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Clinical use of music as an adjunct to evidence-based treatment for treating posttraumatic stress disorder

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ABSTRACT

Substantial efforts have been made to provide evidence based therapeutic treatment for combat veterans seeking mental health services for posttraumatic stress disorder (PTSD). Due to the clinical complexity of PTSD, discovering a muti-effect approach treating both the diagnostically significant PTS symptoms as well as the non-diagnostic associated features of PTSD would be beneficial.

This independent investigation was developed to explore the relationship of music to the current evidence-based treatment practices for PTSD. The researcher explored the relationship between the physiological, psychological and social effects of both music and PTSD, the mechanisms of change intrinsic to PTSD therapy, and the clinical applications of music as an adjunct to *in vivo* exposure therapy, Acceptance Commitment Therapy (ACT) and mindfulness.

The uniquely holistic biopsychosocial processes engaged by music and the associated theoretical underpinnings informed the author's approach. During the experience of working musically with trauma survivors, the author developed specific experiential and behavioral exercises to compliment the therapeutic elements of ACT, mindfulness and *in vivo* exposure therapy. The utilized approach included individual guitar lessons and group listening exercises designed to work musically with clients' anxieties *in vivo*, foster mindfulness skills with the goal to become re-engaged in life by practicing noticing when thoughts become a distraction from

fully participating in the present moment, and to provide a valued activity that can act as a bridge from the psychological principles of ACT to the ultimate goal of behavioral activation.

CLINICAL USE OF MUSIC AS AN ADJUNCT TO EVIDENCE-BASED TREATMENT FOR TREATING POSTTRAUMATIC STRESS DISORDER

A project based upon independent investigation, submitted in partial fulfillment of the requirements of the degree of Master of Social Work.

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Chapter I

Introduction

Substantial efforts have been made to provide evidence based therapeutic treatment modalities for combat veterans seeking mental health services for posttraumatic stress disorder (PTSD). A well-established body of medical research on combat veterans and the pathology and symptoms of PTSD has developed (Friedman, 2007). PTSD can be intensely dysregulating, causing significant distress across the continuum of individual functioning. Due to the constellation of posttraumatic stress (PTS) symptoms, primarily hyperarousal and hyperavoidance, evocations are felt in the body that can lead to a number of maladaptive secondary efforts in an attempt to maintain control over these bodily sensations. As a result, distinguishing and treating only the diagnostically significant PTS symptoms as listed in the American Psychiatric Association's (APA) Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) independently from the non-diagnostic associated features of PTSD including extreme discontent, depression, diffuse fear and anger, humiliation, lack of self-esteem, loss of optimism, loss of enjoyment, difficulty modulating affect, diffuse distrust, isolation, unwillingness to communicate, relationship difficulties, and self-deprecation can be difficult. Due to the clinical complexity of PTSD, discovering a muti-effect approach would be beneficial. This author posits that PTSD therapeutic interventions should be multivalent and should aim to provide parallel therapeutic experiences aimed at 1) reducing the primary PTS symptoms of arousal and avoidance and 2) reducing secondary symptoms caused by individuals' maladaptive attempts to maintain control of bodily sensations associated with PTSD.

Combat veterans living with symptoms of PTSD can display vast incongruities in how they make meaning and react *in vivo* with their environment. As if their mind and body are out of rhythm with their surrounding environment and frozen apart from the present moment, these individuals' symptoms can be triggered by a small event that has little to do with the here and now. Recently, significant psychiatric evidence has demonstrated possible connections between specific symptoms of PTSD associated with the body's autonomic dysregulation and the biological, psychological and social evidence that music can, as stated by Osborne (2009a), "modulate and regulate the autonomic nervous system" (p. 335). Buttressed by the evidence this study asks the question – Can music compliment evidence based therapeutic modalities used in PTSD treatment facilities and, if so, in what ways? Using the frameworks of exposure, acceptance and mindfulness therapeutic practices currently associated with evidence-based practices for treatment of PTSD, this study posits that incorporating a musical component into a therapeutic milieu experience can further support the current evidence based treatment modalities and make a modest addition towards a multimodal, holistic, wrap-around, therapeutic environment to treat PTSD.

The usefulness of the findings may enable a more systematic and operational analysis of how to better attune to the needs of clients suffering from symptoms of PTSD. Furthermore, if the findings are compelling, the content may inform future pedagogical methods of social work education. Finally, this research will be used for this author's Smith College School for Social Work Master of Social Work thesis and content will be used for future presentation, potential publication, and foundation of future study.

Chapter II

Biopsychosocial of PTSD

Before humans are rational, logical or intellectual, humans are emotional. Of all human emotions, according to Berger and Schneck (2006), the most fundamental are those, which potentiate survival. Berger and Schneck (2006) postulate,

> Emotions were with us before self-awareness. The instinct to survive in the face of perceived threats is the engine that propels physiological function. Thought (based on the cognitive awareness of internal and external events) is a luxury afforded as an "after"-thought, whereby the event(s) enter consciousness long after… a response to the event has already taken place instinctively (p. 109).

The most fundamental human emotion predicating behavior is fear for the survival of the self and the species (Darwin, 1872; Chiao, et al., 2008). As Berger and Schneck elucidate, human beings appear to unconsciously react first and consciously think later. In the case of fear, humans are gifted with a crude and extremely fast system that can unconsciously react in as little as .039 seconds (Pessoa & Adolphs, 2010). Etiologically, fear is arguably one of the strongest drives of human emotion and behavior (Bradley, Codispoti, Cuthbert, & Lang, 2001; Berger & Schneck, 2006). For instance, while hiking to the summit of a hill an individual can come across many dangers, one of which is a rattlesnake. With eyes fixated on the summit of the trail, the hiker is unaware that (s)he is about to step down on a rattlesnake laying in the middle of the trail. Luckily the fear system in the brain is working correctly and without thinking the hiker immediately jumps over the snake. Shortly after, the conscious part of the brain has the afterthought, "Wow that was a rattle snake I could have been bitten." When a person

experiences situations felt to be dangerous, and the emotion of fear is generated, a signal is sent to the central nervous system (CNS) (the command center), which begins a series of physiological conditions that prepare the individual to face a life-threatening situation. As noted by Chiao et al. (2008) psychologically fear is subjective, but physiologically the body reacts to fear in a complicated, although more universal, cascade of internal events. Fairbank, Ebert and Costello (2000) have established that people are well equipped to cope with certain levels of fear experiences, and that this is something that humans are hard wired to deal with in everyday existence.

Given that people are well equipped to deal with fearful events, Fairbank et al. (2000) note that there is a normal range of fearful reactions. However, how does one determine what is a normal or typical reaction to a fearful event? Even with all of the advances of modern medicine, scientists are far from fully understanding how the human body functions, including all variations of normal and abnormal manifestations of life. Hans Selye, as cited by Janosik and Davies (1986), identified the general adaptation syndrome (GAS) as the natural physiological adaptation of an organism to shift its basic operating parameters to enable a reaction during an extraordinary event (Janosik & Davies, 1986). This physiological flexibility of a normal functioning body, known to modern theorists as *complexity theory*, seeks to maintain an internal balance of physiological properties critical for sustaining life (blood pressure, pulse, blood sugar, pH, et cetera) while dynamically interacting with the demands of an external environment (Thayer & Lane, 2000). The environment is constantly changing, and our internal system is constantly searching for the minimum amount of energy to meet the demands required by the environment. As a result, normal functioning is achieved via flexibility of the organism while rigidity is related to abnormality, morbidity and sickness (Peng & Buldyrev, 1994). As an

illustration of the above, people who function with a disorder such as Post Traumatic Stress Disorder (PTSD) are found to experience a disruption of the normal or healthy internal balance of mental and physical functioning resulting in psychological and physiological inflexibility.

As PTSD disrupts flexible physiological functioning, individuals' behaviors can be conceptualized as reactive attempts to control internal sensations. According to the DSM-IV TR (American Psychiatric Association, 2000), PTSD is diagnosed when symptoms cause clinically significant distress, social and/or occupational impairment and exist for more than one month. PTSD is specified as acute if the duration of symptoms is less than three months and chronic if the duration of symptoms is three or more months or with delayed onset if symptoms begin at least six months after the traumatic moment. Four criteria must be met for an individual to be clinically diagnosed with PTSD.

A) An individual must be exposed to an intensely traumatic event in which death, serious injury and/or the integrity of the self was threatened and the individual experienced severe fear, helplessness or horror.
B) An individual experiences recurrent and intrusive recollections of the traumatic event that cause intense psychological distress and physiological reactivity.
C) Persistent avoidance in an effort to control associated stimuli or internal evocations, which needs to include three or more of the following: avoiding stimuli associated with the trauma (including places, people, activities, ideas, emotions and/or conversations about the trauma), becoming psychologically numb, displaying restricted affect, an inability to recall the traumatic event, becoming isolated, having a diminished interest in important activities, becoming socially estranged from others and having a sense of a shortened future.
D) Persistent arousal, which needs to include two or more of the following: hypervigilance, exaggerated startle response, irritability, anger, loss of concentration and/or difficulty falling asleep. (For the complete diagnosis see Appendix A: DSM-IV-TR diagnostic criteria for PTSD.)

PTSD can be intensely dysregulating, causing significant distress across the continuum of individual functioning. Due to the constellation of PTS symptoms, primarily hyperarousal and hyperavoidance, evocations are felt in the body that can lead to a number of maladaptive

secondary efforts in an attempt to maintain control over these bodily sensations. This chapter will discuss: 1) the substantiated evidence suggesting that PTSD causes complex and severe dysregulation of metabolic homeostatic functioning that alters physiological flexibility and, ultimately, experience of and reaction to the environment, and 2) the maladaptive psychological choices of the conscious mind in an effort to control and avoid bodily sensations and associated stimuli of traumatic triggers.

The Physiology of PTSD

PTSD - the mind, body and basic metabolic functioning.

The basic regulation and metabolism of energy is one of humans' most important bodily functions. When working properly, the body seeks to maintain flexibility by balancing the internal energy needs of vital organs in response to various demands of the social environment. Stress and fear have significant consequences on physical regulation.

