The Effectiveness of Mindfulness Training on Young Adult Musicians Experiencing Music Performance Anxiety

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Abstract

Background: Research has shown that music performance anxiety (MPA) is experienced by individuals in all age groups and skill levels. Due to the need for effective treatment of performance anxiety in musicians, researchers have begun to investigate the viability of mindfulness, which has been proven as an effective treatment in populations with generalized anxiety. Although preliminary studies have been undertaken in examining the effects of mindfulness training on the experience of MPA, these efforts have been by a small group of researchers, and further replication and statistical significance is needed. **Objective**: This study aims to monitor the effects of a two-week mindfulness intervention on musicians using questionnaires and heart rate data. **Methods**: This experiment used a control group design, in which the first 13 participants collected were allocated to the experimental group, and the next 13 collected were allocated to the control group. All participants underwent the same baseline data collection involving completing the state side of the State-Trait Anxiety Inventory (STAI) directly before and after performing in front of a mock jury panel while wearing a hear rate monitor watch. After this session, only the experimental group partook in two weeks of mindfulness training consisting of 6-9 sessions, each an hour in duration. Once the two-week intervention was concluded, both experimental and control groups participated in a post-intervention data collection identical to the baseline session. **Results:** The experimental group experienced a decrease in anxiety between pre- and post-intervention while the control group experienced an increase of anxiety. A two-way mixed ANOVA analysis revealed that there was a significant relationship between the changes in anxiety when comparing the control and experimental groups. However, statistical analysis also revealed that the two groups exhibited statistically different levels of anxiety at baseline. Heart rate data revealed no significant differences between groups. **Conclusion:** Data from the STAI suggests that mindfulness has a significantly positive effect on the cognitive experience of music performance anxiety. Through this study no correlation was found between the physiological experience of music performance anxiety and mindfulness training.

Keywords: Mindfulness, Music Performance Anxiety, Heart rate, Questionnaire,

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Introduction

Music performance anxiety (MPA) has been shown to impact adults, adolescents, and children alike (Kenny 2006), and Kenny has stated that "no category of performer is exempt from the experiences of MPA" (2006, p. 56). Studies on musicians in professional orchestras have reported that the majority of them struggle with their anxiety levels while performing. A study by Van Kemenade and colleagues (1995) found that 59% of orchestral musicians experienced performance anxiety to such an extent that it impacted their personal and/or professional functioning, while a study conducted by James (1998) surveying 56 different orchestras found that 70% of musicians experienced anxiety that interfered with their performance quality. The ubiquity of MPA may have resulted from the nature of job insecurity in the music performance field; it was not encouraged to address these issues with one's private instructor or colleagues for fear of negative consequences, such as the loss of career opportunities, so the issue was never resolved (Sieger, 2017). This secretive attitude may have led to the widespread experience of debilitating music performance anxiety amongst professional orchestral musicians, in addition to the prevalent attitude that anxiety is a normal aspect of performance. The experience of performance anxiety is abundant throughout the Western Classical Music community, with both music teachers and students voicing the need for better education on mechanisms for inhibiting the severity and debilitating nature of music performance anxiety (Sieger, 2017; Fehm & Schmidt, 2006). Researchers such as Kenny (2011) and Patston (2014) have explicitly supported the essentiality of music teachers receiving proper education on performance anxiety. In order to address the need for treatment in such a large number of musicians struggling with their anxiety levels, researchers have begun to investigate the potential of mindfulness in ameliorating the symptoms of MPA. The following review of

literature will summarize the scientific literature pertaining to the nature of MPA, the effectiveness of mindfulness training as a treatment for general anxiety, and the effectiveness of mindfulness as a treatment for MPA.

1. Review of Literature

1.1 Research on the Nature of MPA

Research has established that MPA is ubiquitous throughout the classical music community, though the precise details of how MPA impacts individuals has yet to be solidified. MPA researchers have identified three separate but interacting systems involved in the experience of music performance anxiety: physiological arousal, behavioral responses, and fearful cognitions (Craske & Craig, 1984; Kenny & Osborne, 2006; Kenny, 2006; Osborne & Kenny 2008). In this section of the literature review, research examining the nature of MPA will be outlined.

In 1990, the work of Abel and Larkin investigated MPA using physiological measures in addition to self-report measures. Their study was conducted on anticipatory anxiety prior to musical examinations (juries) and involved measuring the increase in heart rate, blood pressure, and self-reported anxiety of 72 undergraduate music students ages 18-23, with a mean age of 19.5. For their experiment, an IBS automated sphygmomanometer was used to monitor blood pressure, and a Lafayett Photoplethysmogram was used to monitor heart rate, with a second Grass Photoplethysmogram during first measurement session to validate the use of the Lafayette Heart Rate Monitor. A baseline measurement was taken prior to jury season to record resting physiological levels and subjective anxiety during a time in which anxiety might be more regulated. The session began with a six-minute adaptation period of sitting quietly, during which students were administered the self-report of confidence and filled out a drug and exercise screening form. Physical measures were then taken, and the abbreviated State-Trait Anxiety Inventory was administered. Approximately one to six weeks later the participants took part in another session of measurements 30 minutes prior to performing their jury examination. The

physiological monitoring began, and participants were administered the Personal Report of Confidence as a Performer, the Report of Confidence, the Abbreviated-State-Trait Anxiety Inventory, and another screening form. After being informed that they would be playing their jury in two minutes, participants were administered an Abbreviated State-Trait Anxiety Inventory for a second time and were then given a reminder that their jury was now in one and a half minutes. Cardiovascular measures were taken for an additional 90 seconds, and then two more Abbreviated State-Trait Anxiety Inventories were given to be filled out immediately after the performance. Results indicated that all participants experienced an increase of heart rate, systolic blood pressure, diastolic blood pressure and self-reported anxiety from baseline to pre-jury, though males experienced higher systolic blood pressure increases prior to the jury. Females experienced higher self-reported anxiety with an increase in reported confidence from baseline to pre-jury. Results indicated that individuals with the most substantial heart rate increases from baseline to jury reported less self-confidence and somewhat higher self-reported anxiety.

A similar study to that of Abel and Larkin was conducted in 2009 by Yoshie and colleagues also sought to clarify how subjective, autonomic, and motor stress responses are impacted by a social-evaluation during music performance. Eighteen pianists with a mean age of 20.4 were recruited for this study and all participants were required to have data collected under two different conditions: rehearsal condition, and competition condition. The rehearsal condition comprised of the participant playing through a solo piano piece of their choice requiring significant technical skill. This took place in a private practice room with no experimenter or judge present. During the competition condition participants were required to perform the same piece of solo piano repertoire in a concert hall as a contestant in an actual piano competition.

During the competition condition a panel of five professional judges and a large audience were present. Participants' anxiety levels were measured directly prior to each performance using a visual analog scale (Cella & Perry 1986), while heart rate, volume of foot sweat, and EMG data were measured continuously throughout the performance with precautions taken to ensure the musicians were not encumbered by the measurement tools in any way. The Polar S810i, a wireless signal transmission belt device, was used to collect beat-to-beat heat rate information, the Techno Science TS100 was used to collect the amount of sweat evaporated off of the sole of the left foot, and surface EMG activity of the motor units in the extensor digitorum communis, flexor digitorum superficialis, biceps brachii, and upper trapezius was collected. Data analysis indicated that participants reported greater anxiety in the competition condition, coinciding with increased in heart rate and sweat rate from practice to performance condition. Additionally, EMG magnitude of proximal muscles and co-contraction of antagonistic muscles in the forearm increased from practice condition to performance condition as well. The researchers concluded that although these responses may aid the ability to readily perform motor tasks, they also have the capacity to disrupt fine motor control and increase the risk of playing-related musculoskeletal disorders. Despite the increase in technological advancements between the two studies, the study by Abel and Larkin as well as the study by Yoshie and colleagues presented similar results regarding heart rate and performance anxiety. Both groups of researchers found an increase in heart rate between the control and performance conditions coinciding with an increase in performance anxiety.

In 1984, another study monitoring the physical and psychological symptoms of performance anxiety was published by Craske and Craig, though this study intended to contrast the systems model and the self-efficacy theory, and their predictions of the formations of fear

and anxiety in the context of pianists. For this study, 40 pianists in between the ages of 16-30 were recruited, and were divided evenly into a relatively anxious, or relatively non-anxious group. This was achieved by giving an initial screening questionnaire for anxiety, the results of which were divided by the median anxiousness levels in order to create a more anxious and less anxious group. It was additionally required that those in the anxious group had reported that their anxiety was currently an issue for performance, whereas in the relatively non-anxious group, it was a requirement that participants had reported that anxiety was not a problem. Each performer took part in two sessions: a practice session in which they were acquainted with the monitoring process and were told they were not being judged in any way, and a performance situation in which they were notified that they were being judged on their performance. Although the participants believed that they were not being judged in the first performance and that they were being judged in real time during the second performance, both performances were rated by video recording after the actual event. During both sessions, the participants were administered the same questionnaires: The State Scale of State-Trait Anxiety Inventory was administered 15 minutes prior to entering the performance studio, the Performance Anxiety Self-Statement Scale and the Subjective Units of Distress Scales were administered directly after the performance. Additionally, a telemetry system was also used to transmit heart rate, respiration, and skin-resistance data to a polygraph in the next room. The quality of each performance was evaluated by two judges based on perceived quality of touch, phrasing, pitch, rhythm, tempo, dynamics, memory, and overall effectiveness. The judges rated the performances through listening to an audio recording, and the sum of the two judges ratings were used for comparison between participants. Another set of raters watched each performance as a video recording without sound and recorded observable signs of music performance anxiety including shoulder lifting, stiffness

in the back, neck, or arms, a deadpan expression, or the intentional moistening of the lips. Results indicated that in the relatively anxious group, the audience condition elicited an intense emotional response in every response system, while the relatively non-anxious group was less reactive and did not exhibit synchrony in response systems. In the low anxiety group, an increase in heart rate was exhibited between the control and performance conditions, though without the expression of cognitive or behavioral symptoms. The high anxiety group, however, exhibited increases in heart rate, cognitive symptoms, and behavioral symptoms between the control and performance conditions. The researchers concluded that these results support the three-system model of anxiety response due to the independence exhibited between the different measures of anxious cognition, autonomic arousal, and behavioral response. The results of this study provide a contrasting perspective from those previously discussed because increased heart rate was perceived in both the high anxiety and low anxiety groups. These results suggest that physiological arousal and the presence of MPA are non-correlational.

Other studies have also presented data supporting the assertion that physiological arousal and the presence of MPA are non-correlational. In 2010 Spahn and colleagues sought to gather information about the physiological state of singers during musical performance, reporting conclusions that contradict the concept of increased physiological symptoms dictating the presence of MPA. For this study, seven singers and two wind players between ages 20-58 were recruited as participants. Heart rate and blood pressure information was measured and collected using a Somnoscreen, and the Spielberger State-Trait Anxiety Inventory was used to collect a self-report of perceived anxiety from the participants. The article states that heart rate and blood pressure were taken before, during, and after a performance given by each participant, and that anxiety measures were administered before and after said performance. The results claimed there

was no clear evidence indicating a correlation between level of anxiety and level of physiological arousal. The authors conclude that although physiological arousal may be a necessary condition for MPA, the expression of physiological arousal does not act as an indicator for the experience of MPA. Additionally, a study conducted by Stephenson and Quarrier in 2005 presented that gender influenced whether an individual was more impacted by the physical symptoms of MPA as opposed to their level of anxiety experienced. Results from the questionnaire-based study indicated that anxiety sensitivity predicted performance anxiety, and furthermore, was a better predictor than trait anxiety. Patterns in anxiety sensitivity were found to be influenced by gender, with anxiety sensitivity predicting music performance anxiety in woman more than in men, and with men having stronger associations between cognitive symptoms and performance anxiety, and whose fears of cardiovascular and respiratory symptoms were correlated with performance anxiety. The correlations between gender and somatic associations with MPA have not been reported in any of the previous studies examined for this literature review, however, in Abel and Larkin's study from 1990 it was reported that although all participants experienced an increase in systolic and diastolic blood pressure prior to performance regardless of gender, the increases in systolic blood pressure perceived in males was higher on average.

In 2004, Miller and Chesky published a study documenting their application of the multi-dimensional anxiety theory to the description of performance anxiety. Their study examined the intensity of cognitive anxiety, somatic anxiety, and self-confidence among 71 college music majors before and during the jury season. One week before the commencement of weekly assessments taking place before and after individual lessons, participants were required to complete a baseline assessment. These weekly sessions led up to the jury season and included a final assessment for their semester jury. Assessments included a modified version of the

Competitive State Anxiety Inventory, a modified version of the Competitive Trait Anxiety Inventory, and a subjective self-assessment of performance. Results indicated that participants experienced higher levels of performance anxiety during solo class performances, and jury than performances in ensemble and studio lessons. Additionally, cognitive intensity was significantly higher than somatic intensity for every performance category, and for the pre-jury setting specifically, cognitive anxiety was significantly more debilitating than somatic anxiety. Higher cognitive intensity was also correlated to lower self-confidence intensity scores, and self-confidence was found to be consistently facilitative.

