	1.450	1.520
1.160	1.373	1.425
.909	1.305	1.355
.783	1.244	1.284
.630	1.191	1.233
.599	1.137	1.174
.538	1.088	1.125
. 481	1.041	1.081
.447	.995	1.029

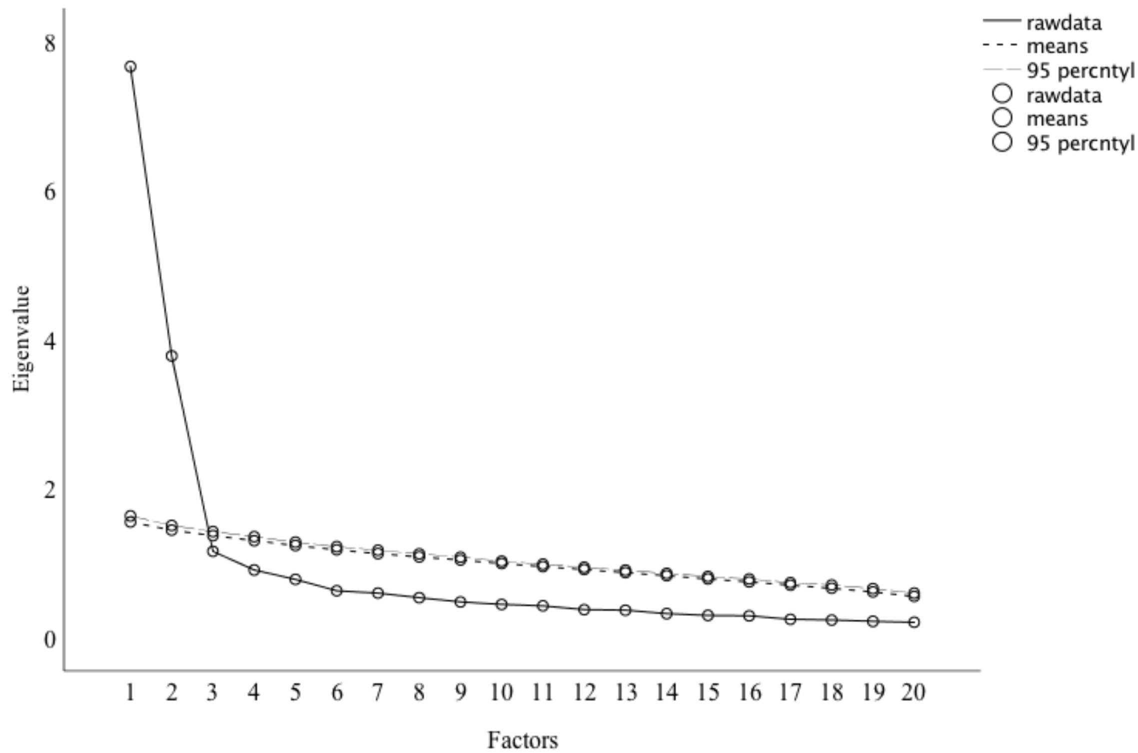

Figure 2. Eigenvalues for actual and permutations of combined Groups 1 and 2 data

Group 3. In order to determine how well the two-factor structure suggested by the exploratory factor analyses and parallel analysis fit the data, we conducted a confirmatory factor analysis in Group 3 (no missing data) with the 20-item MSRIS. In order to avoid poor model fit due to poor single item distributions, we created small item groupings ("testlets") for each of the suggested factors from the exploratory analyses.[3]

The model fit indices indicated a good model fit, $\chi^2 = 13.86$, df = 8, $p = .086$. Further, the root mean square error of approximation (RMSEA) was .052, indicative of a good fit (Hu & Bentler, 1999). The comparative fit index (CFI) was .995 and the goodness of fit index (GFI)

[3] "Testlets" included (a) Mastery 1 (Relaxation items 1 and 4, Confident Coping items 18 and 21), (b) Mastery 2 (Relaxation items 2 and 5, Confident Coping item 19), (c) Mastery 3 (Relaxation item 3, Confident Coping items 17 and 20), (d) High Arousal 1 (Psyched-up items 6, 10, and 11, Anxiety item 15), (e) High Arousal 2 (Psyched-up item 7, Anxiety items 13 and 16), (f) High Arousal 3 (Psyched-up item 8, Anxiety items 12 and 14).

was .983, which both indicate good fit (Schreiber, Nora, Stage, Barlow, & King, 2006) (see Figure 3).

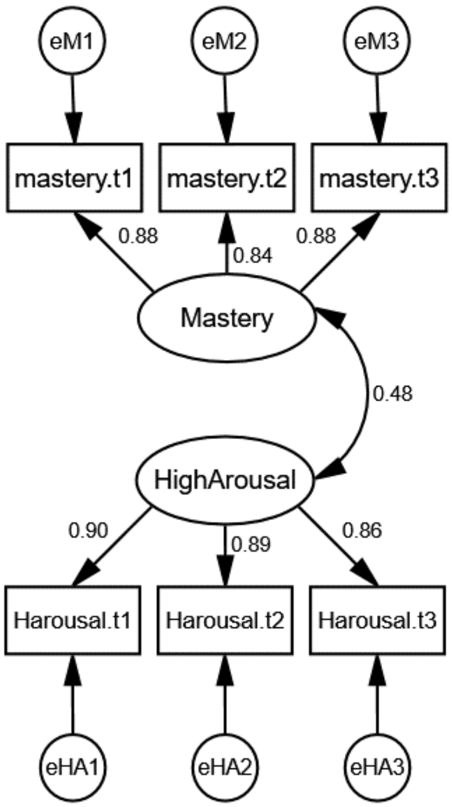

Figure 3. Confirmatory factor analysis model for Group 3 of the MSRIS, with standardized parameter estimates

Relations between the MSRIS Factors[4]

Based on the two-factor structure suggested by the exploratory analyses in Groups 1 and 2, the parallel analysis on combined Group 1 and 2 data, and the confirmatory analysis in Group 3, sum scores for the subscales were computed so that the relation between the factors could be analyzed. The correlations between the factors were all positive and statistically significant, *r*'s of .394, .350, and .436, *p*'s < .001, respectively. The latent correlation is estimated to be $r = .48$ (see Fig. 3).