Stress and fear are central to the diagnosis of PTS. The brain plays a large part in the regulation of stress and ultimately basic homeostatic metabolism; in particular, the hypothalamus is a significant component of this process. The hypothalamus is part of the limbic system, which is a group of brain structures that also includes, but is not limited to, the amygdala, thalamus and the hippocampus. Together, the limbic system functions to process information gathered by our senses and regulate emotions, memory, and arousal. The hypothalamus integrates a variety of internal and external sensory information, including stress and fear, and transmits the information to the CNS and endocrine system (Dolan DNA Learning Center, n.d.).

Recent brain research suggests there are two *roads* of sensory information processing in the brain, both involving different parts of the limbic system. First is the high road that is a slow,

subjective and conscious appraisal process and the second is the low road that is a nearly automatic and unconscious appraisal process (Brattico & Jacobsen, 2009; Swallow, 2002).

When the amygdala (the fear center) is not triggered, the sensory information is sent from the thalamus through the hippocampus where an individual can evaluate the current stimuli and compare it to explicit past experiences and finally to the cerebral cortex causing a conscious reaction (Swallow, 2002). If the sensory information sent from the thalamus to the amygdala is perceived to be dangerous, the amygdala sends an alarm signal to the hypothalamus, which activates the autonomic nervous system (ANS) causing a nearly instantaneous *fight or flight* response (Swallow, 2002). When the amygdala is triggered, a cascade of internal bodily reactions governed by the neuroendocrine system and hypothalamic pituitary adrenal (HPA) is set in motion by the hypothalamus in order to provide the maximum amount of energy for survival. In this process the signal to the hippocampus is inhibited sending the impulse away from the meaning making area of the brain. Berger & Schneck (2006) comment, "As long as the amygdala is in 'alert' perceived threat mode, all roads lead to fire stations, rescue squads, emergency services, and hospitals" (p. 88). When an individual has PTSD the amygdala's mode of sensory information processing can become inflexible and locked in a hypervigilant state. A combat veteran with chronic PTSD can have an amygdala with a very crude sense of danger - associating anything that looks like, smells like, sounds like or feels like the previously experienced threat to almost immediately be perceived as the threat. Needless to say, an individual with PTSD is subject to many false alarms.

The body's reaction to stress is governed by the endocrine system, particularly the HPA. Consistent evidence reveals that PTSD has a dysregulating effect on normal HPA functioning (Osborne, 2009a). The hypothalamus releases corticotropin-releasing hormone (CRH) into the

blood that then triggers the anterior pituitary gland to release adrenocorticotropic hormone (ACTH) into the blood. The adrenal gland receptors on the kidneys react to the ACTH by releasing the steroid cortisol into the general blood stream. The increase of cortisol boosts the level of sugar in the blood traveling to the organs associated with fight or flight and suppresses the immune system to provide the most energy during a life threatening event. After the traumatic event the hippocampus completes the HPA cycle by responding to the elevated levels of cortisol in the blood by inhibiting the release of CRH and ACTH, ultimately lowering level of cortisol. This feedback loop exists in a delicate balance and when its flexibility is altered the individual can become locked into a state of dysregulation (Osborne, 2009a).

Studies have indicated that within 24 hours after an acute traumatic event, individuals with PTSD have typically displayed higher levels of cortisol in their urine than individuals without a PTSD diagnosis (Lemieux & Coe, 1995). Delahanty, Nugent, Christopher, and Walsh (2005) suggest that high levels of both cortisol and epinephrine (adrenaline) in the urine after a traumatic event may be associated with the future development and the severity of PTS symptoms. However, conclusive evidence pointing to one pattern of HPA adjustment in PTSD has been astonishingly variable with some finding higher levels of cortisol in clients with PTSD, some finding lower (Rasmusson, Vythilingam, & Morgan, 2003). Moreover, cortisol levels in complex or long-term trauma cases are opposite of what might be expected. For example, researchers have found that combat veterans with chronic PTSD have remarkably lower urinary cortisol levels compared to individuals without the PTSD diagnosis (Mason, Giller, Kosten, Ostroff, & Podd, 1986; Yehuda et al., 1990). Goenjian et al. (1996) proposed a theory to explain these findings suggesting associated persistent intrusive recollections of the trauma (criterion B in the DSM-IV-TR) to potentially be causally related to the low levels of cortisol in the body.

They hypothesized that over the period of five years (the lapse in between the trauma and their study) the individuals' repetitive intrusive thoughts caused enough distress to induce more permanent physiological changes on the HPA axis, altering its functioning.

Chronic PTSD, in particular, is believed to significantly alter the HPA feedback loop leading to low levels of cortisol in the body. One possible explanation for this is what Yehuda (2000) referred to as "negative feedback inhibition" (p. 63). The author found a correlation between PTSD and increased glucocorticoid receptor sensitivity in the hippocampus. As a result, the HPA becomes more sensitive to negative feedback inhibition and becomes hyper-suppressive of cortisol in the body. Another possible explanation for the lower cortisol in the body is postulated by Fries, Hesse, Hellhammer, and Hellhammer (2005) as *adrenal exhaustion* suggesting that the phenomenon of adrenal exhaustion is related to hypocortisolism, a physiological adaptation that occurs at the basal metabolic level to the source(s) of chronic stress due to the prolonged period of hyperactivity in the HPA axis. Another possible explanation of the low levels of cortisol in the body after periods of chronic stress was presented by authors Rasmusson et al. (2003) proposing that the adrenal neurosteroid dehydroepiandrosterone (DHEA) could play a role in the low levels of cortisol and the HPA axis adaptation to chronic stress and in the diagnostic symptoms related to PTSD.

Another way to think about basic metabolic flexibility is known as *allostasis* and *allostatic load*. Allostasis is the body's physiological short-term natural adaptation and maintenance to traumatic events. Allostatic load is the long-term physiological effect of the traumatic event(s) and the negative implications on the body (McEwen, 2000). The allostatic load of PTSD can take many forms, including chemical imbalances in the brain (McEwen, 2000).

The chemicals that enable the brain to transmit signals across neurons, ultimately shaping actions, emotions, feelings and perceptions, are called neurotransmitters (Boeree, 2009). According to Coupland (2000), several neurotransmitter chemical imbalances are associated with the allostatic load of PTSD. Coricotropin-releasing hormone (CRH), which is part of the HPA axis and is secreted by the hypothalamus during times of stress, was found to be elevated in the cerebrospinal fluid of PTSD patients. Interestingly, this irregularity of higher CRH was also found in patients with a diagnosis of major depression - a frequent comorbid diagnosis with PTSD (Osborn, 2009a). In brief intervals of stress, CHR is essential for adaptation and maintaining metabolic flexibility; however, the acute or chronic nature of PTSD enacts a behavioral cost and encumbers allostasis in individuals with PTSD.

Several other neurotransmitters have significant roles in PTS. Glutamate, a neurotransmitter that plays many important functions in the brain including the cognitive functions of learning and memory, is considered to be central to the phenomena of synaptic plasticity - the use-it or lose-it model of synaptic brain development and knowledge pathways (Osborne, 2009a). Elevated levels of glutamate may be associated with dissociative episodes and reduced hippocampus volumes related to trauma episodes which further support the negative feedback inhibition theory put forth by Yehuda (Coupland, 2000). Yehuda (2000) notes that gamma-aminobutyric acid (GABA) is the primary inhibitory neurotransmitter in the central nervous system (CNS) regulating the neural activation within the nervous system and critical to the process of muscle tone regulation (Watanabe, Maemura, Kanbara, Tamayama, & Hayasaki, 2002). Although there is limited direct study correlating GABA and PTSD, changes in GABA levels are thought to contribute to anxiety disorders and reduced levels of GABA have been associated with alcoholism and depression, both comorbid diagnoses with PTSD (Coupland,

2000). Coupland (2000) observes that noradrenalin is a neurotransmitter that, among other functions, releases norepinephrine (adrenalin) during a stressful event. By increasing the heart rate, blood flow increases to the muscles powering the fight or flight response. Hyperactivity of norepinephrine is also associated with the allostatic load PTSD, specifically in the disruption of attention and, potentially, related to fear reinforcement and hypervigilance (Coupland, 2000). Norepinephrine is synthesized from dopamine, which PTSD may also affect. PTSD may disrupt the dopamine firing system; in particular, it may entrain the amygdala to become overactive when evaluating external sensory stimuli (Coupland, 2000). A healthy dopamine firing system is associated with allostasis effecting subjective motivation and reward centers -- an impaired system is associated with loss of motivation, emotional distancing, social drift and, potentially, the allostatic load of schizophrenia and psychotic depression (Coupland, 2000). Changes in the levels of acetylcholine, an amine neurotransmitter found in both the peripheral and central nervous systems, has been observed in individuals with PTSD. Acetylcholine is involved in the control of memory and may be a factor in reoccurring nightmares and hypervigilance (Coupland, 2000). Serotonin is another amine neurotransmitter that, when depleted, is associated with impulsivity, irritability, aggressive and suicidal ideations – all PTSD symptoms. Additionally, serotonin deficits may be related to the difficulty of unlearning a conditioned fear response in individuals with PTSD (Coupland, 2000).

During traumatic events, endogenous opioid peptides are naturally produced in the body and are released in the amygdala and the periaqueductal gray (PAG), contributing to the modulation of pain and of defensive behavior. The opioid circuits are associated with blocking pain, and it is hypothesized by Coupland (2000) that opioid dysfunction could contribute to emotional numbing and loss of motivation in PTSD. Trescot, Datta, Lee, and Hansen (2008)

have noted that opioids have a long history of psychopharmacological uses to treat acute pain. Drugs such as morphine, codeine, hydromorphone, levorphanol, oxycodone, hydrocodone, oxymorphone, buprenorphine, nalbuphine, butorphanol, pentazocine, fentanyl, alfentanil, sufentanil, meperidine, propoxphene, methodone, and tramadol are the most common opioid drugs medically used (Trescot et al., 2008). Furthermore, opiate withdrawal may exacerbate PTSD symptomatology, as withdrawal is found to cause the CRH levels to increase and the noradrenenal to become reactiveated in the HPA system (Coupland, 2000).