As demonstrated through this collection of studies, the research community has yet to reach a consensus regarding the nature of psychophysiological manifestations of MPA. Although all authors presented agree that the experience of MPA can be viewed as an interaction between psychological states and autonomic arousal, there is still dispute about how these systems interact, initiate, and maintain MPA. Certain conclusions presented in this literature review have dictated that although a change in physiological state can be observed when performing, this does not necessitate the experience of MPA in a musician (Craske & Craig, 1984 ; Spahn, Echternach, Zander, Voltmer, & Richter, 2010). Additionally, Miller and Chesky found through their research that in all performance scenarios observed, cognitive intensity was significantly higher than somatic intensity. In contrast, the studies conducted by Abel and Larkin as well as Yoshie and colleagues demonstrated that individuals with higher increases in heart rate from resting to performance also exhibited the lowest levels of self-reported confidence and highest levels of self-reported anxiety. The presence of contrasting results in this area of study indicates that further research is needed to solidify the correlation between physiological arousal and the experience of MPA.

1.2 Effectiveness of Mindfulness as a Treatment for General Anxiety

The adaptation of mindfulness to clinical treatment popularized by Kabat-Zinn (Kabat-Zinn & Burney, 1981) introduced the North American demographic to an accessible form of stress management characterized by mindfulness techniques. The rise of mindfulness in North America encouraged the development of a new branch of scientific research investigating impacts of mindfulness training on various aspects of mental and physical wellbeing (Baer, 2003). A multitude of mindfulness techniques have been explored by the scientific community such as yoga, meditation, and others. For the purposes of experimentation these practices have been removed from their original religious connotations, and despite the variety of techniques being used, these experiments all seek to influence the levels of mindfulness experienced by participants. From a scientific perspective, meditation has been defined as "a form of mental training that aims to improve individual's core psychological capacities, such as attention, and emotional self-regulation" (Tang, Hölzel, & Posner, 2015). It is for this reason that researchers and health practitioners have become increasingly interested in the clinical application of mindfulness techniques among populations struggling with physical or psychological disorders. This section of the literature review will encompass studies investigating the effectiveness of mindfulness as a treatment for anxiety through monitoring the changes in sample populations with psychological conditions after exposure to meditation training.

In a study conducted by Vollestad and colleagues (2011), the effects of mindfulness-based stress reduction on patients with heterogeneous anxiety disorders was investigated. Sixty-eight participants were recruited for this study, with an average age of approximately 42 years. Participants were randomly assigned to experimental or control groups, and self-report measures were taken at baseline, start of treatment, midway through treatment, and at the end of treatment

by all participants regardless of group assignment. The measures used in this study were the Beck Anxiety Inventory, Beck Depression Inventory, Bergen Insomnia Scale, the Five Factor Mindfulness Questionnaire, the Penn State Worry Questionnaire, the Spielberger State Trait Anxiety Inventory, and the Symptom Checklist 90-Revised Edition. The intervention lasted eight weeks and comprised of weekly 2.5-hour sessions on the Kabat-Zinn mindfulness approach and one half-day meditation retreat. These sessions included didactic material, mindfulness exercises, and discussion groups. Through these sessions participants became familiar with body scanning techniques, sitting meditation with awareness of breath, and mindful movement. Results indicated that participants in the experimental group improved significantly on all outcome measures. Researchers concluded that through these results, mindfulness-based stress reduction was shown to be an effective treatment for individuals with anxiety disorders.

Similar results were reported in a study published by Hoge and colleagues in 2013. This study sought to compare the effects of a mindfulness-based stress reduction program with both experimental and control groups comprised of individuals with general anxiety. This study was eight-weeks in duration and involved 93 participants over the age of 18. Prior to the experiment's commencement, all participants completed diagnostics screens, baseline clinician ratings, self-report questionnaires, and Trier Social Stress Testing (TSST). Baseline questionnaires were the Clinical Global Impression of Improvement, the Clinical Global Impression of Severity, the 21-Item Beck Anxiety Inventory, the Hamilton Anxiety Rating Scale, the Structured Interview Guide Hamilton-Anxiety, and the 24-Item Self-Report Pittsburgh Sleep Quality Index. After baseline measures were completed, participants were then randomly selected for either the experimental group receiving a mindfulness intervention, or the active control receiving a stress management education course. The mindfulness-based stress reduction program involved eight

weekly classes during which breathing techniques, hatha yoga, and body scanning were instructed. Participants also underwent a single weekend retreat and were required to maintain daily home practice throughout the eight-week program. The stress reduction program was intended as an active control, and therefore class and homework time was equal to that of the mindfulness course. After the eight-week period, the same battery of questionnaires and TSST used at baseline was administered to all participants for the second time. Results indicated that mindfulness training produced significantly greater reductions in anxiety than in controls.

Additional corroborative results were published in 2014 by Lo and associates in their article evaluating the effects of compassion-mindfulness therapy on individuals who experience symptoms of depression and anxiety. Researchers recruited 82 participants ranging from 17-69 years of age for this eight-week intervention experiment. Participants were randomly assigned into either the treatment or control group and were then administered a baseline assessment which included the Beck Depression Inventory, the Body-Mind Spirit Well-Being Inventory, and the Hospital Anxiety Depression Scale-Anxiety Subscale. Over the course of the intervention, the experimental group received 20 hours of instruction on body scanning, mindful yoga, and self-compassion emphasized through loving-kindness mantras. In addition, each participant was to maintain three sessions per week of audio disk guided individual practice lasting at least 30 minutes long. After the eight-week intervention, all participants were administered the same compliment of questionnaires used at baseline to complete the experiment. Researchers found that compassion-mindfulness training produced significant positive changes that were not present in the control group. Additionally, these changes were maintained up to a 3-month period after the conclusion of the study.

Despite the many positive results being published regarding the effectiveness of mindfulness training in a variety of populations, the scientific community is not unanimously in support of the conclusions being drawn by many researchers studying this phenomenon. As the prevalence of mindfulness in western psychology increases, a growing area of literature has developed to identify the flaws in papers being published touting the benefits of mindfulness training. In a series of published papers by Nicholas Van Dam and colleagues, the limitations of studying mindfulness in a quantitative context are discussed (Van Dam, Earleywine, & Danoff-Burg, 2009; Grossman & Van Dam, 2011; Van Dam, Hobkirk, Danoff-Burg, & Earleywine, 2012; Van Dam, Hobkirk, Sheppard, Aviles-Andrews, & Earleywine, 2014; Van Dam, van Vugt, Vago, Schmalzl, Lazar, Kerr, Gorchov, Fox, Field, Britton, Brefczynski-Lewis, Meyer, 2018). A major concern expressed through these articles is the limitation of measuring mindfulness through self-report measurements. Three examples are cited as the most used self-report tools for the measurement of mindfulness: the Kentucky Inventory of Mindfulness Skills (Baer, Smith, & Allen, 2004), the Five Facets of Mindfulness Questionnaire (FFMQ) (Baer et al. 2008), and the Mindfulness Attention Awareness Scale (Brown & Ryan 2003). Van Dam and colleagues have questioned the use of these measures due to the disparity between their characterizations of mindfulness, citing a lack of consensus in the definition of mindfulness throughout the scientific community (Grossman & Van Dam, 2011; Van Dam et al., 2018). It is recommended that researchers endeavoring to monitor the effects of mindfulness training should continue to examine the psychological and physiological changes that accompany mindfulness training as opposed to maintaining a primary focus on measuring the level of mindfulness itself (Grossman & Van Dam, 2011).

In conclusion, it has been demonstrated through randomized control experimentation that mindfulness-based stress reduction interventions can significantly reduce the symptoms of anxiety and depression disorders (Hoge et al., 2013; Lo, Ng, & Chan, 2014; Vollestad, Siversten, Nielsen, 2011). It is, however, important that researchers use mindfulness self-report tools with caution to minimize drawing weak conclusions based on inadequate measurements of mindfulness. The literature has suggested that a more appropriate method of observing the impact of mindfulness is not with measuring the level of mindfulness itself, but the impact that mindfulness training may have on other pertinent symptoms, such as anxiety. Due to the positive effects that have been attributed to mindfulness training such as a reduction in anxiety (Astin, 1997; Hoge et al., 2013; Lo et al., 2014; Vollestad et al., 2011) and an increase in focused attention (Dunn, Hartigan, & Mikulas, 1999) this treatment has been considered for use in other more specific anxious populations, such as musicians who experience performance anxiety (Chang, Midlarsky, & Lin, 2003).

1.3 Effectiveness of Mindfulness as a Treatment for Music Performance Anxiety

In an attempt to provide a coping mechanism for the reported 69% of university level music students experiencing performance anxiety (Khalsa & Cope, 2006), mindfulness practices are now being researched as a potential treatment for musicians struggling with MPA. This area of study began in 2003 with Chang, Midlarsky, and Lin's seminal research on the impacts of a meditation intervention on music students attending the Manhattan School of Music and has now been further explored by researchers looking at mindfulness training workshops and yoga. In 2006, Khalsa and Cope's study on the impacts of yoga on music performance anxiety (MPA) was published, becoming the first research article on the subject. In the work of both Chang and Khalsa respectively, self-report questionnaires are used to collect the data for each study. The

impacts of yoga on MPA have received the most research attention due to the interest of Khalsa and associates, though for the purposes of this literature review, the lesser researched relationship between meditation and MPA will be the focus. In the following section, the few studies investigating the effectiveness of mindfulness as a treatment for MPA will be discussed.

As mentioned previously, Chang, Midlarsky, and Lin conceived the field of research investigating mindfulness meditation as a treatment for musicians suffering from performance anxiety. In their 2003 research article, Chang and colleagues recruited a group of 19 musicians studying at the Manhattan School of Music. The musicians were randomly assigned to either the control or experimental group and were administered the Confidential Personal Information Questionnaire and Performance Anxiety Inventory. The experimental group then received a series of eight weekly meditation classes, each one hour and a quarter in duration. Classes were delivered by a certified meditation instructor who guided the students to cultivate their own daily meditation practice. During each class, students were given meditation education on the essentials of sitting, standing, walking, lying down, and sleeping forms of meditation. Additionally, the group was encouraged to ask questions and engage in discussions about how to apply mindfulness techniques to their musical practice and performance. Each member of the experimental group was also required to complete their own private meditation sessions for 20 minutes daily. After the eight-week period, both groups participated in a public performance, before which they were administered post-tests for state anxiety and performance concentration. At this time each participant completed the Performance Anxiety Inventory, State Anxiety Inventory, and the Cognitive Interference Questionnaire. Results reported that the experimental group experienced reductions in performance anxiety that were not present in the control;

however, comparisons between the control and experimental groups failed to reach statistical significance, purportedly due to a small sample size.

Using the same data collected from their 2003 publication, Chang, Midlarsky, and Lin released another study on the effects of meditation on musical performance in 2008 with the addition of Vance Zemon as a co-author. This article discussed the data from two independent professional musicians serving as jurors for the final performance of their 2003 experiment, evaluating the individual performance quality of each participant. The jurors were instructed to use the Music Performance Quality Rating Form, which gauges musical performance quality using five categories: technical competency, pitch production, rhythmic/tempo production, expressiveness/musicianship, and tone quality. Inter-rater reliability was tested for between the two judges to ensure consistency of performance quality measurement. This information was then used to compare the relationship between short-term meditation practice, performance anxiety, and music performance quality. Results from this study indicated that meditation training had an impact on the relationship between anxiety levels and music performance quality. While the control group demonstrated a significant decrease of performance quality with the increased presence of anxiety, the meditation group experienced the opposite: an increase in performance quality with the increase of anxiety. These findings suggest that Chan meditation may facilitate a relationship between music performance quality and music performance anxiety.

Although the only published studies currently conducted on MPA and meditation are those by Chang and colleagues, there are other studies focusing more broadly on generalized mindfulness training and MPA. In a study by Clevenger from 2015, the relationship between length of time with mindfulness exposure and music performance anxiety. For this experiment no intervention was used, and the Kenny Music Performance Anxiety Inventory and the

Mindfulness Attention Awareness Scale were administered to college level musicians through an online questionnaire interface. The results of this study indicate that there was no significant correlational relationship between music performance anxiety and mindfulness. In a study from 2015 conducted by Czajkowski and Greasly, an interventional approach was used to monitor the effects of a mindfulness course for singers on musical preparation, performance, skill development, and practice. Eight vocalists with an average age of 20.25 were recruited as participants for an eight-week intervention program. Prior to mindfulness training, all participants were administered the Five Facet Mindfulness Questionnaire (FFMQ) as a baseline measure. The participants then received training through the Mindfulness for Singers Course, which is a combination of the mindfulness-based stress reduction course developed by Kabat-Zinn in 1990, and the MBCT used by Segal and colleagues in 2002, and Williams and Penman in 2011. Participants were also required to maintain ten minutes of daily practice and the completion of a weekly task throughout the duration of the intervention. In order to assist them in their individual practice, participants were provided with both verbal and written mindfulness guidance. After the eight-week intervention period had concluded, the participants were administered the FFMQ a second time, and were also interviewed individually for 15-30 minutes regarding any impact the training had on their lives. Due to the small sample size, the results from the FFMQ were not statistically significant, however, change from baseline to post intervention were positive for all facets.

