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SPECIAL ISSUE

Exploring the Effects of Shared Heart-Focused Intention in Music Performance on Musicians and Audience Members

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*This exploratory study sought to determine if a shared group intention by members of a string quartet for two pieces of music would have an effect on themselves and audience members. An experimental design was implemented consisting of two interventions. The first intervention introduced a series of exercises focused on posture and biomechanical movements. The second intervention introduced HeartMath's Quick Coherence and Heart Lock-In techniques. The Pachelbel Canon in D and Mozart Divertimenti in F K138 were chosen as the works to perform. For data collection, all participants (*N = *12) were fitted with ambulatory Bodyguard heart rate variability (HRV) recorders. Qualitative data were collected with questionnaires, and videos recorded comments. All three sessions were video recorded. Repeated-measures analysis of variance was used to test within-subjects effects in baseline HRV measurements among three sessions. Audience participants (*n = *8) and musician participants (*n = *4) were analyzed as separate groups. Quantitative results showed a significant change in HRV among the musicians from baseline after the Heart Lock-In breathing technique was introduced. Qualitative results showed improved mental focus and feelings of connectivity among the musicians. Audience HRV data had a high level of artifact, and the results showed no significance. After the final performance, qualitative comments focused on the performances being more engaging and the musicians being more connected with each other.*

When we attend concerts, it seems as though the emotions of our fellow audience members as well as the performers' emotions are synchronized and can be felt. It is a collective experience, and every person there has an impact on that vibrational experience. Music has often been referred to as the universal language, a language of emotion. Throughout evolution, emotions have instinctively guided humans' actions and decisions (Evans, 2002). Within all societies and cultures, a primary function of music is to bring people together; its very essence is communal.

The effects of an individual's interpretation of a piece includes their intentions for effective communication of the emotion and feeling to the audience (Palmer, 1997). Expressive music performance should be a goal for musicians. Research from the 1990s on has become more focused on this. Studies have qualitatively confirmed that professional musicians are able to communicate particular emotions to audiences (Behrens & Green, 1993; Gabrielsson & Juslin, 1996; Gabrielsson & Lindström, 1995; Juslin, 1997, 2000; Juslin & Madison, 1999; Ohgushi & Hattori, 1996).

The person creating the sound is placing awareness and intention as they create the sound, and that information carries to the individual hearing the sound (Goldman, 2002). To that point, the current study sought to determine if an emotional intention determined and held by musicians in a string quartet would be conveyed through their music and perceived by the audience members.

Objectives and Design

Participants

Participants included four musicians (two women, ages 55 and 65 years; two men, ages 26 and 31 years) and eight audience members (four women and four men, ages 19–60 years). Musician participants were recruited from a local symphony and volunteered. Audience members were recruited from Chico State University and local announcements in Chico and Redding, California. Six college students (two women, four men) and two older women volunteered.

This study examined the effectiveness of musicians' communication of feelings and emotions through two short pieces, the Pachelbel Canon in D, and the Mozart

Divertimenti in F K138, to audience members. An experimental design consisting of two interventions was implemented. The first intervention introduced the Posture Protocol, a series of exercises focused on posture and proper biomechanical movements to reduce physical tension and stiffness. The second intervention introduced the Heart Lock-In technique, which the musicians practiced while using the Inner Balance Trainer app (HeartMath Inc., Boulder Creek, CA).

The experiment as well as participants' experience and feedback were videotaped for analysis.

Research Design

The study took place over 5 weeks. The musicians and audience were together for three sessions, during which two pieces of music were performed. Two interventions were introduced to the musicians: the Posture Protocol following the first session performance and the Heart Lock-In following the second session performance. The first two sessions were 1 week apart; the third followed 3 weeks later in order for the musician participants to practice the technique with the Inner Balance app and Bluetooth monitor. A third step was introduced to the musicians in the third Zoom meeting, the Heart Intention Score Rehearsal protocol.

Session 1

Prep. Audience members and musicians were given a questionnaire, and heart monitors were attached to all participants. A 10-minute baseline reading of heart rate variability (HRV) was taken. The musicians performed the Pachelbel and Mozart pieces. A postperformance 10-minute baseline reading of HRV was taken. The sensors were removed, and audience members were instructed to leave.