The research clearly elucidates the complex affects of PTSD on the body. Chronic stress and fear have devastating results, compromising internal flexibility and rendering the individual unable to respond appropriately to the demands of the external environment.

PTSD - the heart and the nervous system.

As discussed by Blake and Bishop (1994), due to their combat experience, veterans living with PTSD can be locked in a state of constant physical arousal. The ability of the heart to healthily fluctuate between states of stimulation and relaxation is regulated by the ANS that organizes the unconsciously controlled bodily functions such as breathing, heart function, and the digestive processes. Bodily functions such as secretory glands, blood oxygen supply and digestive and metabolic functions are some of the body's involuntary self-regulating functions that help to maintain a state of equilibrium (Buckley & Kaloupek, 2001). The imbalance between arousal and relaxation in war veterans has been documented by a significant body of research on the effect of PTS on the heart (Green, Grace, Lindy, Gleser, & Leonard, 1990; Shalev, 2000). During times of stimulation or arousal, the sympathetic nervous system is responsible for the body's increased heart rate. Conversely the parasympathetic nervous system

slows down the heart to prepare the body for energy storage, digestion, immune responses, salivation, urination, defecation and lacrimination (Cohen et al., 2000; Ellis & Thayer, 2010).

Evidence reveals that veterans who live with PTS symptoms have significantly different cardiovascular activity than individuals without a PTSD diagnosis. An example of this is found in a study by Muraoka, Carlson, and Chemtob (1998), which examined the cardiovascular activity of Vietnam combat veterans living with PTSD over the course of twenty-four hours. The results found that the veterans with PTSD displayed a higher heart rate than individuals without PTSD (80.8 beats per minute [bpm] vs. 71.9 bpm respectively) and higher diastolic blood pressure (80.1 vs. 71.5 millimeter of mercury [mmhg] respectively). Significantly, when observed during sleep, combat veterans with PTSD had on average a much higher resting heart rate of 71 bpm when compared to individuals without PTSD whose average heart rate was 62.7 bpm. The connection between PTSD and chronic cardiovascular arousal is further substantiated by Buckley and Kaloupek's (2001) meta-analysis of the basal cardiovascular activity of individuals with PTSD. In their work the authors examined thirty-four studies having to do with the cardiovascular activity of patients with PTSD. In total 2,670 subjects were examined and information was collected for variation in heart rate and systolic and diastolic blood pressure. The results of the meta-analysis substantiated many previous studies, suggesting a strong association between PTSD and cardiovascular hyperarousal, finding that individuals with a diagnosis of PTSD had a higher resting heart rate and elevated blood pressure than individuals exposed to trauma without a PTSD diagnosis and to individuals without a history of trauma exposure (Buckley & Kaloupek, 2001). Not only do individuals living with PTSD have a higher resting heart rate and elevated blood pressure, it appears that PTSD also effects the recovery time for the heart to return to a normal resting rate after a sudden shock (Kibler & Lyons, 2004).

Kibler and Lyons (2004) measured the relationships of PTSD to the severity of physiological reactivity to acoustic startle, habituation, and recovery. The authors found a significant relationship between the severity of PTS symptoms and the length of time for the heart to return to base line. Clearly there is ample evidence to attest to the fact autonomic dysregulation is a prominent element of the PTSD condition.

Cohen et al. (2000) conducted a study using a power spectral analysis (PSA) of heart rate variability comparing individuals diagnosed with PTSD and/or panic disorder to a control group of non-diagnosed individuals. The study found clear evidence of autonomic dysregulation in clients suffering from PTSD. During the study, three electrocardiogram (ECG) recordings were made: 1) while the subjects were resting, 2) while recalling either the traumatic moment (patients diagnosed with PTSD) or the specific conditions (patients diagnosed with panic disorder), and 3) post-recall while resting. Interestingly, and in contrast to other studies, Cohen et al. (2000) found that measurements of:

> Autonomic activity while recounting traumatic events in PTSD patients was not significant. This lack of further response to the stimulus of recounting a traumatic event suggests that in PTSD a state of chronic autonomic over-stimulation prevents or obtunds the ability of the autonomic nervous system to respond [to] further [stimulus] (p. 9).

This report indicates that PTSD causes a dysregulation of the autonomic nervous system; specifically, an increase in activity of the sympathetic nervous system and, simultaneously, a decrease in activity of the parasympathetic autonomic nervous system. These results potentially indicate PTSD locks individuals into a state of permanent hyperactivation in which they become desensitized and are unable to produce a further state of arousal in the presence of stimuli that

individuals from control groups responded to with a stress response. As a final note, the report further substantiates the theories of negative feedback inhibition and adrenal exhaustion.

PTSD - breath and respiration.

Physiologically humans' automatic rhythmic breathing is thought to originate in the region of the brain called the pons. The pons is located in the brain stem between the midbrain and the medulla. In response to internal metabolic and homeostatic demands the brain sends signals along the spinal axis in separate axons dedicated to the inhalation and exhalation processes. The inspiratory and expiratory axons run to receptors in the abdominal organs that control muscle groups concerned with breathing (Dolan DNA Learning Center, n.d.). This automatically generated rhythmic breathing, referred to as homeostatic or metabolic respiration, is the normal human breathing state. However, external stimuli and environmental changes influence respiration producing behavioral breathing. Homeostatic breathing and behavioral breathing co-exist *in vivo* with the individual's subjective emotional states – such as sorrow, joy, anxiety and terror - and constantly affect an individual's respiration rate (Homma & Masoka, 2008). Behavioral breathing can also be a conscious activity and can be employed by individuals purposefully for affective change - for example, breathing retraining used in the therapeutic modality *prolonged exposure* (PE) (Foa, Hembree, & Rothbaum, 2007) or the *Ujjayi* breath used in yoga practice (Emerson, Sharma, Chaudhry, & Turner, 2009). Breath to perform activities such as singing, speaking, holding the breath and voluntary hyperventilation are all examples of behavioral breathing. Interestingly, behavioral breathing is generated in different parts of the brain, mainly in the primary motor cortex and. also, the thalamus and cerebellum (McKay, Evans, Frackowiak, & Corfield, 2003). The signals generated in behavioral respiration descend

down the same pathways as the autonomic (homeostatic) respiration signals to the receptors in the abdominal organs.

Individuals who suffer from PTSD have been reported to suffer from higher rates of irregularities related to breathing including sleep apnea (Ocasio-Tascon, Alicea-Colon, Torres-Palacios, & Rodriguez-Cintron, 2006), upper respiratory tract infection, asthma, pulmonary emphysema, hyperventilation and an increase in susceptibility to allergies (Donker, Yzermans, Spreeuwenberg, & Van Der Zee, 2002). As PTSD is an anxiety disorder that causes individuals to live in constant state of arousal and hypervigilance, it seems likely that there is a correlation between PTSD and breathing disorders. Surprisingly, there is limited research on the specific effects of PTSD on respiration; however, considerable research on the effects of stress and subjective fear on respiratory functions has been conducted. The psychophysiology of fear and anxiety in humans has been linked to the amygdala and changes in respiratory patterns. In one study, Masaoka and Homma (2004) reported that when the amygdala was activated it affected the way in which the individual drew air, using the muscles in the chest rather than the abdomen to inhale oxygen. The role of the amygdala and its relation to breathing patterns has been linked to fear conditioning and to individuals' reactions to anxiety and stress that can be associated with the arousal continuum called the *defense cascade model* presented by Bradley, Codispoti, Cuthbert, and Lang (2001), which posits that an individual's level of defense is organized along a continuum that begins at a calm state during which the individual has yet to perceive any noticeable threat and progresses to the alert phase. The alert phase is post-encounter of a potential threat during which time the individual judges the magnitude of potential danger. Freezing can occur in this phase - a time when the individual is highly activated, hypervigilant and primed for action. The final phase is the action phase, also known as the fight or flight

phase. During these periods of high tension and stress, an individual's ventilation increases causing more oxygen to enter the blood stream - in turn causing more oxygen to enter the brain. A study by Van Diest, Bradley, Guerra, Van den Bergh, and Lang (2009) found that individuals in the final stage of the arousal continuum had a tendency towards hyperventilation, which can cause individuals to feel more stimulated and lightheaded. As reported by Masaoka and Homma (2001), individuals who perceived a threat to be imminent were observed to increase their respiratory frequency. As a result, the authors speculated that anxiety played an "important role in the dyscontrol of metabolic ventilation" (p. 175).

PTSD - hearing and the perception of sound.

Perception of sound is another key area that appears to be effected by both combat and PTSD. Statistics show that hearing loss disability is one of the largest United States military compensation classes awarded to combat veterans. Based on a personal conversation between Doug Ohlin and Maria Mayorga, Mayorga (1997) reports that over the 20 previous years the military had awarded $3.5 billion dollars to combat veterans as compensation for hearing losses. This information suggests that dangerous explosions and heavy artillery fire experienced during combat are responsible for hearing losses as well as for the reactions exhibited by veterans who are exposed to auditory stimuli that cause a re-experience of combat trauma and associated PTS symptoms (Mellman & Davis, 1985). The veterans who experienced such weaponry at close proximity may suffer from symptoms related to exposure to auditory stress. As a result, combat veterans who experienced significant auditory stress may experience difficulty hearing and listening. Moreover, combat veterans may suffer from other vestibular related symptoms related to auditory stress including loss of balance, motion sensing, loss of spatial orientation, compromised muscle tone and posture, and vertigo (Cassandro et al., 2003).

Decibels (dB) are the units used to measure the volume of sound and ultimately sound pressure, which is one of the causes of hearing loss. As reported by The National Institute for Occupational Safety and Health (NIOSH) and overseen by the Center for Disease Control (CDC), the highest volume considered safe is 106 dB with a maxim exposure time of 3.75 minutes (National Institute for Occupation Safety and Health, 2009). Dr. Brian Fligor states that sound levels exceeding 132 dB could result in permanent and immediate hearing loss. He also indicated that the peak sound levels of many firearms exceed the maximum decibels, ranging from 140-145dB for a small rifle to 158-174dB for a large pistol (Fligor, 2010).