The study of mindfulness training in relation to MPA has not been thoroughly researched at this time. Although studies have reported positive results on the purported effects of mindfulness training on musicians experiencing MPA (Chang et al., 2003; Lin, Chang, Zemon, & Midlarsky, 2008; Czajkowski & Greasly, 2015) unfortunately, these studies lacked the

necessary number of participants to achieve statistical significance and are therefore rendered as preliminary research in this domain. Conversely, the results of Clevenger's 2015 study contradict the concept of mindfulness mediating the symptoms of MPA. The validity of certain results in this area of research (Clevenger, 2015; Czajkowski & Greasly, 2015) must also be viewed critically since the use of mindfulness self-report as a primary source of information on participants is not a reliable method of obtaining data, as documented by Nicholas Van Dam and colleagues (Van Dam et al., 2009; Grossman & Van Dam, 2011; Van Dam et al., 2012; Van Dam et al., 2014; Van Dam et al., 2018). It must therefore be concluded that at this point in time, additional experimentation on the effects of mindfulness meditation on MPA should be undertaken with increased sample sizes and more rigorous methodological considerations in order to provide conclusive results.

1.4 Research Questions

The studies outlined in this literature review have confirmed that there is a need in the field of MPA for assistance in coping with the debilitating nature of performance anxiety. Musicians experiencing performance anxiety suffer from negative cognitive cycles, uncomfortable somatic symptoms, and behavioral responses (Kenny 2006, Osborne & Kenny 2008, Craig & Craske 1984). In their 2010 study, Raes and Williams concluded that mindfulness reduces the experience of self-perpetuating ruminative cycles, which, as previously stated, is one of the three interactive components in the experience of performance anxiety. Kabat-Zinn popularized a mindfulness treatment in which individuals are encouraged to briefly note the content of their daydreams, thoughts, and bodily sensations without judgment and when possible, return attention to the present moment (Kabat-Zinn, 1994). The ability for an individual to accept their current state of being may also contribute to a performer's ability to cope with their mental

and physical state, thereby reducing their anxiety induced behaviors. Additionally, it has been demonstrated that meditation can encourage a decrease in physiological reactivity in stressful situations (Tang, Hölzel, & Posner, 2015). Many studies have demonstrated that mindfulness education can have positive effects on individuals struggling with generalized anxiety, and success with the application of mindfulness treatments with anxious musicians has also been observed (Vollestad et al., 2011; Lo et al., 2014; Hoge et al, 2013; Chang et al., 2003; Lin et al., 2008). The predisposition for anxious individuals to experience MPA and the success that has been observed in treating anxious individuals through mindfulness interventions indicates the viability of applying this intervention style as a treatment for MPA. The positive effects of mindfulness on generalized anxiety have been thoroughly investigated through questionnaire-based research, though more research utilizing both questionnaire and physiological measurements with a focus on specific anxious populations is needed.

The research questions for this study are:

1. Will mindfulness training have an impact on the levels of state anxiety in musicians before and after performance measured by the state side of the State-Trait Anxiety Inventory (Spielberger, 1989)?
2. Will mindfulness training have an impact on the heart rate of musicians before and during performance?

This literature review has elucidated the method by which future research should proceed in order to strengthen the field of mindfulness research, and this master's thesis intends to address this. The existing literature on the impacts of mindfulness meditation training on MPA is very limited, with only two published qualitative studies (Chang et al., 2003; Lin et al. 2008). In previous studies on mindfulness and MPA, statistical significance was not achieved due to a lack

of participants (Chang et al., 2003; Lin et al., 2008). Although more participants would have been preferred, this study recruited 26 individuals, which allowed for more robust statistical testing. Additionally, past experiments on mindfulness and MPA have only utilized questionnaires (Chang et al., 2003; Lin et al., 2008) in order to collect data on participants, though it has been shown that the experience of MPA is an interaction between three systems: psychological, physiological, and behavioral (Kenny 2006, Osborne & Kenny 2008, Craske & Craig 1984). This study will address two of the three interacting systems by using questionnaires to monitor psychological states, and physiological measurements to monitor heart rate. This study has been informed by previous literature, and aims to produce results that better the understanding of mindfulness as a treatment for MPA.

2. Methodology

2.1 Participants

This study looks at experienced young adult musicians who have completed or are currently in the process of completing an undergraduate or graduate degree program in music, or to have achieved grade 7 from the Royal Conservatory of Music. These requirements correspond to individuals who have attained a high skill level on their instruments and who have had many experiences performing. Participants were excluded from participating in this study under two circumstances: engaging in an established practice of mindfulness activities and/or mindfulness training prior to the onset of the study, or due to psychological disorders that they were currently being medicated for.

Twenty-six participants between the ages of 18 and 35 were recruited for this study. These participants played a range of instruments, and the distribution of participants over each instrument was as follows: 12 pianists, 3 violinists, 2 percussionists, 2 violists, 1 bagpiper, 1 clarinetist, 1 flautist, 1 French horn player, 1 guitarist, 1 trumpeter, and 1 vocalist. Individuals were allocated to the control and experimental groups based on date of enrollment in the study. The first 13 participants who registered to be a part of this study were allocated to the experimental group, while the next 13 served as the control group. This assignment method was used in order to maximize the number of individuals in the experimental group during the limited time available to deliver the mindfulness intervention. Participants were recruited through convenience sampling by email invitation, and passive recruitment by wall mounted posters throughout the University of Ottawa music building. Additionally, private music instructors were contacted by email encouraging their students to participate. This was a typical case sampling

with the intention of attracting a group that reflects the overall experience of music performance anxiety in the young adult music performance sector of Ottawa.

2.2 Data Collection

2.2.1 Questionnaires

Prior to experimentation, demographic information from each participant was collected. Information including, but not limited to, age, gender, previous experience with mindfulness activities (yoga, meditation, mindfulness-based stress reduction), use of alcohol and beta blockers, cardiovascular health, and pre-existing psychological conditions was collected. During experimentation a battery of questionnaires was utilized to monitor the participants' levels of anxiety directly before and after performing both at pre-intervention, and at the conclusion of the two-week intervention period (post-intervention). The validity of the most ubiquitous mindfulness questionnaires has been disputed by Grossman and Van Dam (2011) primarily due to their attempt to quantify trait mindfulness (an individual's trait characteristics are stable over time). Therefore, the choice was made to avoid collecting data on mindfulness for this thesis experiment. The data analysis for this research is instead focused on the comparison of change in MPA levels between control and experimental groups.

2.2.1.1 Spielberger State-Trait Anxiety Inventory

MPA was measured directly before and after performance using the State section of the State-Trait Anxiety Inventory (STAI) (Spielberger, 1989). This measure was chosen due to its ubiquity in the literature, and for the ability to quickly and effectively measure the current levels on anxiety being experienced by the participants. This questionnaire contains 20 questions in which participants use a four-point Likert scale to rate their response to questions. Participants are asked to respond with how much each statement resonates with how they feel at this moment,

and the option of responses range from “not at all” to “very much so”. Each question is phrased as a first-person statement and pertain to both anxiety positive and anxiety negative states. For example, question two states “I feel secure”, and question four states “I feel strained” (see Appendix B for the full questionnaire).

In 1990, Oei, Evans, and Crook, established the utility and validity of the STAI with anxiety disorder patients. Their study tested the factor structure of the scale using 205 panic disordered patients with and without agoraphobia, with results supporting the distinction between state and trait anxiety in the scale and also for the utility of the tool for measuring anxiety. Since then, many studies have been using this tool to measure anxiety. In an MPA context, Spahn and colleagues used the tool in their 2010 article addressing the correlation between cognitive and somatic expressions of anxiety. It was also used by Vollestad and colleagues (2011) for their study investigating the effects of mindfulness-based stress reduction on patients with heterogeneous anxiety disorders. The STAI has been used in both the contexts of MPA, as well as for measuring the effects of mindfulness intervention, illustrating its suitability for the present study.

2.2.2 Apparatus

Heart rate data was collected by the Polar 500 wrist watch. This was considered a viable option due to other instances of using Polar brand products for measuring heart rate during music performance research purposes (Yoshie, Kudo, Murakoshi, & Ohtsuki, 2009). This watch produced beat to beat information in a spreadsheet through which time stamps were available for each second that the watch recorded heart rate. We were able to coordinate this time stamp from the video to identify the heart rate of each participant during each second of their musical performance in baseline and post-test sessions.

2.3 Procedure

2.3.1 Testing session

This study was approved by the University of Ottawa Research Ethics Board and participants signed a consent form prior to any research activities taking place. By signing the consent form participants were indicating an understanding of the study procedures and any potential risks involved with participation. At this time participants were also asked to fill out a demographic questionnaire. Afterwards, both experimental and control groups partook in pre-intervention data collection. Each participant was asked to arrive ten minutes prior to their scheduled appointment. Upon arrival, participants were brought to a quiet and private space in which they would be comfortable. They were then fitted with the Polar 500 heart rate measurement watch and were told they could begin filling out the STAI. After completing the questionnaire the participant was given approximately 5-7 minutes to warm up on their instrument before being brought to a different room and performing 6-10 minutes of solo repertoire in front of a mock jury panel of two individuals. This room was temperature controlled, and had light cancelling curtains which controlled the potential effect of outdoor distractions or influences. Directly after the performance, the participant was guided back to the same private space in which they completed the STAI a second time. The experimental group then underwent a two-week mindfulness training intervention, while the control group was not involved in any activity provided by the research team. Additionally, the control group was not permitted to participate in any mindfulness-type activities while they were a part of the study including meditation, yoga, and mindfulness work-shops or stress relief courses. At the end of the two-week intervention period, all participants took part in a post-intervention data collection

identical in structure to the pre-intervention session. See Figure 1 below for further clarification of the structure utilized for this study.

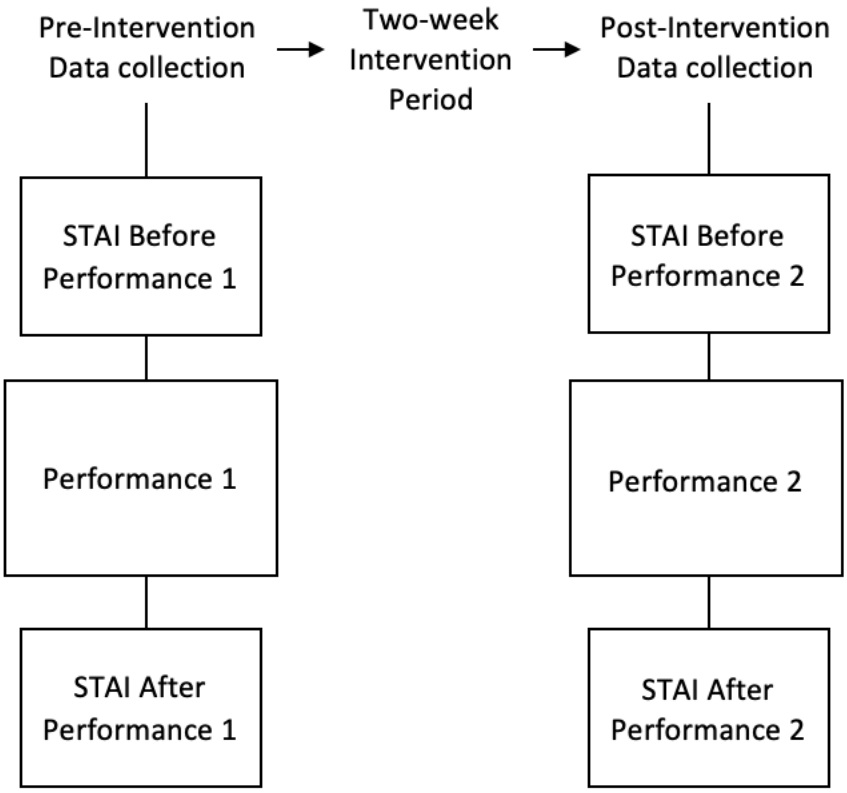


Figure 1. Structure of the experiment

2.3.2 Performance Requirements

Each participant was asked to prepare roughly 10 minutes of repertoire that they had performed at least once previously. This was not strictly adhered to by all participants, and the result was a range between six to ten minutes of music performance. Additionally, each participant was asked to play the same pieces of music in both the baseline and end of experiment sessions, and to wear attire that was appropriate for an audition or performance environment.

2.3.3 Jury

A mock jury of two volunteers was present in the performance room during the pre-intervention and post-intervention performances. The presence of the jury was not for the judgement of musical performance quality, but to invoke the experience of a real audition/performance situation. Participants were notified that these individuals would not be grading them on their musical performance. The two jury members were sitting behind a desk directly in front of where the participants performed. They were also equipped with a blank piece of paper and pencil and were asked to make notes as though they were writing comments about the participant's performance.

2.3.4 Treatment

Participants in the experimental group underwent a two-week mindfulness training program. The program was comprised of ten sessions over the course of two weeks, and consisted of meditation, breath awareness, body scanning, mindful walking, qigong, and discussion groups. During the discussion, participants were encouraged to talk about their experience with the mindfulness training so far, their daily stresses, and their experience with MPA in the past. Often, the teacher would call upon each individual to share some aspect of their experience so that each person was contributing to the discussion.

The first week of mindfulness training took place from Monday to Friday, with Saturday and Sunday serving as days off from the practice. Another five mindfulness training sessions took place from Monday to Friday of the second week, and the post-intervention data collection took place on the Saturday or Sunday directly after the conclusion of mindfulness training. Each session ran from 8:00am-9:00am and was conducted in a group format. A total of ten mindfulness classes were offered over the course of the two-week intervention, but participants

were asked to come to between a minimum of six and a maximum of nine sessions in order to keep the participants within a similar range of exposure. The majority of the participants in this study were either currently in university or were recent graduates, and therefore coming every morning for two weeks was not a viable option for these individuals. Participants in the experimental group were asked to refrain from any practice of additional mindfulness activities (meditation, yoga, mindfulness-based stress reduction, etc.) outside of the formal sessions throughout the duration of the intervention. This was in attempt to control the amount of exposure to mindfulness practice each participant was subject to during the experiment.