[4] There were outliers on the mastery (14 cases) and high arousal (1 case) subscales of the MSRIS, which were operationalized as values greater than 1.5 times the interquartile range for each subscale. Outliers were winsorized to 1.5 times the interquartile range, and analyses were performed with winsorized data. The pattern of results was consistent with and without outliers in the data and thus the results reported in this manuscript include outliers.

Discussion

Although we originally hypothesized that the MSRIS would have a four-factor solution capturing distinct imagery strategies including relaxation, psyching-up, anxiety, and confident coping, results suggest that the MSRIS has a more parsimonious two-factor solution.

The finding that low and high arousal imagery items (i.e., relaxation and confident coping) loaded onto the mastery factor was surprising and suggests that mastery oriented imagery does not preclude the experience of heightened arousal and is more nuanced than simply imagining being relaxed. Indeed, high arousal imagery can be used for a mastery orientation as long as it is concurrently used with imagery that might impart musicians with a sense of self-efficacy in relation to anxiety (e.g., "I can handle this and it won't derail my performance") or imagery that helps to normalize the experience of anxiety. Further, because the high arousal items (i.e., confident coping) loading onto the mastery factor incorporate imagining performing with confidence, control, and focus in the presence of anxiety, this might suggest that the strategies musicians use to regulate anxiety are intricately linked to those used to imagine successful performances.

Due to the conceptual differences between arousal and anxiety reviewed above, as well as the use of distinct psyching-up and anxiety imagery scripts in previous research (e.g., Cumming et al., 2007), the finding that psyching-up and anxiety items loaded onto the high arousal factor was surprising. Further, because psyching-up imagery has been used in intervention research to help athletes reappraise anxiety and view it in a more facilitative direction (e.g., Cumming et al., 2007), it could be viewed as a strategy containing an element of mastery. However, perhaps high arousal imagery must be more explicit in its mastery orientation than simply imagining getting "revved-up" to perform. Further, if high arousal is indeed the most salient aspect of the psyching-up and anxiety items included in the MSRIS, additional research must be conducted to determine whether musicians actually use this form of imagery as a *strategy* in their practicing and rehearsal. Compared to the arousal regulation items included in the FIMQ which asked musicians about their use of imagery as well as their emotional experience in response to imagery (Gregg et al., 2008), we only included items which were intended to measure musicians' intentional use of arousal imagery. However, it is possible that the distinction between high arousal imagery used in practicing and rehearsal and the experience of excitement and anxiety in response to imagery may be difficult for musicians to distinguish. Although it is possible that musicians use high arousal imagery to imagine the excitement that can accompany performance, or expose themselves to MPA prior to performances, our surprising findings suggest that future research must investigate the validity of the high arousal subscale of the MSRIS as one that measures an imagery strategy.

Part B

As previously noted, the primary aim of Part B was to investigate the psychometric properties of the MSRIS, as well as the relation of its subscales with MPA, expertise, imagery vividness, and other forms of performance imagery. Our original hypotheses regarding the relations between the MSRIS subscales and MPA were updated in light of the unexpected two-factor MSRIS solution suggested in Part A.

Specifically, because we found that mastery imagery does not preclude the experience of heightened arousal, we could no longer directly test our hypothesis that relaxation imagery would be positively associated with MPA. However, we hypothesized that *mastery* and MPA would be positively associated as *mastery* might impart musicians with a sense of control in relation to performance anxiety which may be important for those with high MPA. Further, we hypothesized that there would be a negative relation between MPA and *high arousal*, and a positive relation between facilitative interpretations of MPA and *high arousal*, as heightened arousal may not be as threatening to those with lower MPA or those who interpret it as facilitating performance.

Method

The three groups of participants who completed Part A of the current research also completed Part B.[5]

Participants completed (a) state and trait measures of MPA, (b) imagery use and vividness measures, and (c) the MSRIS. The use of multiple groups allowed us to analyze the reliability of our measure in multiple samples, and asses the replicability of our findings. Certain measures differed across groups due to different constraints (e.g., time, piloting in Group 1). Specifically, imagery vividness measures were not used during the piloting phase in Group 1 and 13 participants in Group 3 who also completed the study during the piloting phase did not complete these measures.

Self-Report Measures

Trait music performance anxiety. The Performance Anxiety Inventory (PAI; Nagel, Himle, & Papsdorf, 1989) was used to measure trait MPA. The original version of the PAI was a 20-item measure which included questions concerning the cognitive, physiological, and behavioural components of MPA. It was originally adapted from Spielberger's Test Anxiety Inventory (1980). This measure has demonstrated good internal consistency, with a Cronbach's alpha coefficient of .89 for the entire measure (Nagel et al., 1989). Several modifications were made to the PAI for this research including: 1) items were re-worded for clarity, 2) the use of "recital" was changed to "performance" to allow for variation in performance situations amongst professional and amateur musicians, and 3) questions were added so that important elements related to performance anxiety (i.e., post-event processing) after performances were also captured (see Abbott and Rapee, 2004 for the role and importance of post-event processing in

[5] The same data screening procedures detailed in Part A were used in Part B.

social anxiety). The revised PAI included 25 items concerning MPA experienced before (6 items), during (13 items), and after (6 items) performances, with responses ranging from 1 (*never*) to 7 (*always*). Items 1 and 2 on the during scale, as well as items 5 and 6 on the after scale are reverse-scored.

State music performance anxiety. The Competitive State Anxiety Inventory-2R (CSAI-2R; Cox, Martens, & Russell, 2003; Martens, Burton, Vealey, Bump, & Smith, 1990) was used to measure state music performance anxiety. The original version of the 27-item CSAI-2 (Martens et al., 1990) was developed to assess the intensity of athletes' cognitive and somatic anxiety, as well as their self-confidence in sport performance. Although the CSAI-2 is one of the most widely used measures in sport, the original version was revised due to concerns regarding its factor structure. The revised version includes 17 items from the CSAI-2 (Cox et al., 2003). Additionally, as per Jones and Swain's (1992) suggestion, a directional scale was added to the cognitive and somatic intensity subscales, which allowed participants to rate whether items hindered or helped their performances, from 1(*hinders*) to 7 (*helps*). This measure has shown acceptable to excellent internal consistency applied to music performance anxiety, with cognitive and somatic intensity alpha's of .84 and .85, cognitive and somatic interpretation alpha's of .78 and .86, and self-confidence alpha of .90 (Yoshie et al., 2009). Several changes were made to make the CSAI-2R appropriate for measuring music performance anxiety. The use of "competition" was changed to "performance," and "losing" was changed to "performing poorly" to better capture the scenarios in which musicians perform. Additionally, in line with Yoshie et al. (2009), the self-confidence item "I am confident I can meet the challenge" was revised to "I am confident that I can meet the audience's expectations." Our revised CSAI-2R included 17 items measuring the intensity of cognitive (5 items) and somatic anxiety (7 items) as well as self-confidence (5 items), with responses ranging from 1 (*never*) to 7 (*always*), and the interpretation of cognitive and somatic anxiety on a scale ranging from, 1(*hinders*) to 7 (*helps*).