The potential stress of high decibels on the auditory mechanisms is the result of blast overpressure. Patterson and Hamernik (1997) reported that the two military situations related to blast overpressure most often reported are "the muzzle blast from firing heavy weapons" and "detonation of explosives and munitions as in incoming artillery rounds" (p. 29). The authors report that the blast overpressure results in the tearing or rupturing of the sensory cells from the basilar membrane in the inner ear. In severe cases, sensory cells are completely torn loose resulting in significantly compromised auditory functioning. In less severe trauma cases the corrosion, repair and defrayal of debris can leave behind a more rigid scar tissue where there was once flexible tissue. During this process, hearing performance is reported to become worse before returning to a stable but permanently compromised auditory performance. The authors suggested that therapeutic intervention during this process might mitigate the loss of hearing (Patterson & Hamernik, 1997).

Other effects of sound on the combat veteran may relate more to psychology or psychophysiology rather than biology, such as traumatic recall. Discomfort with certain sounds can become associated with particular memories or traumatic moments and can become

habituated. Sounds, such as helicopters, planes, fireworks, loud horns, alarms, et cetera, may trigger a combat veteran with PTSD and initiate the chain reaction of GAS (National Institute of Mental Health, 2010). Sounds associated with PTS converge in the basolateral complex of the amygdala where startle and stress systems are stimulated (Coupland, 2000). As a result these sounds can be related to the principal PTSD symptom cluster of hyperarousal, in particular the exaggerated acoustic startle response. Interestingly, certain connections between sounds and body movement appear to be hardwired to the spinal muscles allowing humans to move almost instantaneously (Meloni & Davis, 1998). As reported by Meloni and Davis (1998), in humans the acoustic startle response may involve a direct pathway from the dorsal cochlear nucleus to the spinal system. The authors state that acoustic startle response can be habituated and that repetitive exposure to startle stimuli can reduce the response. However, acoustic startle response studies are inconclusive in humans, but the research seems to present a symptom that is to some degree plastic and with therapeutic potential (Meloni & Davis, 1998).

PTSD - changes in physical activity and behavior.

Some physical body movements and behavioral patterns displayed by combat veterans with PTSD can be understood as the veterans' maladaptive efforts to control and avoid evocations from their traumatic experiences. However, these patterns are difficult to assess. Past reports have indicated a strong association between PTSD and physical ailments, but, so far, direct causation is unsubstantiated.

As reported by Robert Preidt (2010), United States soldiers with PTSD returning from the Iraq, Operation Iraqi Freedom (OIF) and Afghanistan, Operation Enduring Freedom (OEF) Wars are suffering more physical ailments than soldiers without the disorder. The study included data from over 90,000 veterans who sought medical services at the Veterans Administration. The

researchers found that women with PTSD suffered a median of seven reported "physical ailments, including lower spine disorders, headaches and leg-related joint disorders" (¶ 3). The researchers also found that men with PTSD suffered a median of five physical ailments including "lower spine disorders, leg-related joint disorders and hearing problems" (¶ 4) (Preidt, 2010).

Psychologically, when an individual is plagued by long-term chronic intrusive thoughts it affects the person's ability to process stress on a biological level, ultimately affecting the individual's ability to act *in vivo* with their environment. Paradoxically, the longer an individual avoids an activity because of fear counterintuitive behavior happens - the fear becomes worse (Riggs, Dancu, Gershuny, Greenberg, & Foa, 1992). For example, a child decides to muster up the courage to jump off the high diving board, but when the child gets to the top (s)he freezes and can not jump. The longer the child stays at the tip of the diving board and does not jump the stronger the sensation of fear. In an effort to control their anxiety, individuals with PTSD react to thoughts, feelings, bodily sensations, or external stimuli associated with trauma by avoidance (Roemer, Orsillo, Litz, & Wagner, 2001). Their avoidant behavior is thought to be a subjective attempt to gain control over their sensations (Silver, Boon, & Stones, 1983). At times, this behavior can present as withdrawn, sluggish, reclusive, and subdued and can be very similar to symptoms of depression (Fairbank, Ebert, & Costello, 2000). In a report by Das et al. (2005), a cross-sectional analysis of 1,803,323 veterans receiving outpatient care at 136 Veterans Affairs medical facilities in 2000 was conducted which found a substantially high rate of obesity among veterans. Expounding upon these findings Vieweg et al. (2007) conducted a study exploring obesity rates among male veterans with and without PTSD. Their report indicates that PTSD might be a significant risk factor for obesity among veterans: veterans with PTSD averaged a higher body mass index (BMI) (29.28 ± 6.09 kg/m^2) than the BMI of the veterans without

PTSD (27.61 ± 5.99 kg/m^2). Furthermore, their findings indicate that veterans with PTSD were more likely to be obese if they were of a low socioeconomic status, using psychopharmacological medications to treat their PTS symptoms and/or if they were diagnosed with a co-morbid condition (Vieweg et al., 2007). Co-morbid diagnoses commonly identified with PTSD are depression, anxiety disorders substance abuse, antisocial behavior and ADHD (Perkonigg, Kessler, Storz, & Wittchen, 2000).

Paradoxically, and in contrast to withdrawn, sluggish and reclusive behavior, veterans with PTSD can also present with behaviors such as irritability, difficulty concentrating, exaggerated startle response, insomnia and hypervigilance, which are related to the hyperarousal cluster in the PTSD diagnosis (American Psychiatric Association, 2000). Several studies have linked the diagnoses of PTSD and attention deficit/hyperactive disorder (ADHD), indeed this cluster of symptoms seems to be very similar to the symptoms of ADHD (Ford et al., 2000). Ford et al. (2000) found an association between the hyperarousal and hypervigilance symptomatology of both ADHD and PTSD. Weinstein, Staffelbach and Biaggio (2000) agreed with these findings and commented on the need for a better-integrated differential diagnosis between the two disorders.

The detrimental effects of combat on troops are deep, enduring and follow a complex course. Solomon and Mikulince (2006) conducted a 20-year longitudinal study of veterans who were diagnosed but who did not receive any evidenced-based treatment for PTSD. The authors took four measurements at one, two, three, and twenty years from the traumatic experience and found that veterans with traumatic combat experiences had more PTSD symptoms than the soldiers with similar but non-traumatic experiences. Interestingly, the authors found that all PTSD symptoms dropped radically by the third year post trauma but acutely rose again

seventeen years later. The development of PTSD symptoms in later life corresponds to a life stage transition that generally includes some reduction in activity, a change from planning to reflection, and/or a change from occupation to retirement. Over the course of this transition, previously repressed traumatic memories could be stirred up. The authors concluded that veterans with PTSD nearing professional retirement may experience a loss of structure, schedule, self-worth, social standing, and social interaction that may trigger a reduction in a sense of safety and mastery and increased vulnerability that was experienced during their traumatic experiences. The implications of this study are substantial. The study highlights the natural evolution that PTSD has on an individual and highlights the inadequacy of avoidance as a coping mechanism. This study further validates the exposure principles found in the evidence based treatment modalities discussed in chapter three.

Chapter III

Four pillars of trauma therapy

The National Institute of Mental Health (NIMH) recognizes PTSD as an anxiety disorder that affects roughly 7.7 million adults (National Institute of Mental Health, 2011). Brief anxiety is an ubiquitously human emotion; however, an individual suffering from an anxiety disorder is described as living with sustained and immobilizing fear and uncertainty. Unlike other anxiety disorders, PTSD is rooted in specific events: PTSD develops after an individual has been the survivor of a traumatic experience, a loved one has been traumatized, or the individual has witnessed a traumatic event (National Institute of Mental Health, 2010). Due to the easily associated stimuli of traumatic experiences, people with PTSD attempt to avoid situations that stimulate traumatic recall. These associations, such as a helicopter flying overhead or combat anniversaries of the traumatic event(s), can be impossible to completely avoid. As a result, individuals are easily susceptible to situations that provoke extreme anxiety, often triggering flashbacks - repeated evocations of their traumatic experience either while awake or while asleep. A flashback can be relived in the form of visual images, auditory sounds, olfactory smells, or subjective feelings. During a flashback individuals may become fused with their memories and actually believe they are reliving the traumatic incidents. As a result of repeated, unmanaged exposure to traumatic events, people with PTSD can become easily startled, irritated, angry, aggressive and/or violent (Basham, 2008). In an effort to control exposure to these feelings by avoidance or isolation, individuals can experience loss of emotional vitality, of interest in previously enjoyed activities and of intimacy.

Trauma focused therapeutic intervention for PTSD has proven to be very effective. This chapter will examine four key components of PTSD treatment in an attempt to address the

question - How can music be used to compliment the four noted elements of PTSD treatment: 1) exposure, 2) affect regulation and the re-stimulation of attachment skills, 3) mentalization and, 4) acceptance or willingness?

Exposure

The etiology of exposure therapy is grounded in empirical research that claims experiential avoidance underscores many forms of psychopathology including PTSD (Hayes, Wilson, Gifford, Follette & Strosahl, 1996). Experiential avoidance refers to the individual's attempts to suppress unwelcome internal experiences including thoughts, emotions and physical sensations (Walser & Hayes, 2006). Experiential avoidance can take the form of emotional numbness and/or denial and is thought to provoke and maintain PTSD symptomatology (Wagner, Roemer, Orsillo, & Litz, 2003) including psychological and physiological symptoms (Pennebaker, Hughes, & O'Heeron, 1987; Pennebaker & O'Heeron, 1984).