The mindfulness classes were taught by Evelyn Tan, a registered speech language pathologist and Mindfulness-Based Cognitive Therapy (MBCT) facilitator and associate faculty member of the Toronto Centre for Mindfulness Studies. Evelyn received her formal MBCT training in 2011 with Dr. Zindel Segal and Dr. Stephen Hickman, though her personal mindfulness practice began over a decade ago with instruction in the Theravadan Buddhist tradition.

2.4 Analysis

2.4.1 Questionnaires

Once the data had been collected, the questionnaires from each participant were entered into Microsoft Excel in order to code each response. All answers from the State-Trait Anxiety Inventory (STAI) were coded according to the official manual, which designated that in order to produce the STAI score, responses to each item on the questionnaire must be added together (see Appendix B). In a few cases, an item on the questionnaire was left blank, though in no case was a participant's STAI data rendered invalid by too many unanswered questions. These blank responses were addressed using the protocol designated by the manual. The data was then

transferred to the Statistical Package for Social Sciences (SPSS), version 25 where the data was analyzed. Since the STAI was administered before and after giving a musical performance, it was decided that the tests administered directly before performing would be analyzed separately from those administered after musical performance. This made it possible to analyze the change in anticipatory anxiety experienced before and after the intervention separately from the change of ability to recover from an anxiety inducing situation before and after the intervention. Once in SPSS the data set was checked for outliers (a z value of more than 2.58 was considered an outlier) and normality (using the Shapiro-Wilk test). STAI results from directly before performance in the pre- and post- experiment conditions were tested separately for outliers and normal distribution. The same outlier testing was then performed on the STAI results from directly after performance in the pre- and post-intervention conditions. No outliers were found, and in both the before-performance and after-performance data sets the results were normally distributed.

The data was then analyzed using a two-way mixed ANOVA statistical test is SPSS. This was performed twice: the first to compare the group change in before-performance STAI results between the pre- and post-intervention conditions, and the second to compare the group change in after-performance STAI results between the pre- and post-intervention conditions. Using the data rendered by SPSS, tables were created in excel to display the data in a clear manner.

2.4.2 Heart Rate

For this experiment heart rate (HR) data was taken continuously throughout the entire data collection session, both in the pre-intervention and post-intervention conditions. Although the participant's HR was being monitored during their entire data collection session, only three time periods were focused on for this research: 30 seconds before entering the stage (t1), from

the moment they enter the stage until they play their first note (t2), and from the first note until they exit the stage (t3). The HR monitor output was a data file with a HR value assigned to each second of the data collection period. Using excel and the time stamp from the video taken of each performance, the HR values corresponding to each of the periods of interest (t1 and t2) were gathered. The mean HR for each participant was then calculated for t1 and t2 respectively. Then, the change in mean HR from the pre-intervention to the post-intervention was calculated for each participant by subtracting the pre-intervention value from the post-intervention value [(post t1 mean HR) minus (pre t1 mean HR)]. This resulted in the change in mean HR for each participant in both t1 and t2 If the resulting value was negative, then the mean HR for that period decreased from pre-intervention to post-intervention, and if the number was positive then the mean HR for that period increased from pre-intervention to post-intervention. These values were then inputted into SPSS and analyzed using an independent samples t-test. In these t-tests the change in mean HR for the experiment group was compared with that of the control group.

3. Results

The results of this thesis will be presented in two parts: the results pertaining to STAI data, and the results pertaining to HR data. The first part will report whether the experimental group exhibited a change in anxiety that was not exhibited by the control group. The second part will report whether the experimental group exhibited a change in HR that was not exhibited by the control group.

3.1 Research Question One: Self-Reported Anxiety

3.1.1 Before-performance STAI

To investigate if the change in before-performance STAI scores from pre-intervention to post-intervention was different for the experiment group versus the control group, a two-way mixed ANOVA was used. See Figure 2 for the change in mean STAI scores from pre-intervention to post-intervention and Table 1 for the statistical results.

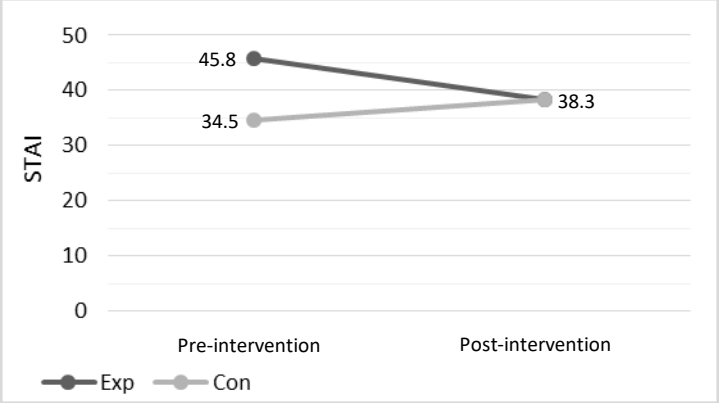


Figure 2. Change in STAI from pre-intervention to post-intervention for experiment and control

Table 1

Results of two-way mixed ANOVA comparing the change in before-performance STAI scores between pre-intervention *and post*-intervention

		F	*df*	*p*	partial η2
Interaction (participant group*time)		7.685	1	0.011	0.243
Main effect of participant group	Pre-ex Before-perf	7.976	1	0.009	0.249
	Post-ex Before-perf	0	1	1.000	0.000

Main effect of time	Experimental Before-perf	4.068	1	0.067	0.253
	Control Before-perf	5.324	1	0.040	0.307

In the before-performance category the experimental group STAI scores reduced, while the STAI scores of the control group increased. This difference in the change in anxiety was statistically significant ($p = 0.011$). However, upon conducting a test on the main effect of participant group, it was found that there was a significant difference in the pre-intervention anxiety levels between the two groups ($p = 0.009$). At post-intervention, the mean STAI scores were the same (38.3 for both groups). The mean STAI scores of both groups changed from pre-intervention to post-intervention. The controls increased significantly ($p = 0.040$). The experimental group exhibited a reduction that was almost significant ($p = .067$).

3.1.2 After-performance STAI

A two-way mixed ANOVA was also used to investigate if the change in after-performance STAI scores from pre-intervention to post-intervention was different for the experimental group verses the control group. See Figure 3 for the change in mean STAI scores from pre-intervention to post-intervention and Table 2 for the statistical results.

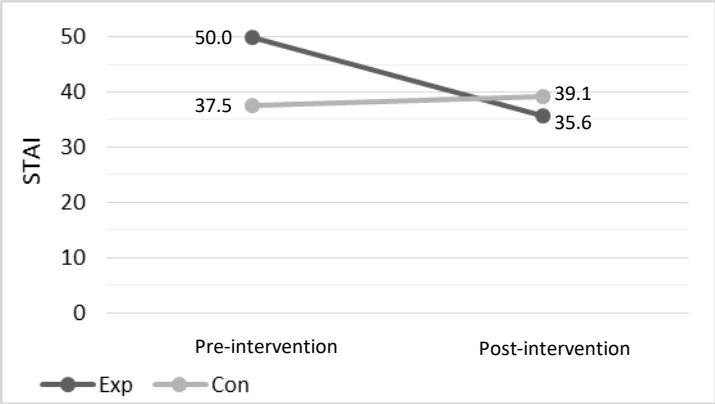


Figure 3. Change in STAI from pre-intervention to post-intervention for experiment and control

Table 2

Results of two-way mixed ANOVA comparing the change in after-performance STAI scores between pre-intervention and post-intervention

		F	*df*	*p*	partial η2
Interaction (participant group*time)		12.235	1	0.002	0.338
Main effect of participant group	Pre-ex After-perf	6.848	1	0.015	0.222
	Post-ex After-perf	0.588	1	0.451	0.024
Main effect of time	Experimental After-perf	17.476	1	0.001	0.593
	Control After-perf	0.287	1	0.602	0.023

In the after-performance category the experimental group scores decreased while the control group scores increased. This difference in change of anxiety was statistically significant ($p = 0.002$). Once again when the main effect of group was analyzed, it was found that there was a significant difference between groups in the pre-intervention condition ($p = 0.015$). It was also found that the two groups were not statistically different in the post-intervention condition ($p = 0.451$). Both groups mean STAI scores changed from pre-intervention to post-intervention. The control group mean increased, but not significantly ($p = 0.602$). The experimental group exhibited a significant reduction in anxiety from pre- to post-intervention ($p = 0.001$).

3.2 Research Question Two: Heart Rate

3.2.1 Statistical Analysis

In Table 3 each participant's individual change in heart rate (HR) from pre- to post-intervention is shown. To summarize the data demonstrated in Table 3, see Table 4 which indicates the number of participants whose mean HR values increased verses the number of participants whose mean HR values decreased.

Table 3

Change in mean HR for t1 (30 seconds prior to entering the stage) and t2 (entrance onto stage until the first note played)

		Mean HR (BPM)		
Participant		Pre-Intervention	Post-Intervention	Difference (Post- Pre)
Experimental Group				
M01 (viola)	t1	75.5	93.4	17.8
	t2	85.1	112.9	27.8
M02 (percussion)	t1	64.4	82.9	18.5
	t2	78.2	93.9	15.7
M04 (violin)	t1	88.5	92.8	4.3
	t2	94.7	98.2	3.5
M05 (bagpipes)	t1	102.9	83.7	-19.2
	t2	100.7	85.9	-14.8
M07 (piano)	t1	76.3	68.2	-8.1
	t2	86.1	78.5	-7.5
M08 (piano)	t1	94.8	81.8	-13.0
	t2	108.1	98.4	-9.7
M09 (violin)	t1	101.8	97.4	-4.3
	t2	95.4	109.4	14.0
M11 (violin)	t1	87.8	92.6	4.8
	t2	100.1	89.1	-11.0
M13 (piano)	t1	89.7	99.4	9.7
	t2	94.4	104.1	9.6
M15 (piano)	t1	113.6	98.9	-14.7
	t2	115.8	105.5	-10.3
M16 (trumpet)	t1	125.2	105.4	-19.8
	t2	123.7	107.6	-16.1
M17 (voice)	t1	81.1	111.7	30.6
	t2	83.6	110.5	26.9
M18 (viola)	t1	94.1	89.4	-4.7
	t2	94.4	91.5	-2.9
Control group				
M10 (guitar)	t1	92.5	116.0	23.5
	t2	99.9	115.0	15.1
M14 (clarinet)	t1	103.9	83.9	-20.0
	t2	102.6	88.5	-14.1
M19 (piano)	t1	105.5	119.8	14.3
	t2	101.1	113.1	12.0
M20 (french horn)	t1	115.6	96.8	-18.8
	t2	116.8	111.4	-5.3
M21 (piano)	t1	118.4	126.6	8.2
	t2	125.0	119.2	-5.8
M22 (piano)	t1	110.0	108.7	-1.3

		Mean HR (BPM)		
Participant		Pre-Intervention	Post-Intervention	Difference (Post- Pre)
	t2	119.4	108.2	-11.2
M23 (piano)	t1	75.3	78.7	3.4
	t2	83.5	82.0	-1.5
M24 (piano)	t1	73.5	77.6	4.1
	t2	75.4	94.7	19.3
M25 (piano)	t1	111.9	119.1	7.2
	t2	126.3	125.2	-1.1
M26 (piano)	t1	82.1	83.7	1.7
	t2	87.8	84.5	-3.3
M27 (percussion)	t1	80.7	69.2	-11.5
	t2	72.0	76.0	4.0
M28 (flute)	t1	106.5	100.8	-5.7
	t2	110.3	105.3	-5.1

Table 4

Number of participants with increases vs decreases in mean HR

Time period	Group	Increase	Decrease
t1	Experimental	6	7
	Control	7	6
t2	Experimental	6	6
	Control	4	8

To investigate if the change in mean HR between pre-intervention and post-experiment was different between the groups independent samples t-tests were conducted; see Table 5 below for the results.

Table 5

Results of the independent samples t-tests comparing HR

	Experimental		Control				
Variable	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*
Change in t1 mean HR	0.14	15.77	0.42	12.88	0.049	23	0.96
Change in t2 mean HR	1.93	15.44	0.24	10.39	-0.317	23	0.75

Results from this analysis indicate that the difference between the experimental and control groups in terms of the change in mean HR was not significant for both t1 ($p = 0.96$) and t2 ($p = 0.75$).

To investigate whether there was a correlation between HR and anxiety levels a Pearson Correlation test was performed. This test compared the change in STAI scores from pre- to post-intervention with the change in mean HR from pre- to post-intervention; see Table 6 below for the results.

Table 6
Results of the Pearson Correlation Coefficient Test

HR variable	STAI variable	*r*	*P*
Change in mean HR, t1	Change in before-perf STAI	0.281	0.174
	Change in after-perf STAI	0.237	0.254
Change in mean HR, t2	Change in before-perf STAI	0.150	0.474
	Change in after-perf STAI	0.173	0.408

All Pearson Correlation coefficients were under 0.3, indicating that no correlation between HR and self-reported anxiety was exhibited.

3.2.2 Descriptive Analysis

In order to provide an alternative perspective on the HR data a descriptive analysis was also conducted on individual samples. The goal of this analysis was to illustrate the variations and patterns present in the heart rate data that were not accounted for in the statistical analysis. For these purposes t3 will also be examined, which was the period from the first note of the performance until the participant left the stage. The following four examples serve as a representation of the larger available data set. Similar patterns can be found in the HR graphs

from the remaining participants, though a full descriptive analysis of each participant will not be conducted for this thesis.