Arousal imagery. As noted above, the 20-item Musician's Self-Regulation Imagery Scale (MSRIS; Finch & Oakman, 2018) was created for this study to measure the frequency with which musicians use different arousal imagery strategies including relaxation, confident coping, psyching-up, and anxiety on a 7-point Likert scale (see Appendix B). However, due to the results in Part A, the relaxation and confident coping items were combined to form the mastery subscale, and the psyching-up and anxiety items were combined to form the high arousal subscale. Responses ranged from 1 (*never*) to 7 (*always*).

Performance imagery. The Functions of Imagery in Music Questionnaire (FIMQ; Gregg, Clark, & Hall, 2008) was used to measure musicians' use of performance imagery. This measure has excellent face validity and was reviewed by music professors and advanced music students during measure construction. The original version of the FIMQ was a 28 item measure adapted from the Sport Imagery Questionnaire (SIQ; Hall et al., 1998) based on Paivio's Analytic Framework of Imagery Effects (1985). This framework suggests that imagery can serve cognitive (e.g., skill rehearsal) or motivational (e.g., skill mastery) purposes, with the following sub-elements: cognitive specific (CS) (e.g., imagining note attack or articulation), cognitive general (CG) (e.g., "running through" an entire performance), motivational specific (MS) (e.g., imagining the excitement of a successful performance), motivational general mastery (MGM) (e.g., imagining confidence and concentration) and motivational general arousal (MGA) (e.g., arousal regulation) (Gregg et al., 2008). In the original study, Gregg et al. (2008) found that the MG-A subscale had poor psychometric properties and was thus not included in the present study. Item 23 was also omitted ("I imagine myself developing a career as a professional musician") in the current study as we did not anticipate that all musicians had professional aspirations and some were already professionals. Thus, our revised version included 21 items from the original FIMQ. In the original version, two items from the CS and one item from the CG subscales were eliminated and a combined Cognitive subscale had an alpha of .75, the MS subscale had one of .80, and the MGM subscale had one of .85. The authors did not specify which cognitive items were removed and thus all were included in the present study. Additionally, “control” was changed to “focus” in the original item 26, and the beginning of items were reworded for clarity. Responses ranged from 1 (*rarely*) to 7 (*often*) and measured the frequency of imagery use.

Visual imagery vividness. The Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973) was used to measure visual imagery vividness. Consistent with previous literature (e.g., McEvoy, Erceg-Hurn, Saulsman, & Thibodeau, 2015; Reisberg, Pearson, & Kosslyn, 2003), we used a four-item version of the 16-item VVIQ (Marks, 1973) in Groups 2 and 3. The four-item VVIQ asks participants to visualize a rising sun and then rate how clearly and vividly they imagine that: (a) the sun is rising above the horizon into a hazy sky, (b) the sky clears and surrounds the sun with blueness, (c) clouds, a storm blows up, with flashes of lightning, and (d) a rainbow appears. Items were rated on a scale from 1 (*perfectly clear and as vivid as normal vision*), to 5 (*no image at all, only knowing that you are thinking of an object*). This shortened version has demonstrated good internal consistency ($\alpha = .89$) (McEvoy et al., 2015). Items were reverse coded in the analyses for ease of interpretation such that higher scores indicate greater imagery vividness.

Auditory imagery vividness. The Auditory Imagery Vividness Questionnaire (AIVQ) was created for this study to measure auditory imagery vividness. This four-item measure was created for the current study to assess auditory imagery vividness for music and was used in

Groups 2 and 3. The AIVQ asks respondents to visualize a piece of music that they have recently performed and consider the image or sensory representation that enters their mind's ear and rate the vividness of the image with relation to: a) the melody, b) the rhythm, c) the dynamics, d) the harmony (e.g., tonal/atonal, chord progressions, consonance/dissonance). Items were rated on a scale from 1 (*perfectly clear and as vivid as normal hearing*) to 5 (*no image at all*). Items were reverse coded in the analyses for ease of interpretation such that higher scores indicate greater imagery vividness.

See Table 4 for self-report data for Groups 1, 2, and 3. Although there were missing data, no imputations were performed and pairwise deletion was used for all correlational analyses reported in the current research.

Table 4 *Means, standard deviations (SD), and Cronbach's alphas of study measures*