Ironically, experiential avoidance is thought to be an instinctive human reaction to associated traumatic stimuli. Unfortunately, humans are unable to avoid intrusive thoughts without denying whole parts of themselves or engaging in destructive activities that eventually enact a behavioral cost (Walser & Hayes, 2006). While intrusive thoughts are a common human experience, survivors of traumatic experiences are particularly susceptible to invasive thoughts and emotions (Rachman & de Silva, 1978). Considerable evidence reveals that people who have been traumatized are found to habitually suppress intrusive thoughts (Pennbaker & O'Heeron, 1984; Silver et al., 1983), that the conscious avoidance of intrusive thoughts is associated with PTSD (Roemer et al., 2001), and that the act of suppression affects the severity of PTSD symptomatology (Riggs et al., 1992). Walser & Hayes (2006) postulate,

> Efforts at control of one's mood may paradoxically cause the mood to continue and may also lead to the execution of many maladaptive behaviors … what individuals believe to be the antidote may actually be the venom that produces the very problem (p.151).

The failed effort to suppress the intrusive thought(s) is followed by a reappearance of the intrusive thought(s), which is then followed by repeated attempts to suppress the intrusive thought(s) creating a positive feedback loop amplifying the initial undesirable thought or feeling (Wegner, Shortt, Blake, & Page, 1990) and increasing the emotional value associated with intrusive thought(s) (Salkovskis & Campbell, 1994). Trinder and Salkovskis (1994) found that individuals who were asked to suppress their thoughts experienced more intrusive thoughts and greater discomfort with those thoughts. It appears that efforts to void unwanted ideas from consciousness brings closer the very thing trying to be avoided.

The majority of current psychological treatment modalities for PTSD view exposure as one of the central therapeutic mechanisms of change (Rothschild, 2003; Tryon, 2005; Walser & Westrup, 2007). Before the 1960s, psychodynamic therapy treated anxiety disorders through talk therapy by trying to uncover the root of the problem (Olatunji, Deacon, & Abramowitz, 2009). Classical psychodynamic therapy is grounded in the notion that human behavior is governed by unconscious impulses and emotions. Monson and Friedman, (2006) state,

> Freud theorized that, because traumatic events overwhelm the psyche, traumatized individuals must engage extremely primitive defense mechanisms such as dissociation, repression, and denial. Catharsis and abreaction, involving high levels of emotional expression, were considered the necessary treatment for countering these primitive defenses (p. 3).

Through psychoanalysis unconscious motives may become exposed and clients may gain insight into behaviors and may experience the catharsis needed to gain emotional relief, and, potentially, clear the way for more flexible deliberation (Rothschild, 2003). By the 1970s behavioral based therapies took a "learning based approach" in which the individual came in contact with provoking stimuli while actively refraining from avoidant or escapist behaviors (Olatunji et al., 2009). Olatunji et al. (2009) noted that early exposure treatment methods were grounded in research originally conducted in the early 1950s in which researchers observed the behaviors of dogs exposed to "objectively safe stimulus that provoked irrational fear" (p. 172). Solomon, Kamin and Wynne (1953) found that the dogs' initial stress reactions began to mitigate and subsequently lessened with repeated exposure to the stimuli. Referred to as shock-extinction, repeated exposure to the triggering stimuli can cause re-evaluation with regard to the expectation of level of danger (Solomon et al., 1953). Modern day exposure therapies apply some of the same principles to the goal of mitigating PTSD symptoms as a result of a habituation of stress response, however with slightly different protocols. Modern day Cognitive Behavioral Therapy (CBT) emphasizes the role thoughts play in influencing individuals' behaviors, feelings and actions and is a particularly effective method of treatment for PTSD (Cukor, Spitalnick, Difede, Rizzo, & Rothbaum, 2009).

CBT is an overarching theoretical paradigm that includes the evidence based therapeutic treatment modalities Prolonged Exposure (PE) and Cognitive Processing Therapy (CPT) for PTSD (for a more comprehensive list see Dobson & Dozois, 2001). CBT approaches for PTSD treatment have accrued vast popularity for their evidence-based empirically supported efficacy, of which PE and CPT treatments are paramount (Cukor et al., 2009; Deacon & Abramowitz, 2004; Monson et al., 2006). A central component to CBT treatment (generally to CBT and

specifically to PE) is therapeutic exposure to traumatic memories and stimuli that cause evocations of a habituated fear response. PE incorporates *imaginal* and *in vivo exposure* in therapy. In *imaginal exposure* clients record themselves verbally describing targeted traumatic episodes and then listen to that recording daily. During *in vivo exposure* clients come in contact with feared or avoided (but safe) stimuli related to the trauma in an effort to, over time, bring down anxiety related to previously avoided stimuli (Foa et al., 2007). From a PE perspective, the therapeutically contained experience of repeated exposure to previously avoided (but safe) traumatic stimuli is meant to systematically desensitize individuals to their habituated fear response (Rothschild, 2003). In this protocol, exposure is understood to be a critical element of therapeutic change.

Similar to PE, CPT also utilizes the mechanism of exposure but with a slightly different agenda. CPT is designed to target natural feelings and thoughts as well as the manufactured beliefs and faulty interpretations of traumatic events that often prevent individuals with PTSD from coming to terms with their traumatic history (Westrup & Zappert, 2008). This exposure-based therapy has been reported by Westrup and Zappert (2008) to be highly effective at reducing PTSD symptoms. CPT has a number of different PTSD protocols, including individual therapy (Resick, Monson, & Chard, 2008), group therapy (Chard, Resick, Monson, & Kattar, 2009) and couples therapy (Monson, Friedman, & Stevens, 2008). Clients work on held beliefs and evaluations associated with their targeted traumatic events in order to candidly confront how current behavior can be influenced by potentially distorted evaluations of their histories (Shipherd, Street, & Resick, 2006). Safely manifesting individual's thoughts about specific traumatic moments exposes the client's rigid beliefs and cognitive distortions, which according to Foa et al. (2007) are usually situated in at least one of three categories: 1) a concept of self as

utterly incompetent; 2) a belief that the world is a completely dangerous place, and 3) a sense of guilt that comes with the rigid belief that the self is to blame for the traumatic incident.

While exposure based therapies have strong scientific evidence supporting efficacy, according to Olatunji et al. (2009) these interventions also have a public relations problem, particularly among clinicians treating clients for PTSD (Becker, Zayfert, & Anderson, 2004). Olatunji et al. (2009) note that some practitioners hold a negative view of exposure therapies due to treatment protocols that initially cause distress and exacerbate symptoms rather than provide relief. Slater (2003) in the article "The cruelest cure" states that the cure for anxiety disorders such as PTSD is terrifying and quotes Victoria Wolfson, a psychiatrist at Boston Medical Center, "I think very few patients can tolerate that adrenaline-based approach" (p. 3). This could account for past reports that indicate a low rate of exposure therapy being conducted in Veterans Affairs clinics (Foy et al., 1996). In light of this viewpoint, the benefits of therapeutic interventions that could complement exposure therapies and provide internal self-regulatory supports during the practice of exposure activities are worth consideration.

Mentalization

Left unchallenged, negative evaluations and cognitive distortions about the self and others can become indelibly rigid for individuals with PTSD. As such, the process of mentalization is a critical agent in the therapeutic process of change (Ballenger et al., 2004). Mentalization is the process of making meaning and attending to one's actions and state of mind as well as the actions and mind-set of another (Bateman & Fongay, 2004). Mentalization involves self-reflection in the effort to understand one's and other's actions, as elucidated by Allen (2003), "in terms of intentional mental states, such as desires, feelings, [and] beliefs" (p. 2).

Importantly for individuals who suffer from PTSD, mentalization is not limited to the specific mental state of the present moment but can be utilized to make meaning of past, present and potential future experiences (Allen, 2003). The abilities to adaptively exercise self-reflection, apply healthy insight into diverse internal and external mental states, and to adaptively communicate one's affective state to another are considered to be the critical components of mentalization. Allen (2003) states,

> We mentalize when we treat others as persons rather than objects… These natural reactions … are infused with moral attitudes and judgments; these reactive attitudes, in turn, are bound up with our experience of others and ourselves as free agents. Mentalizing is our inherently personal interactions with others, we are not usually objective, detached, or indifferent. Our natural interactions have a moral dimension to the degree that we approve or disapprove of others' actions; we feel grateful or resentful. These reactions are intrinsic to mentalizing interactively in all our relationships (¶ 7).

As such, mentalization is an essential component of healthy relationships - not only with others but also with one's self (Bouchard et al., 2008).

Gaining insight into affective states can provide individuals with PTSD the mentalizing experience of making meaningful connections between their traumatic experiences and the cognitive distortions commonly associated with PTSD that often lead to the diagnostic symptoms of PTSD, such as social avoidance and isolationism, irritability, anger, hypervigilance, difficulty falling asleep, exaggerated startle response, sense of foreshortened future, recurrent intrusive thoughts, numbness, and dissociation. Seligman (2007) postulates that individuals with PTSD "May well be prone to pathological idealization [and] paranoid projections of internal

malignancies ... Thinking reflectively and making meanings that make sense are a crucial aspect of feeling secure in the world" (p. 324). As such, many forms of PTSD therapy consider psychoeducation to be an important component of treatment (Ballenger et al., 2004; Oflaz, Hatipoğlu, & Aydin, 2008; Dorrepaal et al., 2010; Murphy, Pynoos, & James, 1997; Lubin, Loris, Burt, & Johnson, 1998; Neuner, Schauer, Klaschik, Karunakara, & Elbert, 2004).

The International Consensus Group on Depression and Anxiety issued a statement that emphasized the importance of psychoeducation in the treatment of PTSD (Ballenger et al., 2004). The consensus statement reflected the opinions of some of the world's foremost authorities on the treatment of PTSD and offered specific therapeutic recommendations in an effort to provide the most effective evidence-based practices for clients. The recommendations of the group have implications for the VA system as a major provider of PTSD treatment for combat veterans (Rosen et al., 2004). Rosen et al. (2004) generated an overview of current practices in the Veterans Affairs system and identified specific aspects of PTSD treatment, including psychoeducation, reflecting the statement of the International Consensus Group on Depression and Anxiety.