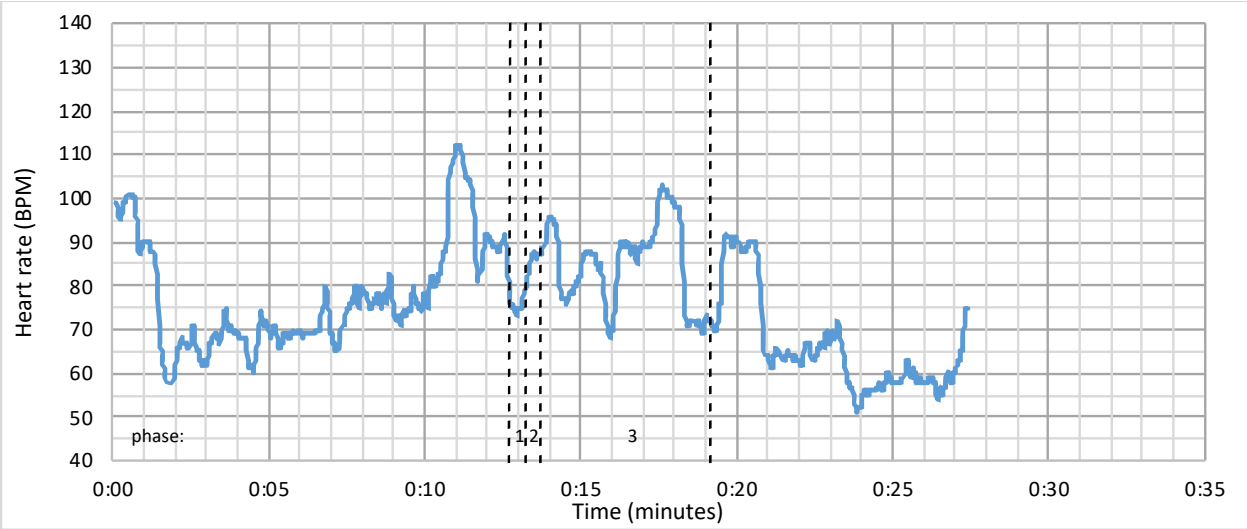


Figure 4. Pre-intervention HR data for Participant M01 (Viola, standing during performance)

Figure 4 shows the heart rate chart for participant M01, who played viola and was standing during performance. During T1 an increase in HR can be observed that continued into the beginning of T3. The increase from the low point while waiting outside the door to the peak just after beginning to play was approximately 20 BPM. Following a series of fluctuations over the course of the T3 that spanned 15-20 BPM, the participant's HR stabilized around 90 BPM for approximately a minute. Afterwards the participant's HR increased to slightly over 100 BPM before exhibiting a decrease of approximately 35 BMP towards the final minutes of the performance.

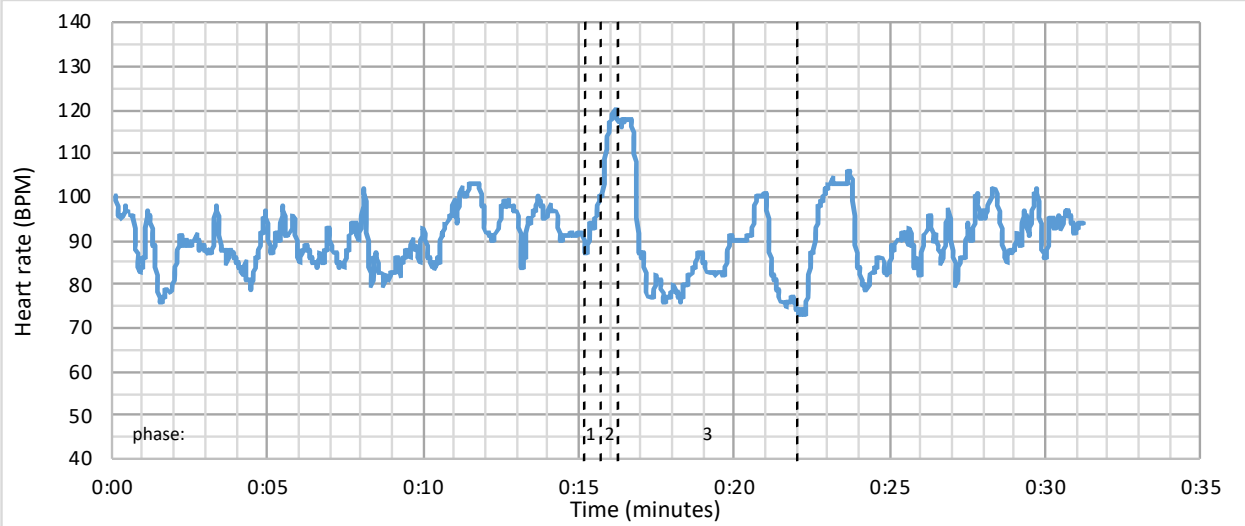


Figure 5. Post-intervention HR data for Participant M01 (Viola, standing during performance)

In Figure 5 the post-intervention HR is shown for the same participant (M01). Similarly to the pre-intervention data, during T1 an increase in HR can be observed which continued through T2 until directly prior to T3. Once again, after starting the performance a drop in HR occurs, though in the post-intervention session the reduction is more substantial (approximately 40 BPM). This is followed by a fluctuating climb of 25 BPM covering the duration of T3 until the final minute of this period. In the final minute of T3 the participant's HR drops approximately 27 BPM (similar to the HR reduction towards the end of the pre-intervention session). This means that right after M01 began performing their HR dropped substantially, and a similar drop can be observed at the very end of their performance during their final moments on stage.

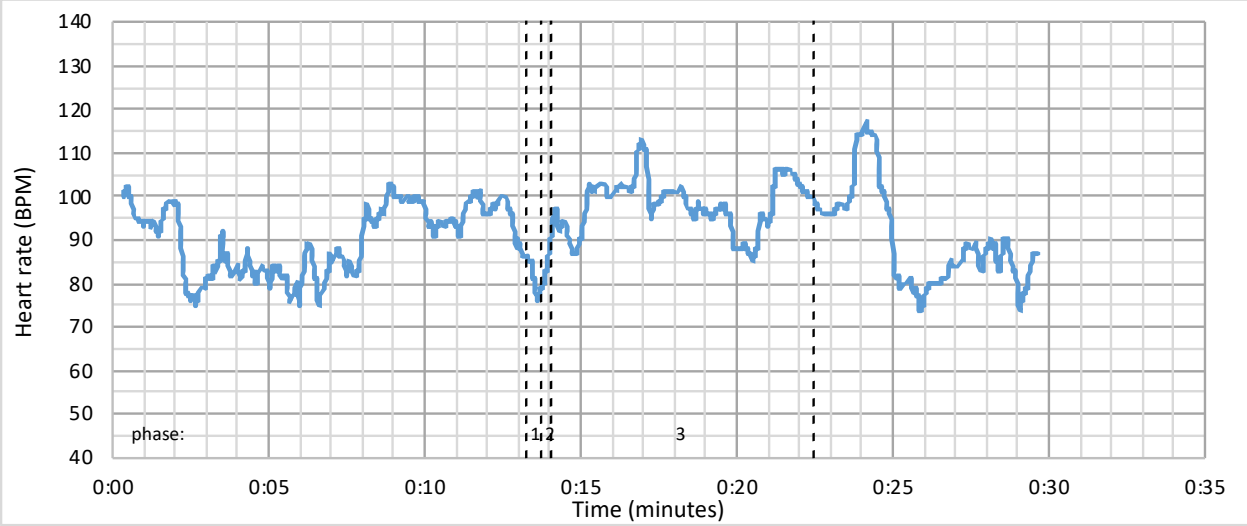


Figure 6. Pre-intervention HR data for Participant M17 (Voice, standing during performance)

Figure 6 displays the HR data for a M17 during the pre-intervention performance. During the majority of T1, the participant experienced a decrease in HR of approximately 10 BPM, though at the end of this period their heart rate began to increase. This increase lasted over the course of T2 until the beginning of T3 and was approximately 22 BPM. In the first minute of T3 the participant experienced a decrease of approximately 10 BPM. Afterwards, HR increased by approximately 17 BPM and then became relatively stable for two minutes. An increase of 15 BPM then occurred, after which the HR dropped 20 BPM. For the next three minutes the participant experienced small fluctuations within approximately 5 BPM, after which a decrease of 10 BPM was exhibited. Towards the end of the performance (T3), the participants HR increased over 20 BPM, until the last minute and a half of this period, in which the HR rate was momentarily static before dropping approximately 12 BPM.

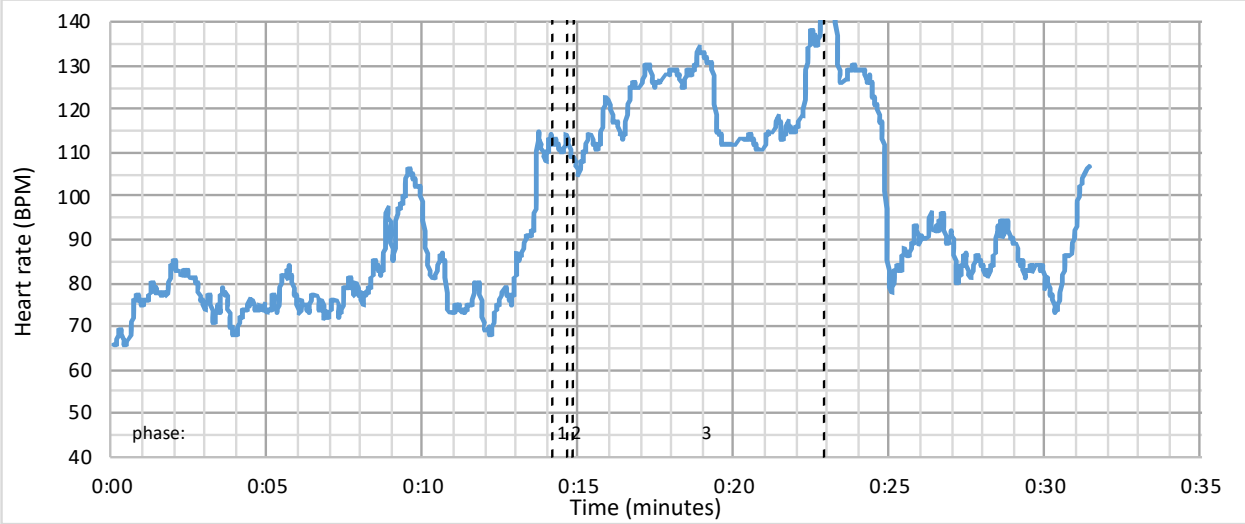


Figure 7. Post-intervention HR data for Participant M17 (Voice, standing during performance)

The HR experienced by M17 in the post-intervention session was higher overall (see Figure 7). Most of T1-T3 took place with the participant experiencing an HR value over 110 BPM, whereas in the pre-intervention session the HR remained mostly under 110 BPM. It is interesting to note that a few minutes prior to T1, this participant's HR was at approximately 70-80 BPM, though this is not in the time period being analyzed. T1 and T2 were characterized by fluctuations within approximately 5 BPM, though at the beginning of T3 a further drop of 5 BPM occurred. After this drop a general trend of increasing HR can be observed, though fluctuations of 5-10 BPM are still present. About half way through T3 a drop in HR of approximately 25 BPM can be observed. After this drop, HR fluctuates for the next two minutes within a range of 10 BPM. During the last minute of T3 the HR value increases to approximately 140 BPM—an increase of about 25 BPM.

From this analysis overarching patterns can be inferred that can be applied to the full participant group used for this study. The nature of these patterns will be discussed during the following chapter.

4. Discussion

This study examined the impact of mindfulness training on young adult musicians, specifically pertaining to their experience of music performance anxiety (MPA) and HR during musical performance. An analysis of the relationship between mindfulness training and MPA was conducted, as well as a separate analysis of the relationship between mindfulness training and HR. An interpretation of these results will be discussed, and then situated within the context of the current literature.

4.1 Research Question One: Mindfulness Training and State Anxiety

The first research question for this study asked whether mindfulness training would have an impact on state anxiety levels as tested by the state side of the Spielberger State-Trait Anxiety Inventory (1989). In order to address this question, the before- and after-performance testing will be considered separately, reflecting the method of analysis used in the previous chapter.

4.1.1. Before-Performance STAI Results

Results from the before-performance category indicated that the experimental group experienced an almost-significant reduction in anxiety from pre-intervention to post-intervention while the control group experienced a significant increase in anxiety from pre-intervention to post-intervention. However, the results also indicated that the groups experienced significantly different levels of anxiety during the pre-intervention data collection, indicating that these groups may be demographically different. This difference in pre-intervention anxiety levels could be attributed to the method used to collect participants. For this study participants were recruited for the experimental group first using advertising that emphasized the opportunity to experience mindfulness classes that may aid in anxiety reduction. The control group was then recruited over the course of a few months following the mindfulness classes. Since the mindfulness classes

could no longer be offered, the study was no longer being advertised with the offer of mindfulness training as a central benefit. This method of recruiting was chosen due to the time restrictions imposed by booking the mindfulness practitioner; the class could only be offered during a limited time, and therefore to maximize group size all participants recruited were allocated to the mindfulness group. It can therefore be surmised that anxious individuals with a vested interest in mindfulness as a coping tool were allocated to the experimental group, while less anxious individuals that did not have this interest were allocated to the control group. If the results are considered from this perspective, the anxiety level of the highly-anxious experimental group reduced to the level of the mildly-anxious control group between pre- and post-intervention. The results can be interpreted that mindfulness engendered an almost-significant reduction of anxiety in the experimental group between pre- and post-intervention. Additionally, the mindfulness training may have prevented the experimental group from exhibiting a similar increase in anxiety to the control group, whose anxiety rose a statistically significant amount from pre-intervention to post-intervention.