	Group 1 (N = 117)			Group 2 (N = 137)			Group 3 (N = 288)						
	Mean (SD)	α	N	Mean (SD)	α	N	Mean (SD)	α	N	F	df	p	ı
PAI													
Before	20.85 (9.37)	.90	116	21.10 (9.73)	.93	131	22.59 (9.26)	.92	278	1.929	(2, 522)	.146	
During	45.59 (15.49)[a]	.89	117	47.25 (17.69)[ab]	.93	130	50.43 (15.39)[b]	.89	275	4.325	(2, 519)	.014	.
After	22.34 (6.45)	.63	117	44.12 (17.22)	.90	131	43.38 (14.47)	.87	263	t(.363)*	223.796	.672	
CSAI-2R													
Cognitive Intensity	20.92 (9.14)[a]	.90	107	20.58 (9.39)[a]	.93	124	23.63 (7.96)[b]	.90	269	7.084	(2, 222.395)	.001	.
Somatic Intensity	27.63 (12.56)	.92	106	27.09 (12.84)	.93	122	29.41 (11.07)	.87	268	1.978	(2. 220.367)	.150	
Self-Confidence	23.71 (7.24)[a]	.92	115	22.53 (7.54)[ab]	.93	130	21.16 (6.79)[b]	.89	276	5.649	(2, 518)	.004	.
Cognitive Interpretation	18.24 (6.91)[a]	.88	112	16.77 (6.15)[ab]	.86	127	16.35 (6.25)[b]	.87	271	3.504	(2, 507)	.031	.
Somatic Interpretation	25.66 (9.21)[a]	.90	111	23.57 (8.34)[ab]	.89	128	23.15 (7.89)[b]	.87	269	3.652	(2, 505)	.027	.
VVIQ	-	-	-	8.70 (3.06)	.83	126	8.83 (3.35)	.83	270	t(.363)*	394	.717	
AIVQ	-	-	-	8.17 (3.53)	.90	126	7.77 (3.32)	.86	270	t(1.096)*	394	.274	
FIMQ													
MS	24.72 (6.22)[a]	.80	114	22.83 (6.77)[ab]	.82	127	22.10 (7.22)[b]	.81	95	4.353	(2, 333)	.014	.
MGM		.87	114		.88	127	29. 43 (8.92)	.85	95	1.933	(2, 333)	.146	
Cognitive	47.84 (11.96)	.89	114	44.19 (13.22)	.91	127	46.15 (12.25)	.86	95	2.613	(2, 507)	.074	.
MSRIS													
Mastery	44.59 (13.02)[a]	.90	113	40.19 (13.12)[b]	.89	127	40.79 (13.54)[b]	.89	268	4.036	(2, 505)	.018	.
High Arousal	32.35 (13.43)[a]	.91	113	29.28 (13.00)[ab]	.92	127	28.55 (12.84)[b]	.90	271	3.446	(2, 508)	.033	.
Experience	15.15 (11.14)		105	14.80 (10.52)		117	15.73 (13.38)		262	.254	(2, 481)	.776	
Training	5.79 (4.15)[a]		79	5.75 (4.71)[a]		91	8.07 (5.49)[b]		230	9.331	(2, 397)	< .001	.

Note. Due to incomplete/missing data, the number of participants for each sub-scale is included in the table. PAI = Performance Anxiety Inventory, CSAI = Competitive State Anxiety Inventory, VVIQ = Vividness of Visual Imagery Questionnaire, AIVQ = Auditory Imagery Vividness Questionnaire, FIMQ = Functions of Imagery in Music Questionnaire, CS = Cognitive Specific, CG = Cognitive General, MS = Motivational Specific, MGM = Motivational General-Mastery, MSRIS = Musician's Self-Regulation Imagery Scale, α = Cronbach's alpha. Superscripts ([a, b, c, d]) represent between groups ANOVAs. For specific variables, values with different superscripts are significantly different ($p < .05$). * T-tests were conducted when only 2 groups were compared: PAI *after* was only compared in Groups 2 and 3 due to the poor reliability of this subscale in Group 1, and only Groups 2 and 3 completed the VVIQ and AIVQ.

Results

Internal Consistency of Study Measures[6]

Trait music performance anxiety. The Performance Anxiety Inventory (PAI; Nagel, Himle, & Papsdorf, 1989) showed good internal consistency in Group 1 on the before ($\alpha = .90$) and during subscales ($\alpha = .89$), but the internal consistency of the after scale was poor ($\alpha = .63$), and was not used in further analyses for Group 1. Six additional items were added to this subscale in Groups 2 and 3[7] and the overall internal consistency was excellent (respectively, α's = .90-.93, .87-.92).

State music performance anxiety. The Competitive State Anxiety Inventory-2R (CSAI-2R; Cox, Martens, & Russell, 2003; Martens, Burton, Vealey, Bump, & Smith, 1990) showed good to excellent internal consistency with Cronbach's alpha coefficients in Groups 1 (α's = .88-.92), 2 (α's = .86-.93), and 3 (α's = .87-.90).

Performance imagery. The Functions of Imagery in Music Questionnaire (FIMQ; Gregg, Clark, & Hall, 2008) showed good internal consistency in our study (α's = .80-.91).

Visual imagery vividness. The Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973) showed good internal consistency in Groups 2 and 3 (α's = .83).

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[6] There were outliers on several variables in our study which were operationalized as values greater than 1.5 times the interquartile range for each subscale. Outliers were winsorized to 1.5 times the interquartile range, and analyses were performed with winsorized data. Variables with outliers included, (a) CSAI-2R cognitive interpretation (4 cases), somatic interpretation (20 cases), and self-confidence (1 case); (b) PAI during (1 case); (c) VVIQ (4 cases); (d) AIVQ (3 cases); (e) Training (9 cases); (f) Experience (38 cases); (g) FIMQ MS (11 cases), MGM (7 cases), and cognitive (9 cases). The pattern of results was consistent with and without outliers in the data. The largest change in a correlation was 0.04, and thus the results reported in this manuscript include outliers.

[7] 13 participants from Group 3 also completed the short version of the PAI after because they were recruited through the University of Waterloo REG during the pilot phase, and were thus not included in the reliability analysis for the PAI after in Group 3, or further analyses including this subscale.

Auditory imagery vividness. The Auditory Imagery Vividness Questionnaire (AIVQ) showed good internal consistency in Groups 2 and 3 (α's = .90, .86).

Arousal Imagery. The Musician's Self-Regulation Imagery Scale (MSRIS) showed good internal consistency with Cronbach's alpha values for Groups 1, 2, and 3 for the mastery factor of .90, .89, and .89, respectively. Cronbach's alpha values for Groups 1, 2, and 3 for the high arousal factor were .91, .92, and .90, respectively.

See Table 4 for specific internal consistency values.

Factorial Validity[8]

In order to further investigate the factorial validity of the MSRIS subscales, we analyzed the relations of the mastery and high arousal subscales with the Functions of Imagery in Music Questionnaire (FIMQ; Gregg et al., 2008), to our knowledge, the only measure which has been developed to assess musicians' use of performance imagery.