Intervention I, the posture protocol, was introduced to the musicians. Specific arm and shoulder exercises and posture adjustments were introduced. The musicians were taken through a series of posture exercises in the seated position, first without instruments to understand the proper movement and range of motion and then again holding their instruments. They were instructed to practice these exercises daily while practicing and performing until the following session.

Session 2

The session began with the prep and baseline outlined in Session 1. Intervention 2, the Inner Balance app and Bluetooth sensor, were introduced to the musicians. The sensors were paired with the musicians' smartphones, and the HeartMath Quick Coherence technique was introduced.

Musicians were instructed to use the app and the sensor while practicing the technique three times a day. Three Zoom sessions followed.

Zoom meeting 1 was an introduction to heart-brain coherence and the effects of emotions on heart rhythms. Musicians were asked to identify what emotions they wanted to express through the music. They chose beauty and peace for Pachelbel, and for Mozart, joy.

In Zoom meeting 2, the Heart Lock-In technique was introduced. This was a three-step process: (1) begin focusing attention on the area of the heart, breathing a little slower and deeper than usual; (2) activate and sustain a renewing feeling such as care or appreciation; and (3) radiate that feeling to yourself and the other musicians.

In Zoom meeting 3, the Heart Intention Score Rehearsal was introduced. This was a five-step process: (1) breathe slower and deeper, focusing attention on the area of the heart; (2) activate and sustain the shared intentions and emotions for the Pachelbel piece; (3) radiate the intentions toward each other; (4) send these intentions to their instruments with which they co-create the music; and (5) send these intentions to the score itself.

This five-step process was repeated for the Mozart. The musicians were also instructed to immediately shift to heart-focused breathing as each movement ended in order to activate and sustain the intentions for the following movement; radiate the intentions toward one another; and, as they read the score, hearing the sound of the music as they read, infused with the intentions.

During the second week of working with the protocol, each musician worked with the Bluetooth sensor and the app, following the breath pacer. All reported that as they practiced, they felt less stressed and more present with their activities.

Session 3

The session began with the prep and baseline outlined in Session 1. The musicians were brought into the performance space to engage in the Heart Lock-In technique and Heart Intention Score Rehearsal protocol. The audience was brought into the room. The performance began.

After the postperformance 10-minute baseline HRV reading, the sensors were removed. The audience was informed about the study design and the two interventions that were introduced to the musicians after filling out the questionnaire response.

Data Collection

After each performance, both groups filled out a questionnaire and rating scale on their experiences during each performance.

Quantitative data were collected with ambulatory Bodyguard HRV recorders. The recorder samples the electrocardiogram at 1,000 Hz and calculates the interbeat interval (IBI), which is the time in milliseconds between consecutive heartbeats. IBI data were stored locally in the device memory and downloaded to a PC at the end of each experimental session. Participant recordings were about 45 minutes in length and took place three times in the fall of 2018: on September 14, September 21, and October 21. One audience subject was unable to participate in the third measurement session due to illness, and their data was not included in the analysis.

Each of the three experimental sessions contained four segments: a 10-minute resting baseline; two musical performances, each 7–10 minutes in length; followed by a 10-minute rest period. The same time clock was used during each of the three experimental sessions.

Measures

To ensure valid comparisons between HRV data from all phases of the protocol, equal-length segments of 5 minutes of consecutive IBI data were extracted from the middle of each protocol segment. IBI data were initially downloaded from the FTP site to a PC workstation and analyzed using DADiSP 6.5. IBIs greater or less than 30% of the mean of the previous four intervals were considered artifacts and interpolated beats were inserted in the analysis record. Following an automated editing procedure, all recordings were manually reviewed by an experienced technician and, if needed, corrected.

A second analysis was conducted using Kubios HRV 3.5. Ectopic beats were corrected using the artifact correction feature. The lowest threshold that eliminated bad beats was used. The average percentage of beats corrected for the musicians was 8%, with a wide range. That is, two of the four performers had no beats corrected, and two had a range of 5% to 33%. The average percentage of beats corrected for audience was 19% due to two participants having bad multiple bad beats. This may be due to interference with skin contact with the sensors.