4.1.2 After-Performance STAI Results

Results from the after-performance category indicated that the experimental group experienced a significant decrease in anxiety from pre- to post-intervention, while the control group experienced a non-significant increase in anxiety from pre- to post- experiment. Once again, results indicated that the experimental group and control group exhibited significantly different levels of anxiety in the pre-intervention session. A similar interpretation can be made regarding demographic differences between groups as was proposed in the previous section: considering the recruitment process, we may be observing the high-anxiety experimental group decreasing significantly to meet the levels of a low-anxiety control. If this is the case, the results

can be interpreted to indicate that the mindfulness training caused a significant decrease of anxiety in the experimental group between pre- and post-intervention.

4.1.3 Comparison to the Literature

The results from this study suggest that participating in a mindfulness training intervention resulted in a significant reduction in anxiety between pre- and post-intervention, and similar results have been published previously in this area of research. In a study conducted by Vollestad and colleagues (2011), 68 individuals were randomly assigned to either the control or experimental group, after which the experimental group underwent an eight-week mindfulness intervention. Researchers found that mindfulness-based stress reduction was an effective treatment for individuals with anxiety disorders. Similar results were published in a study by Hoge and colleagues from 2013. In this study 93 participants were put into either a mindfulness group, a stress management training group, or a group receiving no training. Each group was tested before and after an eight-week intervention period and results indicated that the mindfulness training produced significantly greater reductions in anxiety than either of the other groups. Results from a study in 2014 by Lo and associates corroborates the findings presented in the previous two articles. In this study 82 participants were randomly assigned to either the experimental or control group, after which the experimental group took part in an eight-week mindfulness training program, while the control group did not receive any training. Results indicated that the experimental group experienced significant positive changes that were not present in the control group. In the area of research dedicated to studying generalized anxiety symptoms, the majority of publications reach the conclusion that mindfulness training reduces anxiety (Hoge et al., 2013; Lo et al., 2014; Vollestad et al., 2011). All of the studies described previously used an eight-week model in which participants underwent one mindfulness session

per week, though due to logistical constraints the present study used a condensed 2-week model with six to nine sessions. Despite the difference of intervention length, this study was able to replicate similar results to the aforementioned studies while providing results that validate the two-week model as a viable option for future mindfulness intervention research.

Results reflecting those on mindfulness and generalized anxiety can be found in the literature researching mindfulness training and MPA. In 2003 Chang, Midlarsky, and Lin published an article examining the effects of eight weekly mindfulness meditation sessions on 19 post-secondary music students. This study reported that the experimental group experienced reductions in performance anxiety that were not present in the control, however, comparisons between the control and experimental groups failed to reach statistical significance. Czajkowski and Greasly also published an article utilizing an eight-week mindfulness intervention on individuals experiencing MPA in 2015. Although this study reported positive changes, the only measurement used to monitor the effects of the mindfulness training was the Five Facet Mindfulness Questionnaire, which has been shown as an unreliable source of data (Van Dam et al., 2009; Grossman & Van Dam, 2011; Van Dam et al., 2012; Van Dam et al., 2014; Van Dam et al., 2018). Clevenger (2015) also used self-reported mindfulness as a primary source of data for their study analyzing the relationship between length of time with mindfulness exposure and MPA in 62 participants over the age of 18. Although there was no significant correlational relationship found between mindfulness levels and MPA, the literature on self-reported mindfulness questions the reliability of these results (Van Dam et al., 2009; Grossman & Van Dam, 2011; Van Dam et al., 2012; Van Dam et al., 2014; Van Dam et al., 2018). A limited number of studies have been conducted pertaining to the relationship between mindfulness and the experience of MPA. In the current literature, Chang, Midlarsky, and Lin's 2003 study applied

the most rigorous methodology, and was most similar to the studies conducted in the field of mindfulness and generalized anxiety testing (Hoge et al., 2013; Lo et al., 2014; Vollestad et al., 2011). In the aforementioned study by Chang and colleagues, a reduction of MPA due to mindfulness training was witnessed though it was not significant. The present study was able to corroborate these results, and additionally, to demonstrate that the interaction between MPA reductions and mindfulness training can be statistically significant.

4.2 Research Question Two: Mindfulness Training and Heart Rate

The second research question for this study asked whether mindfulness training would have an impact on the heart rate (HR) of musicians directly prior to performance. This question was answered through a statistical analysis as well as a descriptive analysis, and both of these approaches will be discussed in the following section.

4.2.1 Heart Rate Results

Results from the statistical analysis conducted on HR indicated that neither the experimental group nor the control group experienced a significant change in mean HR from pre- to post-intervention. Additionally, there was no correlation perceived between change in mean HR and change in anxiety levels between pre- and post-intervention. Due to the lack of nuance provided in the statistical analysis, the descriptive analysis was conducted. The intention of the descriptive analysis was to identify patterns in the HR data that were lost to the averaging process used in the statistical analysis. Two main patterns were found through the descriptive analysis that could provide a new prospective to the HR data. The first pattern identified was an increase/decrease in HR directly prior to performance (t1-t2). During this period, the participants' activities were only loosely controlled, and other activities may have had an impact on this change in HR other than increased anxiety or emotional arousal in preparation of

performing. For example, some participants were sitting up until they were summoned to perform, whereas others remained standing for the entire duration that they were waiting to be summoned. Additionally, one participant requested to use the washroom during this time, and others could have been pacing the hall before they were called. Precise behavioral information from this time was not collected, and therefore, HR artifacts from any number of activities could be presenting themselves in the data from this period. The second pattern identified was a sudden increase/decrease in HR at some point during the performance (t3). Although this time period was video-taped and more controlled—the participants were given specific instructions on what to play, and what to do once they entered the space—it was determined that there were still factors that may have introduced variability in the data. The changes in HR during this period could have been caused by anxiety, though they could have also been caused by the physical exertion of playing a musical piece, which varies based on the instrument, characteristics of the piece, and the passage of the piece being played. Certain dips in HR could also have been caused by pauses in the music, or when changing music between pieces, while increases in HR could have been caused by anticipating difficult passages, or mistakes made during execution of a passage. It should also be noted that when comparing from pre- to post-intervention, behavioral changes such as sitting instead of standing, or playing the same piece at a different tempo could also be conflated with changes in HR based on a different level of anxiety. The conclusion drawn through this analysis was that t1 would have needed closer behavioral monitoring in order to interpret the data, and that a detailed comparison between the video recordings and HR graphs during t2 and t3 is needed before meaning can be taken from the data. The influences on this data set are uncertain, and therefore a detailed interpretation of the HR results is beyond the scope of this thesis.

4.2.2 Comparison to the Literature

The results of this study were not conclusive regarding the impacts of mindfulness on HR. Although no previous studies have currently been published analyzing the effect of mindfulness on HR during a musical performance, there is an existing literature on the relationship between HR and musical performance. In a study conducted by Abel and Larkin from 1990, the anticipatory anxiety prior to musical performance of 72 undergraduate music students was measured by self-report questionnaires, HR and blood pressure. For their study, HR was taken over the course of a short interval prior to a plying a piece in both a practice condition, and then later in a performance condition. HR values from each period were then separately averaged to yield mean values corresponding with practice and performance respectively. These values were then examined using a one-way repeated measures analysis of variance, which compared the practice HR with the performance HR. Results indicated that HR values were significantly higher in the performance condition than in the practice condition. A similar study by Yoshie and colleagues (2009) studied the difference in HR between a practice state and performance state in 18 young adult musicians. Continuous HR was taken while the musicians played a piece of music in two different conditions: a rehearsal condition and a performance condition. The HR values taken were then averaged to create a mean HR value for each condition, and these means were then compared through paired t-test. Similarly to Abel and Larkin, the results of this study demonstrated an increase in HR from the practice condition to the performance condition. Despite having used a similar method of data analysis to the studies mentioned previously, the current study was not able to draw a conclusive relationship between the two sessions being compared (pre-intervention verses post-intervention). However, this difference in results may be attributed the fact that both of the aforementioned studies were

conducting a comparison between a practice state verses a performance state, whereas the current study sought to compare two performance states before and after an intervention period. Additionally, these studies did not take individual levels of MPA intensity into account during the HR analysis. Individuals who experience intense MPA may exhibit different HR variations to those who experience mild MPA, and this may have been averaged out in the data analysis.

Other studies featured in the literature review present an opposing perspective on the relationship between HR and MPA. The research of Craske and Craig (1984) contrasted two different theoretical models of performance anxiety. For this study, 40 pianists between the ages of 16-30 were recruited and evenly divided into either a relatively anxious group, or a relatively non-anxious group. Each participant played through a piece of music twice: once in a practice context in which they were notified that they would not be judged in any way, and once in a performance context in which they were notified that they would be judged on musical ability. During both sessions the participants were administered the same questionnaires and continuous physiological measurements were recorded using a telemetry system. The results of this study suggested that physiological arousal and the presence of MPA are non-correlational. Spahn and colleagues (2010) conducted a study on nine musicians between the ages of 20-58 that resulted in similar conclusions to those of Craske and Craig. In this study participants completed a self-reported anxiety measure before and after performance, while physiological measures were recorded continuously using a Somnoscreen. This article concluded that the expression of physiological arousal does not act as an indicator for the experience of MPA. In 2004 Miller and Chesky published a study examining the intensity of cognitive anxiety and somatic anxiety in 71 college music students. Participants completed a battery of questionnaires, which provided the data set for this study. In agreeance with the two previous articles mentioned, it was found that in

individuals experiencing MPA, self-reported cognitive intensity was significantly higher than self-reported somatic intensity. Although each of these studies utilized a different methodology, each reported results indicating that physiological arousal does not directly relate to MPA, which reflects the statistical results reported in the present study.

4.3 Conclusion

Music performance anxiety impacts the lives of many musicians, who could benefit from constructive coping mechanisms to minimize the intensity of their symptoms. This study examined the effect of a mindfulness training intervention on individuals who experience music performance anxiety, and results indicated that mindfulness training can significantly decrease self-reported anxiety. The statistical results of this study did not find a relationship between mindfulness training and mean heart rate. Statistical testing also indicated that MPA and heart rate are not correlated. Furthermore, descriptive analysis indicated that these relationships cannot be conclusively reported without further examination. Overall, the results of this study demonstrate that mindfulness had a positive effect on self-reported music performance anxiety that was not witnessed in the control group.

An important limitation of this study was the number of participants available. Although this study produced significant results in the self-report category of the data, more participants could have contributed to stronger results in the HR analysis. Physiological data such as HR is characterized by variability and having more participants could have contributed to achieving the statistical power needed for this type of data analysis. This study would have also benefited from a more consistent sampling between the control and experimental groups. Although logistical limitations impacted the ability to recruit for this study, an ideal study design would have utilized a randomized control trial in which all participants experienced a similar level of baseline

performance anxiety. The HR portion of this study would have benefited from a more controlled environment during the data collection process, because differences in behavior between each participant may have left artifacts in the HR data. Since certain periods during data collection were not properly controlled, a wide range of activities could have been done directly prior to the performance which were not recorded for research purposes.

Further research with larger sample sizes could benefit this area of study and provide more support to the significant results produced in this thesis. The field of MPA research could also benefit from the application of randomized control trial testing on the impacts of mindfulness on a population experiencing MPA. Further studies analyzing the effectiveness of mindfulness training on individuals who experience high intensity MPA verses those experiencing low intensity MPA is still needed, since this relationship has not yet been studied. As this is one of the first studies to employ physiological measures to a study on mindfulness and MPA, more research into the physiological impacts of mindfulness on MPA is still needed. Additionally, research analyzing the correlation between physiological arousal and the presence of MPA would be beneficial, since current studies on this topic report contradictory results. The HR data from this study may be used in future research as well. Further analysis of the HR patterns in each participant could be conducted in order to confirm whether mindfulness training had an impact on experimental group participants, though this numerical analysis would be complex and is beyond the scope of this thesis. Additionally, using the HR data generated from this study researchers could analyze the ability to recover from anxiety inducing situations (such as making mistakes during performance) in those who experienced mindfulness training, since the improved recovery from stressful stimuli has been attributed to mindfulness practice in previous research. Research has established mindfulness as an effective coping mechanism for

generalized anxiety. Preliminary results indicate that mindfulness could also be an effective tool for combatting music performance anxiety, though further research supporting these results is needed.

Additional Information:

This project has been designed as a subsection of a larger project involving Dr. Andra Smith, a professor with the University of Ottawa's School of Psychology. Dr. Smith will be conducting an MRI scan of each participant before and after the intervention period in order to observe possible changes in brain activity imparted by mindfulness training.

References

Abel, J. L., & Larkin, K. T. (1990). Anticipation of performance among musicians: Physiological arousal, confidence, and state-anxiety. Psychology of Music, 18, 171-182.