We found moderate to strong correlations between the mastery subscale of the MSRIS and the FIMQ. Specifically, there were significant correlations between the cognitive subscale (C) of the FIMQ and mastery in Groups 1, 2, and 3 (respectively, r = .591, .522, .589, $p < .001$). The correlations between the motivational specific subscale (MS) and mastery were also significant (respectively, r = .594, .650, .598, $p < .001$), as were those between motivational-general mastery (MG-M) and the mastery subscale of the MSRIS (respectively, r = .687, .608, .652, $p < .001$). The strong associations between the mastery subscale of the MSRIS and the FIMQ subscales – in particular the motivational-general mastery subscale – suggest that the mastery subscale of our measure strongly relates to imagery used for similar purposes.

[8] Pairwise deletion was used for all correlational analyses.

Although there were significant correlations between the high arousal subscale of the MSRIS and the FIMQ, these relations were weak to moderate. Specifically, there were significant correlations between the cognitive subscale of the FIMQ and high arousal in in Groups 1, 2, and 3 (respectively, $r = .214, .185, .345$, all $p < .037$). The correlations between the motivational specific subscale and high arousal were also significant (respectively, $r = .259, .204, .492$, all $p < .022$), as were those between motivational-general mastery and high arousal in Groups 1 and 3 (respectively, $r = .239, .416$, all $p < .011$). The weak to moderate correlations suggest that our measure captures distinct forms of arousal imagery and differentiates high arousal imagery use from that used for cognitive and motivational purposes.

Skill and the MSRIS

Participants completed a one item measure of their perceived skill level in comparison to others with similar training and experience. There were no significant relations between skill and the mastery subscale of the MSRIS Groups 1, 2, or 3 (respectively, $r = .084, .121, .102$, $p = .375, .175, .094$), or between skill and the high arousal subscale (respectively, $r = .138, .060, -.057$, $p = .145, .500, .352$).

Years of Experience and Training and the MSRIS

Because not all musicians had a primary instrument, the correlations between experience (operationalized as years played) and training (operationalized as years of training) and the MSRIS subscales were computed for those playing a primary instrument.

The correlations between experience and the mastery subscale of the MSRIS were not significant in Groups 1 or 2, or 3 (respectively, $r = .010, .093, .015$ $p = .919, .334, .815$), nor were the correlations between experience and the high arousal subscale of the MSRIS in Groups 1 and 2 (respectively, $r = -.184, -.148$, $p = .065, .112$). Although there was a significant relation between experience and high arousal in Group 3 ($r = -.282$, $p < .001$), the magnitude of this correlation was highly similar to the non-significant findings in Groups 1 and 2. The correlations between training and the mastery subscale of the MSRIS were not significant in Groups 1 or 2 (respectively, $r = .208, -.033$, $p = .071, .762$). There was a significant relation between training and mastery in Group 3 ($r = .187$, $p = .006$), yet the magnitude of this correlation was again highly similar to the non-significant finding in Group 1. Last, the correlations between training and high arousal were not significant in Groups 1, 2, or 3 (respectively, $r = .110, -.139, -.037$, $p = .343, .203, .585$). Because the magnitudes of the significant findings in Group 3 were highly similar to those in Groups 1 and 2, these differences appear to be driven by the larger sample size in Group 3.

Imagery Vividness and the MSRIS

There were significant relations between the mastery subscale and the VVIQ in Groups 2 and 3 (respectively, $r = .217, .234$, $p < .05$), and the AIVQ in Groups 2 and 3 (respectively, $r = .206, .247$, $p < .05$). In Group 2, there was a significant negative relation between high arousal and the VVIQ ($r = -.250$, $p = .01$), and a trend towards significance between high arousal and the AIVQ ($r = -.173$, $p = .053$). In Group 3, high arousal was not significantly related to either the VVIQ ($r = -.077$, $p = .208$) or AIVQ ($r = -.041$, $p = .498$) (see Table 5).

Table 5

Correlations between the MSRIS subscales and imagery vividness measures

	Group 2		Group 3	
	Mastery	High Arousal	Mastery	High Arousal
VVIQ	.217*	-.250**	.234**	-.077
AIVQ	.206*	-.173	.247**	-.041

Note. MSRIS = Musician's Self-Regulation Imagery Scale, VVIQ = Vividness of Visual Imagery Questionnaire, AIVQ = Auditory Imagery Vividness Questionnaire.
**. Correlation significant at the .01 level.
*. Correlation significant at the .05 level.

MSRIS and MPA

Performance anxiety inventory. Mastery was significantly related to the before subscale in Groups 1 and 3 (respectively, $r = .420, .178, p < .01$), the during subscale in Groups 1 and 3 (respectively, $r = .350, .214, p < .001$), and the after subscale in Group 3 ($r = .222, p < .001$)[9]. However, in Group 2, the before, during, and after PAI subscales were not significantly related with the mastery subscale (respectively, $r = .064, .018, .022, p = .476, .837, .805$).

High arousal was significantly related to the before subscale in Groups 1, 2, and 3 (respectively, $r = .454, .301, .342, p < .01$), the during subscale (respectively, $r = .451, .358, .384, p < .01$), and the after subscale in Groups 2 and 3 (respectively, $r = .306, .387, p < .001$).

Further, there were significant differences in the magnitude of correlations between mastery and the PAI subscales in Group 2, in comparison with those in Groups 1 and 3. The correlations between mastery and PAI before and during were significantly greater in Group 1 in comparison with Group 2 (respectively, Z = 2.29, 2.65, $p = .002, .004$)[10]. Although the correlations between mastery and PAI before were not significantly different between Groups 2 and 3 (Z = 1.06, $p = .145$), the magnitude of the correlations between mastery and PAI during and after were significantly greater in Group 3 compared to Group 2 (respectively, Z = 1.82, 1.86, $p = .034, .031$).

Competitive state anxiety inventory-2 revised.

Cognitive intensity. In Groups 1 and 3, cognitive intensity was significantly related to mastery (respectively, $r = .361, .216, p < .001$), but this association was not significant in Group

[9] The after subscale in Group 1 had a poor alpha coefficient and was not included in the analyses.
[10] One-tailed significance tests were performed because we were interested in whether the correlations between MPA and the mastery subscale of the MSRIS were significantly greater in Groups 1 and 3, compared to Group 2.

2 ($r = .158$, $p = .083$). However, there was a significant relation between cognitive intensity and high arousal in all groups (respectively, r's = .274, .377, .285, $p < .01$).