The time domain metric of root mean square of successive differences (RMSSD) was used as the primary biomarker along with the frequency domain measure of the natural log of the high frequency, thought to reflect vagal tone (Shaffer et al., 2014).

The 10-minute resting baseline data were analyzed pre- and postsession and between sessions. Repeated-measures analyses of variance (ANOVAs) were done to compare HRV over sessions.

Statistical Analysis

Initially, to help control for any baseline differences between sessions, the within-session resting baseline measurement was subtracted from the measurement values of the remaining three protocol segments, the first and second musical pieces and the postmusic resting HRV measurement.

Repeated-measures ANOVA was used to compare the difference from baseline HRV measurements for each of the same participants at the three different experimental session time points. Each HRV measure was considered separately, and audience participants ($n = 8$) and musician participants ($n = 4$) were analyzed as separate groups. To identify specific pairwise differences for measures with significant within-subject effects, post hoc tests were performed with Bonferroni adjustments for multiple comparisons.

Results

A within-subjects ANOVA on musicians from the second analysis with Kubios showed a significant improvement in RMSSD between Sessions 1 and 3 ($F_{1,4} = 16.05$, $p < .028$), Cohen's $d = .94$ (Figure 1).

Audience data had a high level of artifact, and the results showed no significance. The data were quite variable, with an average of 19% of beats eliminated (Figure 2). The data from two of the eight participants were not included in the second analysis due to unusually high percentages of artifact.

Qualitative data from the musician participants' questionnaires indicated that the identification of common emotions and feelings they wanted to express through both pieces of music facilitated the final performance. The results also showed an improvement in mental focus during the performances (Figure 3). They reported that continued focus on the emotions while practicing heart-focused breathing on their own and in pairs helped facilitate their feeling of connection with one another (Figure 4). However, self-reported levels of performance anxiety for most were not reduced (Figure 5).

Audience members' responses to the questionnaire for levels of stress were above average for all sessions (Figure 6).

During and Postexperiment Comments From Audience and Musicians

All participants' postexperiment comments offered personal insights on the positive experiences in the last performance. After the final performance, all audience members commented that the performances were more engaging and connected among the musicians. One commented on the