Making meaning of the physical sensations associated with PTSD can provide individuals with the understanding that PTSD significantly dysregulates the body and is not just a psychological disorder. As such, it is worth considering activities that provide safe, meaningful experiences for clients to engage in that promote mentalization. The recent use of *behavioral activation* techniques such as yoga, music and other mindfulness practices in PTSD therapy (*Integral Yoga Magazine*, 2009) reflects this intention. During an interview with *Integral Yoga Magazine* (2009), Van der Kolk states,

> The challenge is to learn how to tolerate feelings and sensations by increasing the capacity for interoception or sitting with yourself, noticing what's going on inside … the function of emotion is e-motion, to engage in action … [the] challenge is to learn how to notice what is happening and how things can and will shift, rather than running away (p.1).

Adjunct therapies, such as yoga, can act as a medium by which individuals can safely sit with their internal physical, cognitive and emotional sensations. These therapeutic activities can function as a mentalizing experience for trauma survivors by encouraging body, mind and spiritual connections while engaging in meaningful activities - ultimately leading to the regulation of affect (Emerson et al., 2009). Emerson et al. (2009) state,

> For thousands of years, Yoga has been offered as a practice that helps one calm the mind and body. More recently, research has shown that Yoga practices, including meditation, relaxation, and physical postures, can reduce autonomic sympathetic activation, muscle tension, and blood pressure, improve neuroendocrine and hormonal activity, decrease physical symptoms and emotional distress, and increase quality of life (p. 124).

Affect Regulation and the Re-stimulation of Attachment Skills

Exposure and adjunct therapies are understood to encourage mentalization and the adaptive integration of anxiety provoking stimuli. By repeated exposure it is thought that stimuli become more predictable and, in turn, an individual becomes more securely organized, psychologically flexible, and develops a greater capacity to self-regulate emotions (Davies, 2004). Notably, the inability to manifest a workable strategy for managing relational stress and anxiety is a characteristic of both insecure attachments and of PTSD (Schore, 2000). Schore

(2000) proposed that PTSD causes structural changes to the limbic system and the ANS, leaving the individual with an inability to employ adaptive anxiety coping mechanisms. Van der Kolk (n.p.) observed that combat PTSD causes dysregulation at a nearly instinctual infantile level resulting in complex dysregulation of internal flexibility and stated, "I was very struck by the similarity, in some ways, by babies and combat Veterans with PTSD, in that if something happened that frightened them they would have catastrophic reactions – they would scream and yell and freeze" (Van der Kolk, n.p.)

PTSD severely undermines psychological and physiological skills in self-regulation with combat PTSD being the most disruptive - dysregulating object relational, interpersonal and family functioning (Renaud, 2008). In Renaud's (2008) investigation of combat veterans' attachment styles, combat veterans demonstrated clinically significant levels of preoccupied, fearful, or dismissing insecure attachment styles. In another study, male veterans who were suffering from combat PTSD were reported to have the highest rates of divorce, unemployment, and interpersonal domestic violence as compared to individuals with other forms of PTSD (Prigerson, Maciejewski, & Rosenheck, 2001). This study expounded upon a previous study depicting the intimate interpersonal relationships of combat veterans with PTSD as riddled with greater violence and emotional disconnectedness (Beckham, Feldman, Kerby, Hertzberg, & Moore, 1997). Beckham et al. (1997) found, "Combat veterans with PTSD reported significantly greater occurrence of violent behaviors over the past year (22 acts) versus combat veterans without PTSD (.2 acts)" (p. 859).

Children of male combat veterans with PTSD were found to have significantly high rates of depression, anxiety and interpersonal aggression (Glenn et al., 2002). Left untreated, the potential cost to future generations by the intergenerational transmission of PTSD symptoms can

be significant. However, research suggests employment of adaptive mentalization skills by individuals with PTSD can be a component in the mitigation of intergenerational attachment dysregulation (Meins et al., 2003). To the extent that a caregiver is able to understand his/her own affective states predicates the caregiver's ability to successfully attune to the various mental states of a child and is implicated in the formation of secure attachments (Koren-Karie, Oppenheim, Dolev, Sher, & Etzion-Carasso, 2002). In sum, the studies suggest that PTSD relating to traumatic combat experiences negatively influences object relational attachment, coping strategies, the regulation of affective states of hyperarousal, stress and fear, the intergenerational transmission of affective regulatory skills, and an avoidant schema for managing intrusive sensations. Based on these studies, the efficacy of PTSD treatment that aims to rebuild the veteran's experience of emotional connectedness by utilizing mechanisms that foster secure object relational attachment and helps to re-foster the subsequent skill of affect regulation is apparent.

Attachment theory has been furthered by the scientific findings of child psychiatrist and neurobiologist Allan Schore (1994), as well as others, substantiating what therapists have anecdotally suggested for years – that the therapeutic relationship between client and clinician may help to rebuild missing or dysfunctional object relational attachments (Rothschild, 2003). Schore (2000) observed that secure attachments are generated by successful affective attunement by important relational objects and indicated that the shape and contour of non-verbal interactions between infant and primary caregivers are extremely complex and advanced. Of critical importance to emotional and temporal development, these non-verbal communications are primarily communicating emotional affect. Stern (1999) suggests that the behaviors involved in the process of attunement convey the subjective sense of the quality of a relationship and

coined the term *vitality contours* to describe this complexly dynamic relationship that is reliant on communication taking place without overt use of verbal language. Stern advocates that facial gestures, body movements and prosodic vocalizations transmit inner thoughts about internal emotional states and are transmitted intentionality to communicate an affective message (Stern, 1985). The influential quality of these interactions is said to hinge on how well an individual is able to attune to the affective tone of another. These everyday, moment-to-moment, minute interactions provide the patterning of stimulation-gratification that individuals take-in as affective templates. Stern (1985) comments, "Affect attunement … is the performance of behaviors that express the quality of feeling of a shared affect state without imitating the exact behavioral expression of the inner state" (pg. 142). Haft & Slade (1989) observed that secure attachments were most often formed when individuals were able to meet three criteria: 1), attune to a wide range of multi-modal sensory stimuli and diverse affective states; 2), be objective in their perception of non-verbal cues; and 3), not become reactive or triggered in any predictable pattern. Healthy attunement was characterized by Haft & Slade (1989) as "flexible and open, with room for a gamut of emotional experiences" (pg. 170).

Much is written about the phenomenon of attunement and its influential role in the quality of attachment relationships. Malloch and Trevethan (2009) provide a working model of how the process of attunement is performed *in vivo*. The authors compellingly assert that the quality of one's attachment is literally performed *in vivo* by human beings' innate musicality (Malloch & Trevethan, 2009). Panksepp and Trevarthen (2009) write,

> The sounds of music communicate emotions vividly in ways beyond the ability of words and most other forms of art. It can draw us together in affectionate intimacy, as in the first prosodic song-like conversations between mothers and infants. It can carry the

> volatile emotions of human attachments and disputes in folk songs and grand opera, and excite the passions of crowds on great social occasions (p. 105).

By combining concepts inherent to the expressive arts (imagery, storytelling, dance, music, drama, poetry, movement, and visual arts) and the fields of neurochemistry, neurobiology, developmental psychology, and cultural anthropology, communicative musicality elucidates an operational definition of how attunement is achieved (Trevarthen & Malloch, 2000). Communicative musicality is defined by these authors as pertaining to the seemingly innate melodic and rhythmic vocal and non-vocal interactions between humans (Malloch & Trevathen, 2009). Communicative musicality is the medium by which the intergenerational transmissions of culturally appropriate meaning(s) are co-created *in vivo* between the infant and caregiver (Dissanayake, 2009). Human beings' innate sense of musicality enables individuals to have a sense of shared experiences in time together (Osborne, 2009b). The *modus operandi* of the attunement process, indicated by rhythmic and melodic responses to communicative vocalizations, facial cues or uses of body language, are in the service of individual's desire, as stated by Stern (1985), "to be with," "to share," "to participate in," and "to join in," (p. 148) the world of another. The individual's innate musicality is in service of the individual's need for companionship and engagement one-on-one or with many.

As proposed by the theory of communicative musicality, it is possible that the mechanisms implicit in the expressive arts can be used to re-stimulate attachment skills in individuals with PTSD. Moreover, it seems important that PTSD treatment for combat veterans take place in therapeutic group environments where successful attunement as well as empathetic failures can be worked with and witnessed by all to learn from. Ironically, the process by which

one attends to another's presentation is to a large extent an unconscious activity. Haft and Slade (1989) observe that individuals become most aware of the attunement process in its absence - during times of empathetic failures or misattunements. Haft and Slade (1989) write,

> When [one] selectively attunes to a particular kind of emotion … e.g., sadness, the [individual] learns not only that this state holds special status … but perhaps that recreating it is one of the few ways the [individual] has available for achieving intersubjective union with [another]. Stern (1985) points out that this carving up of the [individual's] experience … can be the beginning of development of the "false self" as Winnicott (1965) described it (p. 169).

Through successful repair of empathetic failures, group members and clinicians can practice the act or process of attunement enabling group members to rekindle attachment skills and gain insight into the mechanisms that influence affective regulatory development.

Acceptance & Willingness

For individual or group therapy to take place, clients must be willing to seek therapeutic interventions. This act alone demonstrates a first step in an individual's willingness to make changes in his/her life. Bryant (2006) states,

> Some individuals may display excessive avoidance that precludes effective therapy … For example, some patients may not attend therapy sessions, be late for sessions, refuse to comply with exposure homework, or perform exposure in a superficial manner. This level of avoidance can reduce therapy efficacy and can lead patients to believe that they are not responsive to [therapy] (p. 211).