Somatic intensity. In Groups 1 and 3, somatic intensity was significantly related to mastery (respectively, $r = .410$, .274, $p < .001$), but this association was not significant in Group 2 ($r = .077$, $p = .406$). However, there was a significant relation between somatic intensity and high arousal in all groups (respectively, $r = .418$, .403, .350, $p < .001$).

Cognitive interpretation. In Groups 1 and 3, there was a significant negative relation between cognitive interpretation and mastery (respectively, $r = -.246$, -.140, $p = .009$, .024), but this relation was not significant in Group 2 ($r = .028$, $p = .760$). The relation between cognitive interpretation and high arousal was not significant in Groups 1, 2, or 3 ($r = .049$, -.056, -.075, $p =$ .608, .534, .225).

Somatic interpretation. In Group 3, there was a significant negative relation between somatic interpretation and mastery ($r = -.234$, $p < .001$), and a trend towards significance in Group 1 ($r = -.182$, $p = .056$). There was also a significant negative relation between somatic interpretation and high arousal in Group 3 ($r = -.166$, $p = .007$). No other relations were significant between somatic interpretation and the MSRIS subscales: In Group 2, somatic interpretation was not significantly related to mastery ($r = -.022$, $p = .806$), nor was it significantly related to high arousal in Groups 1 and 2 (respectively, $r = .047$, .084 $p = .626$, .349).

Further, there were significant differences in the magnitude of correlations between mastery and the CSAI-2R subscales in Group 2, as compared with those in Groups 1 and 3. The correlations between mastery and cognitive intensity, somatic intensity, and cognitive interpretation were significantly greater in Group 1 compared to Group 2 (respectively, Z = 1.62, 2.63, 2.11, p = .052, .004, .017). However, the difference in correlations between mastery and somatic interpretation between Groups 1 and 2 was not significant (Z = 0.59, p = .277). The magnitude of the correlations between mastery and somatic intensity and interpretation were also significantly different, and these associations were greater in Group 3 than Group 2 (respectively, Z = 1.84, 1.97, p = .032, .024). The differences in correlations between mastery and cognitive intensity and interpretation were not significant between Groups 2 and 3 (Z = 0.54, 1.53, p = .295, .063).

Because there were differences in group composition, we investigated the relation between MPA and mastery in subsets of the data such as females-only and in specific musical genres (e.g., classical musicians). However, the pattern of discrepant results regarding the relation between mastery and MPA in Group 2 as compared to Groups 1 and 3 remained.

Self-confidence. There were no significant relations between self-confidence and mastery in Groups 1, 2, or 3 (respectively, r = -.059, .148, .097, p = .537, .098, .114) or high arousal (respectively, r = -125, -.114, -.084, p = .188., .203, .169). See Table 6 for the correlations between the CSAI-2R and the MSRIS.

Table 6

Correlations between the CSAI-2R and the MSRIS

	Group 1		Group 2		Group 3	
	Mastery	High Arousal	Mastery	High Arousal	Mastery	High Arousal
CSAI-2R						
Intensity						
Cognitive	.361**	.274**	.158	.377**	.216**	.285**
Somatic	.410**	.418**	.077	.403**	.274**	.350**
Interpretation						
Cognitive	-.246**	.049	.028	-.056	-.140*	-.075
Somatic	-.182	.047	-.022	.084	-.234**	-.166
Self-Confidence	-.059	-.125	.148	-.114	.097	-.084

Note. MSRIS = Musician's Self-Regulation Imagery Scale, CSAI-2R = Competitive State Anxiety Inventory 2, Revised.
**. Correlations significant at the .01 level.
*. Correlations significant at the .05 level.

Intensity and Interpretation of MPA and its relation to Self-Confidence

Correlation coefficients were computed between the intensity and interpretation subscales of the CSAI-2R in order to determine the relation between the experience of cognitive and somatic anxiety and their interpretation as hindering or helping performance. The correlations between the subscales were similar across all Groups. Specifically, cognitive intensity and interpretation were negatively correlated (respectively, r = -.398, -.335, -.469, p < .001), as were somatic intensity and interpretation (respectively, r = -.367, -.310, -.545, p = < .01). Self-confidence was significantly negatively related to the cognitive intensity scales (respectively, r = -.637, -.574, -.537, p < .001), as well as somatic intensity (respectively, r = -.581, -.458, -.442, p < .001). Self-confidence was also significantly related to the cognitive interpretation scales (respectively, r =.341, .463, .451, p < .001), as well as the somatic interpretation scales (respectively, r =.430, .346, .423, p < .001).

Discussion

Several notable findings emerged regarding the relations between the Musician's Self-Regulation Imagery Scale (MSRIS) subscales and performance imagery, imagery vividness, and MPA. Further, the MSRIS demonstrated good to excellent reliability in multiple groups.

Factorial Validity. The moderate to strong correlations between the mastery subscale of the MSRIS and the Functions of Imagery in Music Questionnaire (FIMQ; Gregg et al., 2008) and the weak to moderate correlations between the high arousal subscale of the MSRIS and the FIMQ suggest that our measure demonstrates factorial validity with an external measure. However, future research must be conducted to investigate the discriminant and convergent validity of our measure.

Imagery Vividness and the MSRIS. Although correlational, our results suggest that imagery vividness may be an important determinant of the types of arousal imagery that musicians use. We found that both higher visual and auditory imagery vividness were associated with the use of mastery imagery. It may be the case that musicians who experience more vivid imagery are better able to create mastery images. On the other hand, we found that musicians who experience less vivid visual imagery use high arousal imagery more frequently, a relation which also trended towards significance for auditory imagery vividness. It could be the case that high arousal imagery is used more frequently by those with lower imagery vividness as high arousal imagery might require less effort or elaboration to imagine compared to mastery imagery.

MPA and the MSRIS. In light of results regarding the two-factor structure of the MSRIS in Part A, our hypotheses regarding the relations between its subscales and MPA were updated. In Part B, we hypothesized that MPA and mastery imagery would be positively associated. We found that trait MPA, as well as state cognitive and somatic anxiety intensity, were positively associated with mastery imagery in Groups 1 and 3. Further, state cognitive and somatic anxiety[11] interpretation – wherein higher scores indicate that anxiety is perceived as *helpful* – and mastery imagery were negatively associated. However, there were no significant associations between mastery imagery and state or trait MPA in Group 2, with many of these relations being significantly different compared to those in Groups 1 and 3.