Astin, J. A. (1997). Stress reduction through mindfulness meditation. *Psychotherapy and psychosomatics*, *66*(2), 97-106.

Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. Clinical psychology: Science and practice, 10(2), 125-143.

Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of mindfulness by self-report: The Kentucky Inventory of Mindfulness Skills. Assessment, 11(3), 191-206.

Baer, R. A., Smith, G. T., Lykins, E., Button, Krietemeyer, J., Sauer, S., Walsh, E., Duggan, D., & Williams, J. M. (2008). Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. Assessment, 15(3), 329-342.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. Journal of personality and social psychology, 84(4), 822.

Cella, D. F., & Perry, S. W. (1986). Reliability and concurrent validity of three visual-analogue mood scales. Psychological reports, 59(2), 827-833.

Chang, J. C., Midlarsky, E., & Lin, P. (2003). Effects of meditation on music performance anxiety. *Medical Problems of Performing Artists*, *18*(3), 126-131.

Clevenger, L. A. (2015). *A study of the correlation between mindfulness and music performance anxiety among college music majors: Implications for counseling and counselor education*. Capella University.

Craske, M. G. & Craig, K. D. (1984). Musical performance anxiety: The three- systems model and self-efficacy theory. Behaviour Research and Therapy, 22(3), 267 280.

Czajkowski, A. L., & Greasley, A. E. (2015). Mindfulness for singers: The effects of a targeted mindfulness course on learning vocal technique. *British Journal of Music Education*, *32*(2), 211-233.

Dunn, B. R., Hartigan, J. A., & Mikulas, W. L. (1999). Concentration and mindfulness meditations: unique forms of consciousness?. *Applied psychophysiology and biofeedback*, *24*(3), 147-165.

Fehm, L. & Schmidt, K. (2006). Performance anxiety in gifted adolescent musicians. Anxiety Disorders, 20(1), 98-109.

Grossman, P., & Van Dam, N. T. (2011). Mindfulness, by any other name…: trials and tribulations of sati in western psychology and science. *Contemporary Buddhism*, *12*(01), 219-239.

Hoge, E. A., Bui, E., Marques, L., Metcalf, C. A., Morris, L. K., Robinaugh, D. J., ... & Simon, N. M. (2013). Randomized controlled trial of mindfulness meditation for generalized anxiety disorder: effects on anxiety and stress reactivity. The Journal of clinical psychiatry, 74(8), 786.

James, I. (1998). Western orchestral musicians are highly stressed. Resonance: International Music Council, 26, 19-20.

Kabat-Zinn, J. (1994). Wherever you go. *There You Are: Mindfulness Meditation in Everyday Life*.

Kabat-Zinn, J., & Burney, R. (1981). The clinical use of awareness meditation in the self regulation of chronic pain. *Pain*, *11*, S273.

Khalsa, S. B. S., & Cope, S. (2006). Effects of a yoga lifestyle intervention on performance related characteristics of musicians: a preliminary study. *Medical Science Monitor*, *12*(8), CR325-CR331.

Kenny, D. T. (2006). Music performance anxiety: Origins, phenomenology, assessment and treatment. *Context*, 51-64.

Kenny, D. (2011). *The psychology of music performance anxiety*. Oxford University Press.

Kenny, D. T., & Osborne, M. S. (2006). Music performance anxiety: New insights from young musicians. Advances in Cognitive Psychology, 2(2-3), 103-12.

E. (2008). Silent illumination: a study on Chan (Zen) meditation, anxiety, and musical performance quality. *Psychology of Music*, *36*(2), 139-155.

Lo, H. H., Ng, S. M., Chan, C. L. (2014). Evaluating Compassion-Mindfulness Therapy for Recurrent Anxiety and Depression: A Randomized Control Trial. *Research on Social Work Practice*, 25(6), 715-725.

Miller, S., & Chesky, K. (2004). The multidimensional anxiety theory: an assessment of the relationship between intensity and direction of cognitive somatic anxiety and self-confidence over multiple performance requirements among college music majors. Medical Problems of Performing Artists, 19(1), 12-20.

Oei, T. P., Evans, L., & Crook, G. M. (1990). Utility and validity of the STAI with anxiety disorder patients. British Journal of Clinical Psychology, 29(4), 429-432.

Osborne, M. S., & Kenny, D. T. (2008). The role of sensitizing experiences in music performance anxiety in adolescent musicians. *Psychology of Music*, *36*(4), 447 462.

Patston, T. (2014). Teaching stage fright?–Implications for music educators. British Journal of Music Education, 31(1), 85-98.

Raes, F., & Williams, J. M. G. (2010). The relationship between mindfulness and uncontrollability of ruminative thinking. Mindfulness, 1(4), 199-203.

Sieger, C. (2017). Music performance anxiety in instrumental music students: A multiple case study of teacher perspectives.

Spahn, C., Echternach, M., Zander, M. F., Voltmer, E., & Richter, B. (2010). Music performance anxiety in opera singers. *Logopedics Phoniatrics Vocology, 35*(4), 175-182.

Spielberger, C. D. (1989). *State-Trait Anxiety Inventory: Bibliography* (2nd ed.). Palo Alto, CA: Consulting Psychologists Press.

Stephenson, H., & Quarrier, N. F. (2005). Anxiety Sensitivity and performance anxiety in college music students. Medical Problems of Performing Artists, 20(3), 119-125.

Tang, Y., Hölzel, B.,K., & Posner, M. I. (2015). The neuroscience of mindfulness meditation. *Nature Reviews. Neuroscience, 16*(4), 213-225.

Van Dam, N. T., Earleywine, M., & Danoff-Burg, S. (2009). Differential item function across meditators and non-meditators on the Five Facet Mindfulness Questionnaire. *Personality and Individual Differences*, *47*(5), 516-521.

Van Dam, N. T., Hobkirk, A. L., Danoff-Burg, S., & Earleywine, M. (2012). Mind your words: positive and negative items create method effects on the Five Facet Mindfulness Questionnaire. *Assessment, 19*(2), 198-204.

Van Dam, N. T., Hobkirk, A. L., Sheppard, S. C., Aviles-Andrews, R., & Earleywine, M. (2014). How does mindfulness reduce anxiety, depression, and stress? An exploratory examination of change processes in wait-list controlled mindfulness meditation training. *Mindfulness*, *5*(5), 574-588.

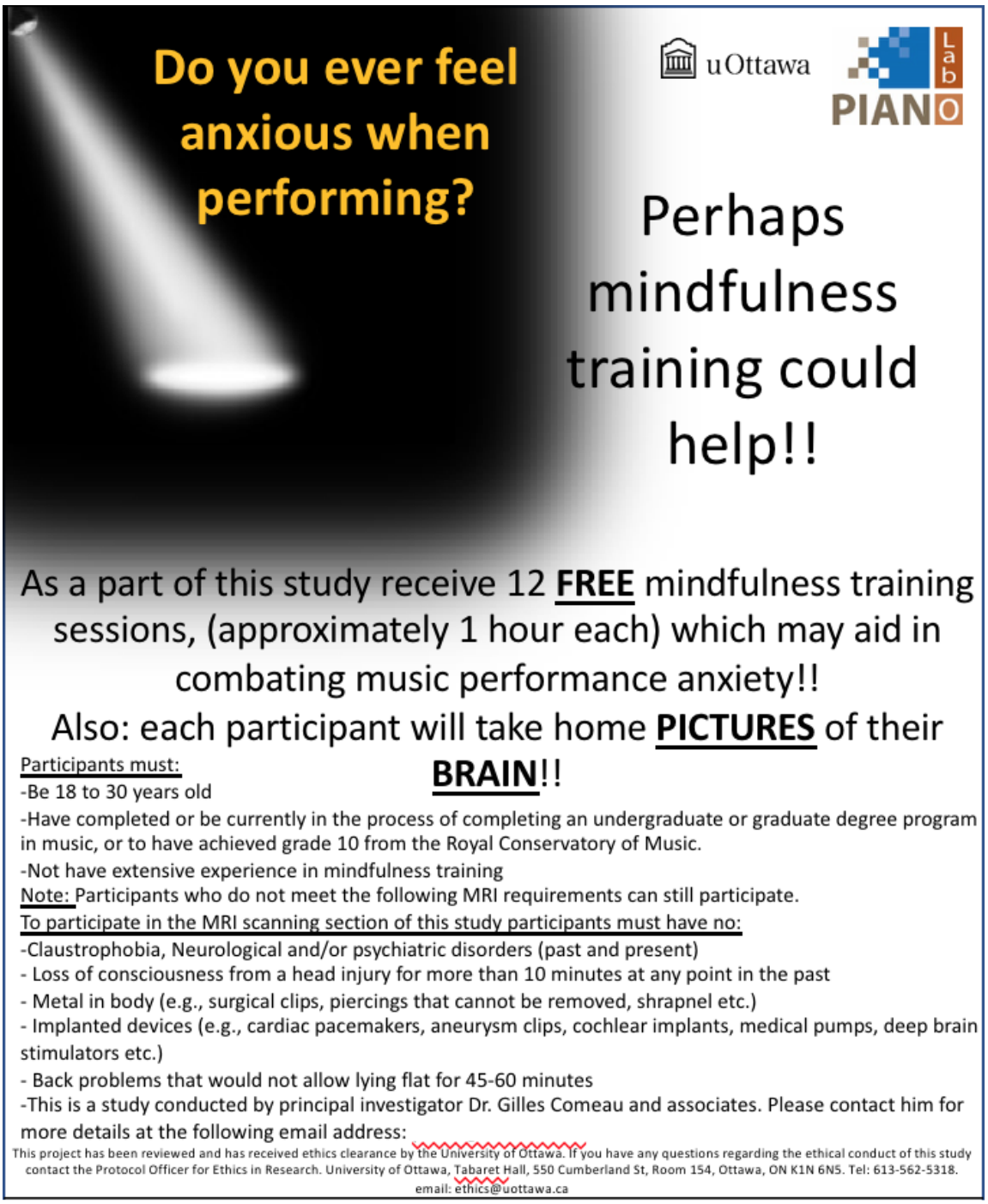
Van Dam, N. T., van Vugt, M. K., Vago, D. R., Schmalzl, L., Saron, C. D., Olendzki, A., & Fox, K. C. (2018). Mind the hype: A critical evaluation and prescriptive agenda for research on mindfulness and meditation. *Perspectives on Psychological Science, 13*(1), 36-61.

Van Kemenade, J. F., Van Son, M. J., & Van Heesch, N. C. (1995). Performance anxiety among professional musicians in symphonic orchestras: a self-report study. *Psychological reports*, 77(2), 555-562.

Vollestad, J., Siversten, B. Nielsen, G. (2011). Mindfulnss-Based Stress Reduction for Patients With Anxiety Disorders: Evaluation in a Randomized Control Trial. *Behavior Research and Therapy,* (49), 281-288.

Yoshie, M., Kudo, K., Murakoshi, T., & Ohtsuki, T. (2009). Music performance anxiety in skilled pianists: effects of social-evaluative performance situation on subjective, autonomic, and electromyographic reactions. *Experimental Brain Research, 199*(2), 117.

Appendix A: Recruitment Materials



LETTER OF INFORMATION and CONSENT FORM

Title of the study: Effects of Mindfulness Training on Music Performance Anxiety

Principal Investigator:
Professor Gilles Comeau
Director of the Piano Pedagogy Research Laboratory
School of Music
University of Ottawa

Co-Investigators:
Dr. Andra Smith
School of Psychology
University of Ottawa

Dr. Donald Russell
Faculty of Engineering and Design
Carleton University

Dr. Rafik Goubran
Faculty of Engineering and Design
Carleton University

Nicole Stanson
School of Music
University of Ottawa

Invitation to Participate:
You are invited to participate in the above mentioned research study conducted by Dr. Gilles Comeau, Dr. Andra Smith, Dr. Donald Russell Dr. Rafik Goubran, and Nicole Stanson. We are conducting research to further our understanding of the effects of mindfulness meditation on the psychological, neurological, and physiological aspects of music performance anxiety.
We are recruiting individuals to participate in two-weeks of mindfulness meditation sessions, with testing sessions before and after this training.

Purpose of the Study:
The objective of this study is to determine whether mindfulness meditation practice is an effective method of diminishing the experience of music performance anxiety.

Participation:
Participants must:
- Be of age 18 to 30
- Be fluent in English (the training is only available in English)
- have completed or be currently in the process of completing an undergraduate or graduate degree program in music, or to have achieved grade 10 from the Royal Conservatory of Music.

Have no:
-extensive experience with mindfulness meditation or other mindfulness activities

Participation (continued)**:**

For MRI participation:
- Claustrophobia
- Neurological and/or psychiatric disorders (past and present)
- Loss of consciousness from a head injury for more than 10 minutes at any point in the past
- Metal in body (e.g., surgical clips, piercings that cannot be removed, shrapnel etc.)
- Implanted devices (e.g., cardiac pacemakers, aneurysm clips, cochlear implants, medical pumps, deep brain stimulators etc.)
- Back problems that would not allow lying flat for 45-60 minutes

-If you do not meet the MRI requirements, but still meet all other specifications of the study you may still be accepted as participants, though you will not take part in the MRI scanning portion of this experiment.

Participants in both the experimental group and control groups will be required to participate in baseline and end of experiment data collection sessions. Activities and time commitments are as follows:

Initial testing (Baseline): Participants will take part in a mock audition in which they will perform 10 minutes of music that they have performed at least once previously. Prior to performance participants will be asked to fill out questionnaires related to their experience performing. Participants will also be signed up for a time in which they will undergo an MRI scanning session.