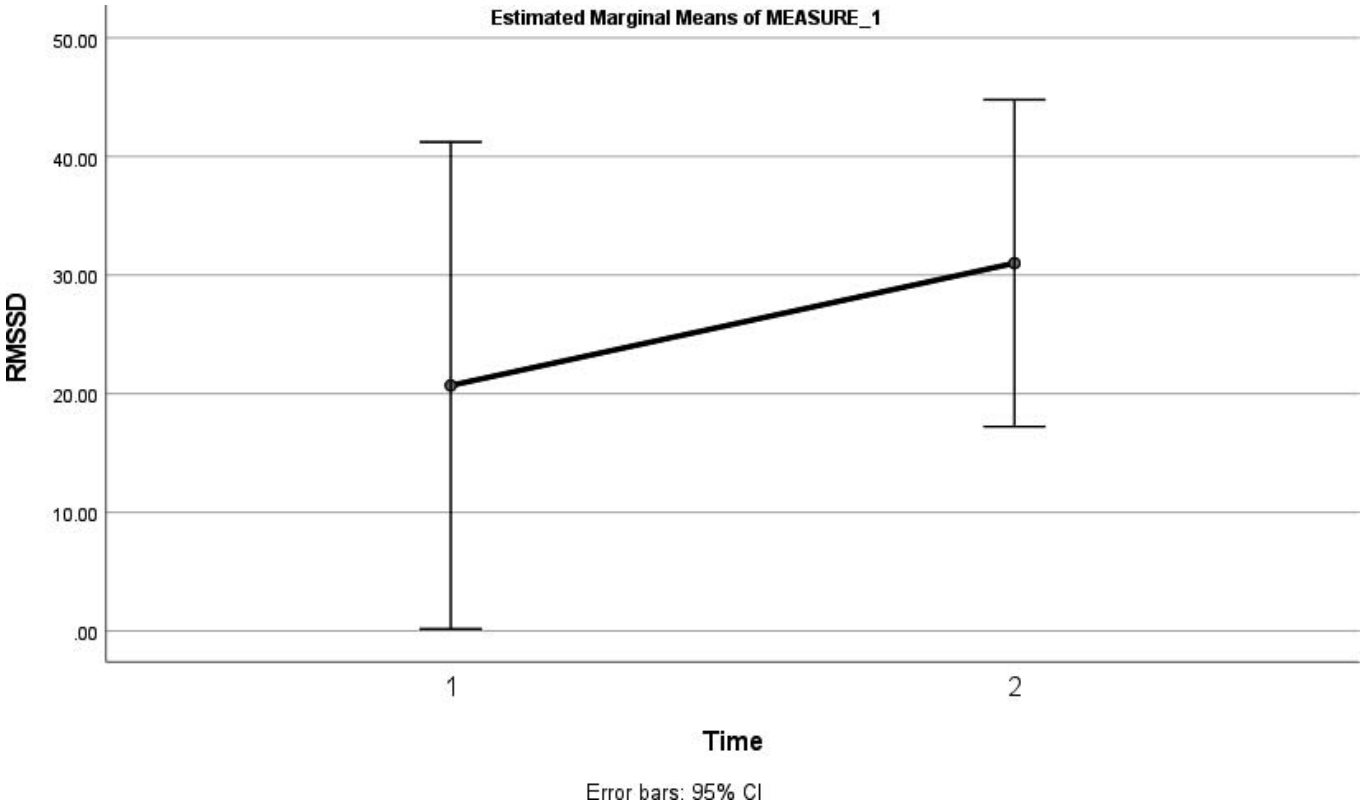

Figure 1. Musicians RMSSD Sessions 1 and 3 comparison.