Thus, our findings in Groups 1 and 3 are consistent with our hypothesis and suggest that self-efficacy in relation to anxiety (i.e., I can manage anxiety and it won't derail my performance) may be more important to musicians with high MPA than simply supressing anxiety. In light of the inclusion of low and high arousal items on the mastery subscale of the MSRIS, the relation between MPA and arousal imagery is clearly more nuanced than that which was was originally predicted in Part A based on emotion regulation theory.

Further – and contrary to our hypotheses – we found a significant positive association between trait and state MPA and high arousal imagery in all groups. It is difficult to reconcile the seemingly discrepant findings that MPA is positively associated with mastery *and* high arousal imagery. Perhaps it is the case that musicians who experience more MPA use all forms of arousal imagery more often, knowing the difficulties they face when they go onstage. Further, perhaps musicians with high MPA use high arousal in the comfort of their practice rooms well before upcoming performances, but use mastery imagery more often as performances approach and anticipatory anxiety increases. Additionally, it could be the case that musicians with higher MPA, who attempt to use mastery oriented imagery end up unintentionally imagining high arousal imagery that is more congruent with their lived experience. Despite instructions to

[11] This relation only trended towards significance in Group 1.

participants to complete the MSRIS as a measure of intentional imagery, this possibility raises additional concerns regarding whether high arousal imagery measured by the MSRIS indeed captures an imagery *strategy*.

Additionally, if it were the case that the seemingly discrepant results could be accounted for by a distinction between anxiety and arousal – with the latter being more facilitative to performance – we might have expected to find significant positive correlations between the interpretation of state anxiety and high arousal imagery. Contrary to our predictions, we did not find this pattern of results in the present study. Further, we found a significant negative relation between the intensity and interpretation of state cognitive and somatic anxiety across the three groups included in this study, suggesting that those who experienced more intense MPA also viewed it in a more debilitative manner.

Limitations and Future Directions

Prior to our study, little was known about whether and how musicians use arousal imagery related to musical performance. The MSRIS is the first measure to reliably measure arousal imagery in musicians and the current research represents a significant contribution to our understanding of the ways in which musicians use arousal imagery. However, when interpreting the results of the current research, several limitations must be noted.

First, due to the correlational nature of our design, the above interpretations must be considered with caution. Secondly, there were differences between the groups on important variables such as years of training, and participants were recruited through a variety of methods (e.g., university and community samples, MTurk).

Additionally, the non-significant relation between the mastery subscale of the MSRIS and MPA in Group 2 is highly perplexing in light of the positive associations found in Groups 1 and 3. Although we considered that differences such as musical genre between the groups might account for this pattern – as mastery imagery might be less important to musicians who perform less complex or technically demanding music – the pattern of findings remained in subsets of the data (e.g., classical or popular musicians only). One possibility is that this pattern of findings emerged due to when participants completed the study. Of note, some research in undergraduate samples suggests that consistent with psychological distance theory (Trope & Liberman, 2010), participants' levels of construal (e.g., abstract or concrete) change over the academic term (O'Brien, 2017). To this end, O'Brien (2017) found that construal levels became more concrete closer to the final exam period which arguably requires more concrete thinking. Although we are not aware of data supporting this phenomenon in MTurk samples from which Group 2 participants were recruited, it may be possible that such phenomena occurred in relation to back to work stress towards the end of summer, the time point around which Group 2 completed the study.

Most importantly, the surprising findings regarding the relations between the MSRIS subscales and MPA raise questions concerning whether participants completed our measure as one of intentional mental imagery as intended. Specifically, the finding that in addition to mastery, the high arousal subscale of the MSRIS was positively associated with MPA was contrary to our initial hypotheses.

Although we attempted to create item content which clearly asked musicians about their intentional use of mental imagery, as previously noted it may be difficult for musicians to differentiate whether they intentionally use arousal imagery to imagine different emotions, or whether they experience such emotions in response to imagining performances. Clearly, additional research must investigate this distinction.

Similarly, it is possible that musicians find it difficult to distinguish between spontaneous (i.e., images that pop into mind) and intentional or consciously created imagery. This may be particularly true for those with higher MPA, as negative spontaneous imagery is a core maintaining feature of anxiety in cognitive models of social anxiety disorder (e.g., Clark & Wells, 1995). Thus, given the significant associations between MPA and the high arousal subscale of the MSRIS – containing anxiety items – it is possible that some musicians were responding to the high arousal subscale of our measure as one of spontaneous imagery. However, inspection of the anxiety items in particular revealed that the item means were quite low and we question this interpretation. Further qualitative research must investigate the distinction between musicians' experience of spontaneous imagery, compared to intentional imagery, in order to inform the conceptual distinction between the two in relation to performance imagery. Indeed, such research will help to inform whether the high arousal subscale of the FIMQ can be interpreted as one capturing an intentional imagery strategy.

Because the factor analytic structure of our measure suggests that mastery is particularly salient or important to musicians – in addition to the level of arousal in performance imagery - future research should also investigate the reasons *why* musicians use different arousal imagery strategies. For example, is mastery oriented imagery used to increase self-efficacy, enhance performance quality, or normalize the experience of anxiety? Is high arousal imagery a strategy used by musicians to expose themselves to the heightened anxiety and arousal that can accompany performance? Furthermore, future research should investigate how helpful musicians perceive these strategies to be and when they are used in relation to performances (e.g., during practicing or right before going onstage).

Most importantly, given that musicians use a variety of arousal imagery strategies, future well-controlled studies must determine whether and how arousal imagery itself impacts MPA. Further, due to the implications derived from the anxiety-performance relation, determining the impact of such strategies on performance quality is of particular importance. Additionally, because imagery vividness relates to and might determine the type of imagery musicians use, future research should also investigate whether imagery vividness moderates the effectiveness of arousal imagery strategies in terms of managing MPA and improving performance quality.

In sum, our study has significantly increased our understanding of how musicians use arousal imagery related to performance, and suggests important avenues for future research.

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Appendix A

Brief Demographic Survey

Some of the questions you will be asked in this survey are open-ended questions.

You can complete this survey in one whole session or in bits and pieces throughout the day. Your survey progress will be automatically saved for up to 24 hours from the time you begin the survey, as long as you access it using the same computer and browser. If you choose to exit your browser during this time, or your browser times-out, simply click on the original survey link and you will be directed to where you left off in the survey.