From cognitive behavioral perspectives, the lack of willingness is a form of avoidance. From a CBT perspective, failed attempts to avoid or control unwanted emotions or thoughts actually exacerbate PTSD symptomology (Trinder & Salkovskis, 1994). As such, continuous attempt to control uncontrollable emotions and thoughts is understood as an impasse to emotional healing - the acceptance of this perspective is understood as a developmental achievement in the therapeutic relationship (Batten & Orsillo, 2005; Miehls, 2011). While working with a client's conceptualization of control and avoidance as a central problem to PTSD symptomology, the metaphor of a "Chinese finger trap" can be used to elucidate this point (Gifford, Hayes, & Strosahl, 2005). The straw tube by itself is flexible and not very strong. After fingers are inserted into the tube, the more force exerted while attempting to pull out the fingers the more rigid, inflexible and tight the tube becomes. It becomes virtually impossible to pull out the fingers by force. Metaphorically, the straw tube can be thought of as the individual's unwanted private emotional experiences. The more the individual attempts to break free, avoid or control the unwanted emotions the more fixed the emotions become – exacerbating PTSD symptomology (Riggs et al., 1992). Like freeing one's self from a Chinese finger trap, a stance of turning into one's sensations creates an openness and acceptance of one's private emotional events and can lead to a sense of subjective liberation (Walser & Hayes, 2006). However, this is not to be misconstrued to mean victims of trauma should accept abusive environments. Clinicians work to simultaneously encourage clients to make changes in their lives that they have the power to change and to accept the emotions, thoughts, and memories that they cannot as the means to emotional healing (Walser & Hayes, 2006). In this sense, acceptance becomes a behavior that can be practiced in the same way a musician practices an instrument. Acceptance

is understood as one's willingness to be open to whatever one is feeling and to commit to making behavioral decisions that are in line with his/her values (Batten & Orsillo, 2005).

Many terms describe the behavioral concept of acceptance; Ghent (1990) applies the word surrender for this purpose. He postulates that surrender in the therapeutic sense is vastly different than the concept of surrender during combat. Therapeutically, Ghent (1990) states,

> Surrender has nothing to do with hoisting a white flag; in fact, rather than carrying a connotation of defeat, the term will convey a quality of liberation and expansion of the self as a corollary to the letting down of defensive barriers (p. 108).

This letting go of defensive posturing is not a passive act of submission but rather a proactive stance of acceptance, enabling a person to be liberated from rigid paradigms and emboldened to let go of the agenda of control and avoidance. In a sense, the softening of inflexible defense mechanisms creates a vulnerability that generates space for new emotional experiences (Miehls, 2011). Vulnerability is believed by Ghent (1990) to enable the creation of a safe and accepting environment and to be in the service of an innate human yearning to be known and understood by another. This is the reason Miehls (2011) views surrender as a developmental achievement in intimate relationships. This author goes on to note that surrender entails a process that over time may cause an individual to feel "a sense of calm and lowered anxiety," and emerge with a re-synthesized sense of "being emotionally connected to another" (p. 8). In other words, the behavioral aspect of surrender or acceptance is the willingness to be open to whatever one is feeling and to commit to making behavioral decisions independent of outcome (Batten & Orsillo, 2005).

As the concept of acceptance is understood to be a developmental achievement in emotional healing, the fostering of acceptance in the therapeutic relationship merits discussion. In the individuals' desire to be known and understood, the environment of a therapeutic relationship can provide a unique opportunity to develop acceptance by examining the co-created mutually subjective interactions of clients and therapists (O'Shaughnessy, 1983). By analyzing the therapeutic relationship, the experience can expose cognitive distortions about the self and another that left unexamined could entangle the client/therapist relationship and could lead to a therapeutic impasse due to dysfunctional relational precedents. Miehls (2011) elucidates that when inflexible interpersonal relationships and cognitive distortions are rigidly reinforced and reenacted, individuals can become locked into binaries – good and bad, victim and victimizer, safe and unsafe, submissive and dominate. As a result, restructuring a sense of self and another is a task that requires both the client and therapist to be willing to commit to an active stance of intersubjective acceptance - what one-person experiences in any given interaction may be very different than what the other experiences.

The examination of both the client's and analyst's intersubjective experiences can be understood by what Ogden (1994) conceptualizes as the "experience of the analytic third" (p. 3). This *third space* can enable the development of relational capacities by providing a safe space to practice self-reflection, acceptance, willingness and commitment to valued actions. The *analytic third* is a conceptualization based on Winnicott's (1971) formulation of *potential space*, referring to the "intermediate area, or potential space between subject and object … filled with the products of … creative imagination … [and] what is injected into it" (p. 101). The space of the analytic third is understood as a space where imagination can develop and the creativity of behavioral acceptance and surrender can manifest (Miehls, 2011). It is from this third space that

individuals can become diffused from their cognitions and can safely observe the unconscious process of recreating, as expressed by Ogden (1994), a "present moment of the past" (p. 3). It has been said that how one does anything is similar to how one does everything, and from a behavioral perspective the analytic third becomes a space where individuals can reflect on their behavioral patterns relating to their acceptance or struggle of internal experiences.

Acceptance, surrender and willingness can be further fostered through the practice of mindfulness. Mindfulness can be defined as a practice of attending completely to the present moment with focused, non-judgmental attention (Luterek, Tarver, & Simpson, 2007). Luterek et al. (2007) write,

> The goal of mindfulness [is] to increase mindfulness, awareness, and acceptance of internal experiences (e.g., thoughts, feelings, memories, bodily sensations) and decrease attachment/fusion to these experiences (i.e., seeing oneself as separate from their pain, thoughts, feelings, memories) (p.1).

The practice of mindfulness requires individuals reengage with the present moment more fully and has been shown to compliment exposure therapy (Hazlett-Stevens & Borkovec, 2001). By including a brief mindfulness relaxation exercise prior to exposure therapy, Hazlett-Stevens and Borkovec (2001) find that the experience produces better therapeutic outcomes. Wilson and Dufrene (2008) observe that since therapy is concerned with gaining insight and learning new and more adaptive behaviors, it makes sense that the inclusion of a practice such as mindfulness - fostering focused, non-judgmental attention to the present moment - increases therapeutic efficacy. Interestingly, the content of mindfulness exercises can be highly diverse. Wilson and Dufrene (2008) conjecture,

> Just look around at the various schools and practices in the traditions from which mindfulness emerged: mantras, breathing, walking, sweeping, playing the flute … the list goes one. What this suggests is that mindfulness can be effectively and usefully applied to a wide variety of content (p. 87).

As such, developing a practice of mindfulness is less about the content or outcome as it is about the process. Noticing - being mindful of the small details of everyday life such as one's breath, pulse, physical sensations, et cetera - can help ground individuals, as stated by Wilson and Dufrene (2008), to the "here and now, and to notice how quickly thoughts take us away from experience" (p. 89).

Acceptance and Commitment Therapy (ACT) is a behavioral intervention for PTSD that, as the name implies, is built on the mechanisms of acceptance and commitment. Unlike PE and CPT, ACT does not explicitly work with the details of traumatic events. Instead of the PE and CPT interventions aimed at desensitization through exposure, ACT helps trauma survivors to exercise acceptance and to find a new way of living grounded in choice and personal value (Walser & Hayes, 2006). Individuals with PTSD have been found to have powerful sensations, experiences, evaluations, and judgments related to traumatic stimuli that cause them to live in a state of reactivity to their internal sensations (Roemer, Orsillo, Litz, & Wagner, 2001). As a result, an individual with PTSD can spend significant energy working to avoid or control anything that can conjure internal sensations associated with traumatic recall (Pennbaker & O'Heeron, 1984; Silver, Boon, & Stones, 1983). The option ACT offers to a client is either to, 1), continue living a life trying to control/avoid unwanted sensations and accept the behavioral cost associated with that decision or 2), to choose to live a life rooted in action based upon

personal values and accepting that unwanted sensations will show up. From an ACT perspective, individuals can reclaim a life of enhanced personal value as long as they are willing to accept that from time to time traumatic stimuli may be evoked. ACT addresses the normalcy and futility of experiential avoidance by helping the client assimilate traumatic memories into a life of flexibility and value (Walser & Hayes, 2006). From an ACT perspective, individuals can become fused with their thoughts, beliefs and cognitive distortions. Cognitive fusion is the entanglement of one's thoughts as reflecting the truth rather than reflecting what they are – thoughts (Walser & Hayes, 2006). For example, from an ACT perspective there is a significant difference between the statements, "I am an angry person," and, "I am having the thought again that I am feeling angry." The later statement is less prescriptive and reflects a more diffused perspective than the first. Through experiential exercises, clients begin to see how thoughts play a role in how one decides to engage with behaviors and activities. As elucidated by Batten and Orsillo (2005),

> The methods used in ACT are specifically directed at decreasing the clients' use of avoidance or escape strategies in coping with unwanted thoughts, emotions and memories and at increasing their acceptance of, or willingness to experience, these private events while engaging in previously avoided behavioral action (p. 97).

As such, a significant component of ACT is what theorists call behavioral activation (Cornelius, 2010). Behavioral activation is the act of performing safe activities that are in line with ones' values even if it means experiencing unwanted symptoms. With the commitment to action as a treatment goal, the client's attention is turned away from cognitive/emotion suppression and turned toward activating behaviors that are self-defined as important (Deliberto,

2008). In this regard, adjunct therapies, such as yoga, art and music, can provide a bridge from the psychological principles of ACT to the ultimate goal of behavioral activation. For individuals who suffer from PTSD, ACT offers individuals a choice that is rooted in behavioral activation and adjunct therapies provide a medium to practice action. By providing behavioral experiences in tandem with ACT therapy, clients have a potential medium to practice new activities while in the safety of an environment in which the experiences can be worked with therapeutically.

In conclusion, therapeutic interventions for PTSD have proven to be very effective and, at the same time, controversial. The four pillars of trauma therapy - 1) exposure, 2) affect regulation and the re-stimulation of attachment skills, 3) mentalization and, 4) acceptance or willingness are essential in understanding and treating the range of PTSD symptoms. Importantly, these four aspects of therapy do not occur in isolation, rather the four pillars of trauma therapy are conceptualized as implicit elements present in effective therapeutic exchanges used to treat PTSD. This chapter examined four key components of PTSD treatment in an attempt to address the question – How can adjunct therapies such as music be used to compliment the four noted elements of PTSD treatment: 1) exposure, 2) affect regulation and the re-stimulation of attachment skills, 3) mentalization and, 4) acceptance or willingness?