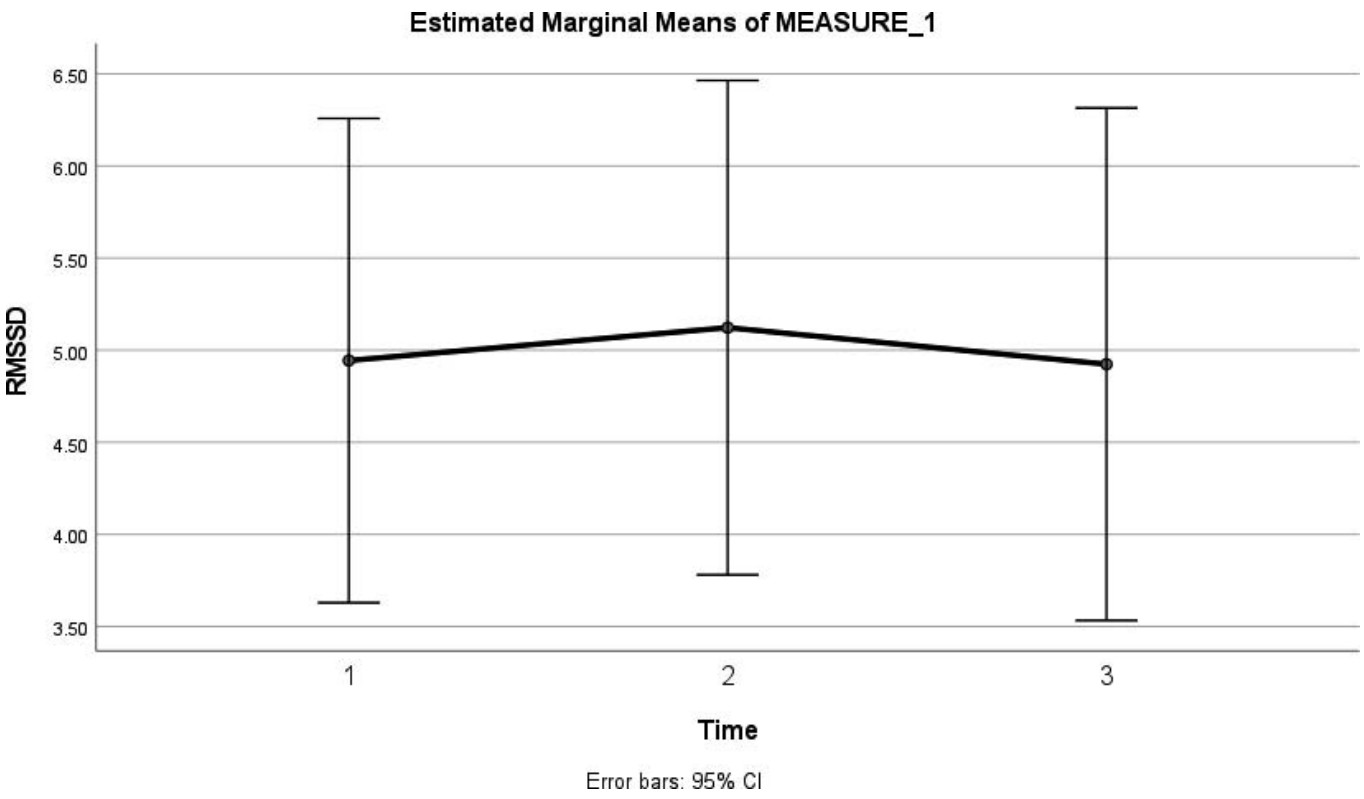

Figure 2. Audience RMSSD between sessions.

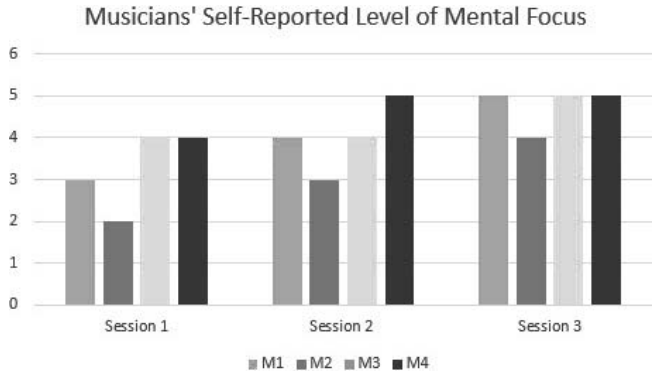

Figure 3. Musicians' self-reported levels of mental focus.

vitality in the performances. Others commented on the beautiful interaction and communication among the musicians, and several commented on the vitality and dynamic contrasts that made the music come alive. Several student participants commented on how relaxed the performance made them feel. This was interesting as it was at the end of exam week for six of the eight participants.

Postexperiment Musicians' Reflections

Musician participants were given a postexperiment questionnaire. Three of the four participants answered.

Reflecting on the Heart Lock-In music intention:

It was an honor to connect with the other instrumentalists and discuss the emotions we all had about the pieces. It gave a meaning and focus to connecting to each other through our hearts.

How was your experience practicing the Heart Lock-In technique with the quartet?

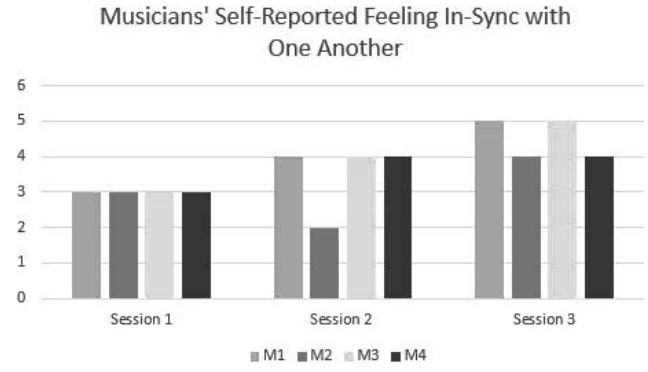

Figure 4. Musicians' self-reported feeling in sync with one another.