Additionally, using your browser's "back" button will disrupt your survey progress. However, your survey progress will be saved. If you select your browser's "back" button during the survey, you will need to "refresh" your browser or click on the original survey link.

To make sure that our data is of good quality we have included a few questions in the study to ensure that you are reading each question carefully.

Below we ask information about you so that we can accurately describe our participant sample. The information you provide below will be kept confidential. You may decline to respond to any of the questions below.

Age in years:

What is your current gender identity?
- ❍ Male (1)
- ❍ Female (2)
- ❍ Transgender (3)
- ❍ No answer (99)
- ❍ Other (please specify): (6) ____________________
- ❍ Check this box if you prefer not to provide an answer to this question

What is your biological sex?
- ❍ Male (1)
- ❍ Female (2)
- ❍ Intersex
- ❍ No answer (99)
- ❍ Other (please specify): (6) ____________________
- ❍ Check this box if you prefer not to provide an answer to this question

What is your **primary** racial group? If you identify with more than one group, please select the one group that represents an important identity for you:

- ❍ Aboriginal (First Nations)
- ❍ Black/African
- ❍ East Asian (e.g., Chinese, Japanese, Korean)
- ❍ Southeast Asian (e.g., Filipino, Vietnamese, Indonesian)
- ❍ South Asian (e.g., Pakistani, Indian)
- ❍ Hispanic
- ❍ Middle Eastern
- ❍ West Indian/Caribbean
- ❍ White/Caucasian
- ❍ Other not listed above: __________________
- ❍ Check this box if you prefer not to provide an answer to this question

Primary occupation:

- ❍ Student (5)
- ❍ Student musician (1)
- ❍ Professional musician (2)
- ❍ No answer (99)
- ❍ Other (please specify) (6) ____________________

1) Do you have a primary instrument (i.e., one you play the most)?:

- ❍ Yes (1)
- ❍ No (2)
- ❍ No Answer (99)
- ❍ Other (please specify) (6) ____________________

2) What is your primary instrument (e.g., voice, piano, flute)?

3) How many years have you played your primary instrument?

4) Have you received formal musical training on your primary instrument (e.g., individual or group lessons)?

- ❍ Yes (1)
- ❍ No (2)
- ❍ No Answer (99)
- ❍ Other (please specify) (6) ____________________

1) Approximately how long was your formal musical training (e.g., in years or months)?
2) What instrument/instruments (voice included) do you most commonly play? Please list up to three instruments in the space below:

- ❑ 1 ____________________
- ❑ 2 ____________________
- ❑ 3 ____________________

3) Approximately how many years have you played your musical instrument/instruments for?

4) Have you received formal musical training (e.g., individual or group lessons)?

- ❍ Yes (1)
- ❍ No (2)
- ❍ No Answer (99)

5) On which instruments have you received formal training (e.g., individual or group lessons)?

6) Approximately how long was your formal musical training (e.g., in years or months)?

7) Please use the scale below to select your view of your skill level in comparison with your peers (i.e., musicians with similar experience or expertise):

0	*100*
Not at all skilled	*Extremely skilled*

8) How frequently do you perform in public:

- ❍ Daily (1)
- ❍ Weekly (2)
- ❍ Monthly (3)
- ❍ Yearly (4)
- ❍ No answer (99)
- ❍ Other (please specify) (6) ____________________

9) In what performance situation do you predominantly perform:

- ❍ Solo (1)
- ❍ Band (6)
- ❍ Orchestral ensemble (2)
- ❍ Chamber ensemble (3)
- ❍ No answer (99)
- ❍ Other (please specify) (6) ____________________

10) During a typical performance, approximately how many people do you perform in front of?
11) What genre of music do you typically perform (e.g., pop, classical, jazz, rock)?

Past and Current Treatment seeking:

1. If cost effective treatment options were available for music performance anxiety, would you be interested in participating?
   y/n
   Other (please specify):__________

2. Are you currently taking medications (e.g., beta-blockers) to help with music performance anxiety?
   y/n
   If "no": Have you ever taken medications (e.g., beta-blockers) to help with music performance anxiety?
   y/n

3. Are you currently seeking treatment to help with music performance anxiety (e.g., counselling, Alexander Technique)?
   If "yes": Please specify:_________

   If "no": Have you ever sought treatment to help with music performance anxiety (e.g., counselling, Alexander Technique)?
   If "yes": Please specify_________

Impairment/Distress Items:

1. I currently find music performance anxiety to be distressing and would like to reduce this
   y/n
2. I currently find that music performance anxiety impairs my performance quality
   y/n
3. I currently find that music performance anxiety impairs my career or career aspirations
   y/n

Appendix B

MSRIS

Imagery is an experience that mimics real experience and can be used to "see," "hear," or "feel" elements of a performance in practice and in conjunction with performing.

We are interested in the extent to which you use imagery for various functions. Although imagery can be experienced spontaneously (e.g., images that "pop" into your mind), the following questions relate to imagery that you intentionally envision.

We are also interested in whether you intentionally imagine different states of arousal related to performance.

Please choose the response that best describes how frequently you ***intentionally*** *use each depiction of imagery below in your practice and/or performing.*

Never						Always
1	*2*	*3*	*4*	*5*	*6*	*7*

I intentionally imagine:

1) Feeling free from any worried thoughts about my performance___
2) Feeling free from any physical tension. ___
3) Maintaining a slow/resting heart rate. ___
4) Myself breathing slowly. ___
5) Myself in a calm emotional state. ___
6) Handling the stress of a performance. ___
7) Remaining confident even though I can feel my heart racing with anxiety. ___
8) Maintaining control even though my muscles are tense. ___
9) Staying focused even though I am worried about making mistakes. ___
10) Coping with anxious thoughts. ___
11) My heart racing with anxiety. ___
12) Blood rushing through my veins with anxiety. ___
13) Being out of control. ___
14) Feeling sick to my stomach. ___
15) Myself in an anxious state. ___
16) My heart beating quickly with excitement. ___
17) Blood pumping through my veins with excitement. ___
18) Being "revved-up." ___
19) Feeling "butterflies" in my stomach. ___
20) Myself in an excited state. ___