- End of Experiment: Participants will undergo the same procedure as at baseline. For each of the MRI sessions, you will lie in a narrow tube in the MRI scanner and hold still for about one hour. The scanner is quite noisy so you will wear earplugs to protect you from that noise. Throughout the experiment, you will be in direct communication with the MRI technologist. The session can be terminated at any point should you experience any discomfort or distress. During the scanning you will perform a functional MRI (fMRI) task that requires you to view stimuli (pictures) using a mirror and screen and respond to instructions on a response pad. You will be asked to view the pictures and rate how anxious they make you feel. You will also have some anatomical images taken of your brain that are very standard in MRI practice and where you do not have to perform any task.

Only participants allocated to the experimental group will take part in two-weeks of mindfulness meditation training during the experiment (individuals allocated to the control group will be offered the mindfulness training course after the conclusion of the post-intervention data collection). Activities and time commitments are as follows:

- Experimental group participants will be required to attend 12 in person group meditation sessions over the course of 14 days. These will each be one hour in duration, and will be scheduled in accordance with participant availability. Participation in all 12 sessions is mandatory.

Baseline and end of experiment data collection sessions will be video and audio recorded for data analysis purposes. Mindfulness meditation sessions will be video and audio recorded in order to document the content presented by the mindfulness practitioner.

Benefits: Participants may gain a valuable tool in coping with their music performance anxiety: mindfulness meditation. If this method of anxiety amelioration proves to be beneficial to any individual, this may become a tool for future performance opportunities.

Risks: There is minimal risk for participants in the research. Participants may feel discomfort in the form of music performance anxiety. Performance anxiety is a relatively normal part of music performance, though in some cases it may become extreme enough to inhibit the ability to play a piece of music as rehearsed, and may cause emotional and psychological discomfort. In order to analyze this phenomena, the participants in question will be required to take part in a musical performance situation that may induce performance anxiety in certain individuals. If they are feeling psychological distress beyond their comfort level at any point during their participation, they are encouraged to discontinue any activity they believe may be attributed to this discomfort.

fMRI does not use x-rays and is a non-invasive technique. MRI is a brain imaging technique that allows us to obtain a 3D picture of your brain using magnet waves. fMRI also records blood flow in certain regions, providing us with an indirect measure of brain activity, because we assume that more blood is needed in areas that are activated.
MRI is a safe technique, and we will make sure that it is safe for you to go into the scanner. There are no known, enduring physical or psychological risks associated with participation in MRI studies; however, you may experience mild physical discomfort associated with the MRI machine during the experiment. This includes having to lie still for 45 – 60 minutes and also being in a tight space for the time of the scanning. This will be addressed by not including participants with lower back pain or claustrophobia. The scanner is loud but you will wear earplugs or headphones. Participants may also experience mild emotional discomfort as a result of viewing the pictures. To mitigate the risk of psychological or emotional discomfort, participants will be told what to expect and will watch a trial run outside the scanner before performing the task. They will also be provided with a list of resources they can access. Lastly, the MRI scan may detect anomalies that neither

you nor your doctor(s) were expecting. This is known as an Incidental Finding. The structural scans are not meant to be diagnostic in nature, however, if the technologist detects an anomaly, s/he will have the scans read by a Neuroradiologist. If the Neuroradiologist determines that the anomaly should be pursued, the researcher will contact the participant with the instructions supplied by the Neuroradiologist for follow-up.

Confidentiality and anonymity: All participant information and data collected in this study will remain strictly anonymous and confidential and are used for research purposes only. Only Drs. Comeau, Smith, Russell, Goubran, student Nicole Stanson and authorized research members at their respective Laboratories will have access to this data. Participants will only be identified through alphanumerical codes that will be used in place of names during analysis and publication. Video recordings will only be associated with the alphanumerical identification of the participant and will be securely stored. Videos of each performance will be watched by the researchers for the purposes of identifying physiological symptoms of music performance anxiety. All collected data will be kept on secure computers under password protection inside the research laboratories, which are locked and armed with security alarms when unoccupied. Access to all computers is strictly monitored by lab administration.

Conservation of data: All audio, video and imaging data will be destroyed five years after the completion of this study.

Compensation: Participation in this study is strictly on a voluntary basis, however, participants will receive a CD with their structural brain scan after the second imaging session.

Voluntary participation: Participation in this study is strictly voluntary and p*articipants have the right to refuse to answer any questions or continue the sessions without fear of reprisal or ill treatment*. Participants can choose to withdraw from the study at any time. Should you wish to withdraw from this study, your data will be destroyed, and not used towards this study in any way.

Information about study results: We would be pleased to share the results of this project with you. In order to receive a summary of the results, please contact the primary investigator, Gilles Comeau.

If you have any questions or require more information about the study itself, you may contact the primary investigator. There are two copies of this consent form, one of which is yours to keep.

If you have any questions regarding the ethical conduct of this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 550 Cumberland Street, Room 154, Ottawa, ON K1N 6N5, by phone at 613-562-5387 or by email at ethics@uottawa.ca.

I, _____, confirm that I have read and understood the information presented in the consent form above, and acknowledge the risks of participation as they have been described. I understand that I am under no obligation to participate, and that I have the right to withdraw from the study at any point, for any reason. By signing this form I confirm that I meet the criteria for participation as described and that I participate at my own risk.

_____ _____

Signature of participant Date

_____ _____

Signature of researcher Date

Between-session instructions agreement

For the entire 14-day duration of my participation:

1. I will not watch any other instructional videos on mindfulness meditation outside of the research sessions.
2. I will not practice mindfulness meditation that I have learned outside of these sessions (this includes mental practice as well as actual physical practice).

_____ _____

Signature of participant Date

Email Transcripts

Dear potential participant,

My name is Nicole Stanson and I am contacting you on behalf of Dr. Gilles Comeau of the Piano Pedagogy Research Laboratory at the University of Ottawa where I am conducting graduate research.

This study will aim to evaluate the effects of mindfulness meditation on music performance anxiety. We will be exploring the symptoms of music performance anxiety through MRI scanning as well as monitoring physical and psychological states before, during, and after performance.

We are looking for participants between 18 and 30 years old, who have completed or are currently in the process of completing an undergraduate or graduate degree program in music, or have achieved grade 10 from the Royal Conservatory of Music.

In order to participate, individuals must:
- Be of age 18 to 30
- Be fluent in English (the training is only available in English)
- have completed or be currently in the process of completing an undergraduate or graduate degree program in music, or to have achieved grade 10 from the Royal Conservatory of Music.

Have no:
-extensive experience with mindfulness meditation or other mindfulness activities

For MRI participation:
- Claustrophobia
- Neurological and/or psychiatric disorders (past and present)
- Loss of consciousness from a head injury for more than 10 minutes at any point in the past
- Metal in body (e.g., surgical clips, piercings that cannot be removed, shrapnel etc.)
- Implanted devices (e.g., cardiac pacemakers, aneurysm clips, cochlear implants, medical pumps, deep brain stimulators etc.)
- Back problems that would not allow lying flat for 45-60 minutes

Please see the attached letter of information and poster to get more details about this project. For more information and to find out how you can participate, please feel free to contact me at...

Hoping to hear from you soon,

Nicole Stanson

Dear _____,

My name is Nicole Stanson and I am contacting you on behalf of Dr. Gilles Comeau of the Piano Pedagogy Research Laboratory at the University of Ottawa where I am conducting graduate research. I got your contact information from the University of Ottawa website and I would like to inform you about an opportunity to participate in an exciting new research project that will be taking place this academic year that you (or your students) may be interested in being a part of. It involves the opportunity to receive a free mindfulness meditation course, and to see your brain as scanned by an MRI before and after this training.

This study will aim to evaluate the effects of mindfulness meditation on musicians suffering from performance anxiety. For this study we will be exploring the symptoms of music performance anxiety through MRI scanning as well as monitoring physical and psychological states. Depending on their eligibility/willingness to be scanned in an MRI, and their random assignment to control or experimental group, participants will take part in the study in one of two ways:

- Experimental Group 1: This group will undergo MRI scanning, and then take part in a mock audition with a jury panel, after which a two-week daily mindfulness training course will commence. After two weeks of mindfulness meditation training, each participant will be scanned in the MRI a final time, and will give a final mock audition.
- Experimental Group 2: If you are unable to or are uncomfortable with being scanned by an MRI, you can take part in the study through participation in this second group. The second experimental group will take part in all of the same activities as the first experimental group, though there will be no MRI component.

Control Group 1: In this group you would only be required to participate in the MRI scanning and the mock performances, with no mindfulness meditation sessions during the experimental process. All control group 1 participants will be offered mindfulness training once the final data collection session has been completed.

Control Group 2: If you are unable or uncomfortable being scanned by an MRI, and have been assigned to the control group, you would only be required to participate in the mock performances, with no MRI scanning and no mindfulness meditation sessions during the experimental process. All control group 2 participants will be offered mindfulness training once the final data collection session has been completed.

We are looking for participants between 18 and 30 years old, who have completed or are currently in the process of completing an undergraduate or graduate degree program in music, or have achieved grade 10 from the Royal Conservatory of Music.

In order to participate, individuals must:

- Be of age 18 to 30
- Be fluent in English (the training is only available in English)
- have completed or be currently in the process of completing an undergraduate or graduate degree program in music, or to have achieved grade 10 from the Royal Conservatory of Music.

Have no:

-extensive experience with mindfulness meditation or other mindfulness activities

For MRI participation:
- Claustrophobia
- Neurological and/or psychiatric disorders (past and present)
- Loss of consciousness from a head injury for more than 10 minutes at any point in the past
- Metal in body (e.g., surgical clips, piercings that cannot be removed, shrapnel etc.)
- Implanted devices (e.g., cardiac pacemakers, aneurysm clips, cochlear implants, medical pumps, deep brain stimulators etc.)
- Back problems that would not allow lying flat for 45-60 minutes

Please see the attached letter of information and poster to get more details about this project. For more information and to find out how you can participate, please feel free to contact me at...

Sincerely,

Nicole Stanson

Appendix B: Questionnaires

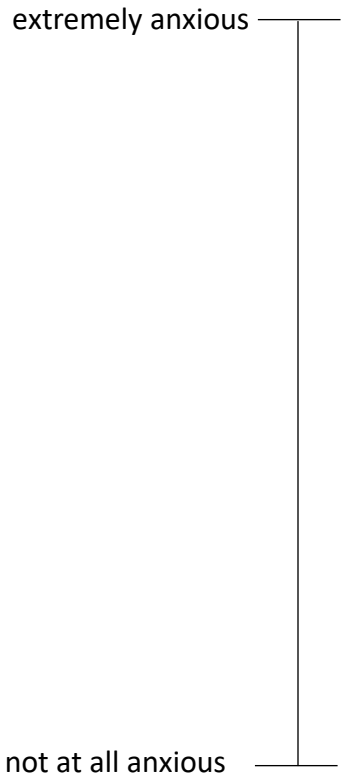
Participant Intake Questionnaire

Identifiers	
Name	
Email address	
Phone number	
Current City/town	
Alpha-Numeric Codes (for office use only)	
Physical characteristics	
Date of birth	
Gender	
Left or right handedness	
Hand preference: Indicate which hand you habitually use for each of the following activities by writing R (for right), L (for left) or E (for either):	
Writing	
Throwing a ball	
Using a racket	
Striking a match	
Hammering	
Using scissors	
Using a toothbrush	
Participant history	
1. How many years of music lessons have you had?	
2. At which age did you commence studying your instrument?	
3. Highest degree of music training attained (degree/RCM certificate/etc.)	
4. Post-secondary education information (current, or most recent): a) Which university? b) Which program? c) Current year of program? d) Which specialization (Performance, musicology/theory, education, pedagogy, etc.)?	

5. Do you play your instrument as an aspect of your career (yes/no)? If so, please explain.	
6. Approximately how many hours per week did you spend practicing/playing your instrument within the following age ranges: a) Child (12 years and under) b) Adolescent (13 to 18 years) c) Young Adult (19 to 24 years) d) Currently	
7. Do you participate in any fitness/physical activities such as sports, etc.? If so, which activity(ies), and how frequently?	
8. If you have experience with any mindfulness-related activities, please answer the following: a) What type? (yoga, meditation, mindfulness-based stress reduction, prayer etc.) b) At what age did you start this/these activity(ies)? c) For how long did you continue to participate in this/these activity(ies)? d) Do you currently participate in this/these activity(ies)? e) How much did you participate in this/these activity(ies) in the past? If you currently take part in mindfulness-type activities, how many hours a week do you typically spend on them?	
9. Which option best describes your performance frequency over the past year?	

a) More than twice a week b) One per week c) A few per month d) One per month e) A few every six months f) One over the course of the year g) none	
10. Do you use any of the following substances to cope with your performance anxiety: alcohol, marijuana, beta blockers?	a) Yes b) No
11. Have you sought professional help for any psychological conditions in the past? If yes, what was the reason you sought help?	
12. Have you been diagnosed with a psychological disorder (bipolar, depression, anxiety etc.)? If so, which one? Are you currently using medication related to your diagnosis?	

13. On the following scale, indicate your average level of anxiety during your last five performances:



Spielberger State-Trait Anxiety Inventory

mind garden.com

SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-1

Please provide the following information:

Name_____ Date_____ S_____

Age_____ Gender (*Circle*) M F T_____

DIRECTIONS:

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4