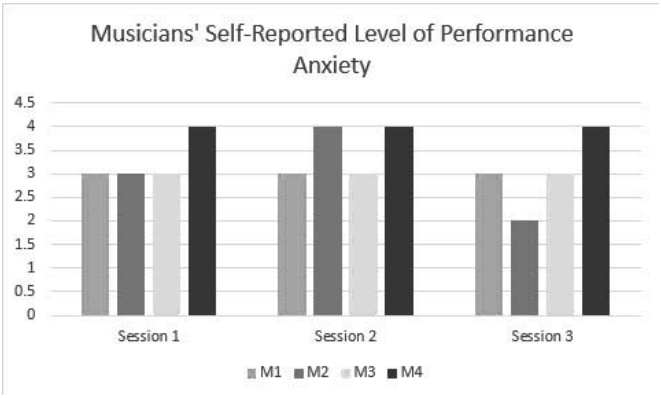

Figure 5. Musicians' self-reported levels of performance anxiety.

- *In person, the Heart Lock-In was a deeper connection than I expected. When we locked in together in person before the final performance, I felt a great deal of warmth coming from my colleagues.*
- *Practicing with the quartet was very rewarding. I felt that I got to be present with them in a more relaxed and peaceful manner.*

Did you find it helpful to think about what feelings and intentions you wanted to draw into your performance of the Pachelbel and Mozart?

- *Yes, it was a great way for me to pinpoint exactly what kind of sound I want to produce and what kind of effect I want the sound to have on the listener.*
- *I found this to be one of the most important things, creating those shared intentions helped me stay grounded and connected to each other during performance. This was completely different from any regular way of preparing to play a piece with others that I have ever experienced. Without rehearsing the actual music with one another, I felt that we all connected to the piece, the audience, and*

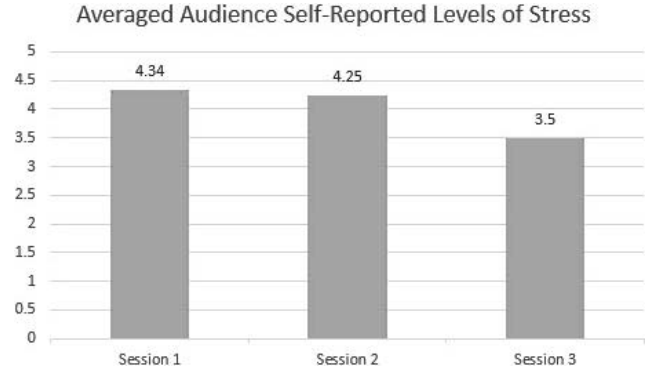

Figure 6. Averaged audience self-reported levels of stress.

especially with each other in a significant way. I was keenly aware of the sounds, emotions, rhythms, breathing patterns, pitches, vibrations, and nuances surrounding me in the room.

Did these exercises help you feel more connected to the music?

- *The music became more internalized on a personal level than it might have with a more traditional approach.*
- *I felt that the intentions of the movement really helped me get into the character of the piece.*

Did these exercises help you feel more connected to each other?

- *I felt that making music with everyone was a very intimate experience after putting in this kind of work.*
- *Through the process of phone meetings and the Heart Lock-In technique, I felt a closer connection with the other musicians.*
- *As we began to play, I relaxed and really enjoyed playing and sharing with the audience.*
- *When practicing heart focused breathing, I was more able to imagine sound realistically, as though I were producing it.*
- *I perceived sound much more and noticed that my sound and other's sounds had a more living quality.*

Discussion

The qualitative finding for stress among audience members speaks to the high percentage of stress people experience daily. Six out of eight audience participants were college music students. Research studies have shown the sources and effects of academic stress on students (Reddy et al., 2018). Stress has reached a level of national concern and is affecting physical, emotional, and mental health.

Musician participants' comments regarding the posture and body alignment work in the first intervention validate the physiological effects of reduced discomfort and wider range of motion when the body is aligned with the instrument. Musculoskeletal problems or tension have been known to affect musicians' control of performance biomechanics (French, 1980; Morasky et al., 1983; Riley et al., 2005; Riley, 2011; Tubiana & Chamagne, 2005). Participants did not complain of musculoskeletal problems and did not have diagnoses by a medical professional. However, their comments reflect a greater awareness of posture and less muscle tension and stiffness:

- *I have less physical interference in my muscles and therefore experience more ease of playing.*
- *When I found proper alignment, my body was more supple in the way it received my instrument. My neck is no longer stiff, and my bow arm is freer to release the full weight of the bow in the desired direction for the optimal sound.*
- *I am more conscious of my posture. The correction to my left-hand position for finger placement on the large size of the viola instantly gave me better dexterity and much less muscle tension. My new awareness of the deltoid muscle has resulted in less shoulder work and tension.*

Emotion and Music

A growing body of music psychology research has already demonstrated that music does elicit a response. Sympathetic nervous system changes associated with physiological arousal, as indicated by increased heart rate and reduced skin conductance, have been commonly measured as peripheral indices of emotion. Emotionally exciting or powerful music affects these autonomic measures of emotion as well (Arjmand et al., 2017; Hodges, 2010; Panksepp & Bernatzky, 2002). Krumhansl (1997) recorded physiological (heart rate, blood pressure, transit time and amplitude, respiration, skin conductance, and skin temperature) and subjective measures of emotion in real time while participants listened to music.

However, these studies do not address the effects of emotions intended in the music performed on the musicians themselves. High levels of performance anxiety have been reported among music students and professionals. Findings from a recent study suggested that performance anxiety was of concern for a significant majority of undergraduate and professional musicians (Papageorgi et al., 2011).

The current exploratory study chose to investigate a group of musicians practicing the HeartMath Heart Lock-In technique to create an agreed-upon intention as to the feelings to be expressed and conveyed through their music performance. The musicians' qualitative comments revealed new awareness and improvements in attention through the process of identifying emotions for each piece, heart-focused breathing techniques, and practicing these together with fellow musicians.

The musicians reported better focus, deeper listening, and interconnectivity to one another:

- *My ability to focus has increased tremendously, and I find myself now having the discipline to dive into daily chores such as practicing or exercise without any internal resistance.*
- *I am able to deal with emails, phone calls, text messages and communication in general more efficiently.*
- *I found my mind chatter was less and my concentration improved.*

Conclusions

Quantitative results for the musicians showed improvement in HRV from the second intervention, the breathing techniques introduced after the performances in Session 2. This is a significant finding, namely, that most musicians, when performing difficult passages, hold their breath. When asked if they breathe with the phrases, they most often answer no.

What is of interest in this exploratory study is the musicians' qualitative comments on the significance of the emotional connection to the music and one another. These comments introduce the question of whether the connection was the combination of the breathing techniques and their focus on the emotional intention.

Our processing and understanding of music, sound, and communication with others, verbal and nonverbal, are tied to our emotions. The question is, which comes first. Is it that once the breathing is embodied, the emotions can be more fully expressed? Are they then more expressive in their playing? Perhaps this enhances reversibility, providing a feedback loop.

It is our opinion that identifying the emotional connection to the music and intention for communication are essential for effective communication. Understanding the importance of music as a social influence and central aspect of daily life also necessitates an exploration of how music interacts with the individual's emotions (Stewart, 2014).

Limitations of the Study

The number of participants in both the musician and audience groups was small. Investigating the long-term effects of the Heart Lock-In technique on the musicians was beyond the scope of the exploratory study. The study did not have a separate control group, just a control within participants. On-the-body electrodes should be checked for secure attachment on the skin for cleaner data collection.

Future Research

Future research might investigate whether long-term practice of the Heart Lock-In technique could have a significant impact on reducing anxiety and enhance well-being as a by-product of practicing breathing techniques along with performing music. HRV data should be analyzed to see if there is a group effect on coherence among the musicians. A longer period of time is suggested for musician participants to practice the Heart Lock-In technique along with the Heart Intention Score Rehearsal protocol on a daily basis.

Future research might also explore the effects of the heart-focused breathing technique on audience members. Further research is also needed to investigate the effects of emotion through a shared-group intentionality, heart-focused breathing technique in music performance in everyday settings on audience members as well as the musicians and teaching listening skills by measuring HRV on both musicians and audience members. Retirement villages, schools, high school music programs, college music programs, and professional performing arts groups might provide subjects for these investigative studies.

Data Availability Statement

HRV data from the study are available upon request. Further inquiries regarding qualitative data can be directed to the authors.

Ethics Statement

The studies involving human participants were reviewed and approved by the Office of Sponsored Programs, Chico State University. The participants provided their written informed consent to participate in this study.

Authors Contributions

The authors confirm sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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