Chapter IV

Biopsychosocial of Music

The observation that music can influence human behavior physiologically, psychologically, and sociologically is not new; indeed, some of our most foundational philosophers including Pythagoras, Plato, Confucius, and Socrates have made direct reference to this topic (Eagle, 1996). Plato expostulated:

> Aren't these the reasons, Glacon, that education in music and poetry is most important? First, because rhythm and harmony permeate the inner part of the soul more than anything else, affecting it most strongly and bringing it grace, so that if someone is properly educated in music and poetry, it makes him graceful, but if not, then the opposite. Second because anyone who has been properly educated in music and poetry will sense it acutely when something has been omitted … since he has the right distastes, he'll praise fine things, be pleased by them, received them into his soul, and, being nurtured by them, become fine and good (Plato, trans. 1894).

Eagle (1996) presents a chronology of textbooks published on music psychology and physiology that begins in 1862 with Hermann Helmholtz's publication "On the Sensations of Tone" and includes 11,000 bibliographic citations on music psychology through 1995. More recently, Tervaniemi (2009) summarized the current empirical studies in the field of the neurosciences of music. These writings demonstrate that music has an ability to conjure emotional and aesthetic responses in listeners and document the complex unique mental and emotional responses each individual has to a piece of music. The articles elucidate the cathartic connection humans have to music and also the highly variable and individualistic nature of musical experiences.

Engaging in musical group activities has been suggested as a medium providing therapeutically corrective psychosocial experiences (Sears, 1968; Eagle, 1996; Cross & Morley, 2009; Soundfeelings, n.d.). *Entrainment* is a phenomenological occurrence and cornerstone of music psychophysiology that is understood as the physiological synchronization between various sensory inputs and the bodily metabolic functions (Berger & Schneck, 2006). First discovered by 17th century Dutch scientist Christian Huygens, the phenomenon of entrainment was observed when he put two pendulum clocks on the wall next to each other. Huygens observed that when the two objects in motion were placed in close proximity to one another they became synchronized, vibrating and moving in rhythmic harmony (Soundfeelings, n.d.). The phenomenon of entrainment has an existential quality applying to various fields of study including biology, pharmacology, astronomy, physics, sociology, music and psychology (Soundfeelings, n.d.). Entrainment as it relates to music is elucidated by Sears' (1968) statement, "music demands time-ordered behavior" (p. 33). Sears (1968) posits that the interactive musical experience is a medium that promotes internal regulation of affect. Sears' argument that an individual's time-ordered, rhythmic relationship to music advances internal physiologic and psychological organization is a key theoretical underpinning which advanced the field of music psychology. Patel, Iversen, Chen, and Repp (2005) understand entrainment as a type of rhythmic "synchronization" (p. 226), noticing that a musical experience can provide a medium for internal self-organization and, consequently, an opportunity to experience the self in relation to others. The crux of the theory of synchronization is that mental health becomes compromised when people become out of tune with their own internal rhythms and/or the rhythms of their social environments (Eagle, 1996). The biopsychosocial synchronization Patel et al. (2005) proposed can also be understood as musical entrainment (Cross & Morley, 2009).

Cross and Morely (2009) suggest that group musical experiences provide a conduit for psychosocial musical entrainment and an intersubjective experience involving an interactive coordination of rhythmic/melodic engagement of self with others.

Expanding on these and other foundational theories Trevarthen and Malloch (2000) coined the term *communicative musicality* by observing that pre-verbal infants' and their caregivers' interactions have a striking sense of "melodic and rhythmic co-creativity"(p.2) and describing the parent/infant interactions as latent with "nonverbal" communication, which contain three parameters "pulse, quality and narrative" (p. 4). This non-linguistic communication was taking place through prosodic vocalizations, facial and gestural movements, and, strikingly, was observed to be infant directed (Trevarthen & Malloch, 2000). Not only does communicative musicality explain the process by which humans can transmute affect and emotion, the intergenerational transmission of cultural and ethnic traditions and values, and the *modus operandi* for pre-verbal dyadic, object relational communications, but also the biological origins of our musicality and, potentially, provides a backdrop to address the question: Why are humans so attached to musical experiences? Panksepp and Trevarthen (2009) state:

> As development proceeds, emotions come to express moments of wonder, longing, joy, rage, pride, fear or gentle affection, and these are woven into complexes of rhythm and melody that may become unforgettable, precious memories in the art of an historic culture, inseparable from rituals of many kinds that rule the way humans come to move and feel together (p.106).

Is this potentially why humans have such authentic, personal, cathartic, but highly individualistic attachments to music?

This chapter illustrates the highly variable and individualistic responses to diverse musical stimuli and highlights the multivariate and affective power of music. The biopsychosocial impacts of music are examined: 1) the physiology of music as it relates to basal metabolism, the heart, breath & respiration, and the perception of sound stimuli; and 2) the psychosocial affect of music as a means to influence human behavior(s).

The Physiology of Music

Music – the mind, body and basic metabolic functioning.

Basic regulation and the metabolism of energy is one of our most important bodily functions. The body must maintain a nimble metabolic flexibility in order to balance the energy needs of vital organ functioning while responding to the demands of an ever-changing social environment. An interruption in this balance has been found to occur as a result of certain chronic health illness conditions. One of the health conditions that can disrupt this balance is PTSD. A large body of research suggests music modulates some of the same physiological systems that PTSD dysregulates: the metabolic response to stress and fear; the neurotransmitters of dopamine, norepinephrine, serotonin, and the neuromodulator oxytocine; and neuroplastic changes in the brain, potentially playing a role in stimulating the development of new neurological pathways. In order to maintain internal balance the body must be able to assess both the internal physiological needs and the demands of the external environment.

As social environments are constantly changing, individuals are constantly evaluating situations to determine the level of safety. The limbic system, located deep in the brain's temporal lobes, is associated with mediating the perception of external stimuli with internal reaction instinctually related to survival and metabolic homeostasis (Kimball, 2009). Berger and Schneck (2006) refer to the limbic system as the “emotional brain” (p. 747) and include the

hippocampus, thalamus, amygdala, parolfactory area, mamillary body, fornix, and the hypothalamus (Berger & Schneck, 2006; Dolan DNA Learning Center, n.d.). As the limbic system is considered to be the emotional center of the brain, it is one of the primary sites being explored for the impact of music on PTSD. Furthermore, trauma is reported to interfere with the integration of left and right hemisphere brain functioning that is facilitated by the brain region called corpus callosum. Cook, Blaustein, Spinazzola, and Van der Kolk (2005) state, "under stress analytical capacities (left brain based) disintegrate, and emotional (right brain based) schemas of the world take over, causing them to react with uncontrolled helplessness and rage" (pp. 10-11). As a result, traumatized individuals can display vast incongruities in both subjective meaning making and the evaluation of and response to the environment (Cook et al., 2005).

Over the past decade, promising research has revealed that musical experiences can promote neuroplastic changes in the brain and may play a role in stimulating the development of new neurological pathways that can become inhibited due to trauma (Chakravarty & Vuust, 2009; Fujioka, Trainor, Large, & Ross, 2009; Hyde et al., 2009; Pantev, Lappe, Herholz, & Trainor, 2009; Trainor, Shahin, & Roberts, 2009; Wong, Perrachione, & Hellmuth Margulis, 2009). Schlaug (2009) states, "Making music places unique demands on the nervous system, leading to strong coupling of perception and action mediated by sensory, motor, and multimodal integrative regions distributed throughout the brain" (p. 372).

Development of the cortex region of the brain appears to be particularly influenced by the effects of music. Recent studies have demonstrated that learning to play a musical instrument can promote cortical reorganization changes. In one study researchers compared two groups - a sensorimotor-auditory group who learned to play a short musical sequence on the piano and an auditory group who solely listened to the musical sequence. The results demonstrated more

significant changes in the cortex of the individuals in the sensorimotor-auditory group. These participants showed better discrimination of tonal frequencies and musical representations demonstrating that learning how to play an instrument causes cortical reorganization (Pantev et al., 2009). In another study, Chakravarty and Vuust (2009) found that individuals who learn to play musical instruments have an increased grey-matter volume density in the cortex. The authors concluded that this is what enables musicians to concurrently listen and reproduce music *in vivo*. In their research, Trainor et al. (2009) elucidate how gamma band responses - commonly associated with attention, expectation and the processes of top-down and bottom-up brain cognition - were much larger in individuals who practiced music. The authors deduce that musical training enhances the oscillatory networks of the brain that control executive functioning and may enhance other cognitive domains. In a longitudinal study, researches Hyde et al. (2009) found that individuals engaged in long-term instrumental training showed greater motor behavioral improvements as compared to the control group and that musical training changed the precentral gyri, corpus callosum, and the auditory cortex brain regions, which is consistent with previous studies on brain differences between adult musicians and nonmusicians (Gaser & Schlaug, 2003; Lee, Chen, & Schlaug, 2002; Schlaug, Jancke, Huang, Staiger, & Steinmetz, 1995; Schmithorst & Wilke, 2001; Schneider et al., 2002). Research clearly demonstrates that music education may be an important tool to promote neuroplastic changes in certain brain structures. However, individuals do not need to learn to play an instrument to have therapeutically powerful cathartic experiences.

In addition to the influence on cortex functioning, listening to music has been found to be an important tool in accessing individuals' affective emotional memory states. As PTSD has been associated with atrophy of the hippocampus and memory, music may be an important

element to include in the therapeutic process. Numerous studies have shown that listening to music can trigger activity in parts of the limbic system, particularly the amygdala and the hippocampus (Brown, Martinez, & Parsons, 2004). During traumatic events, one of the endogenous actions in the brain is the release of opioid peptides in the amygdala and the periaqueductal gray (PAG). Harikumar et al. (2006) noted that opioid peptides in the brain locations contribute to the modulation of pain and of defensive behavior. In their study about the effects of music on medical procedures, Harikumar et al. (2006) found that listening to music during a colonoscopy procedure significantly helped to reduce the amount of sedative medications administered. Moreover, results indicated a significant decrease in subjective discomfort during the procedure (Harikumar et al., 2006). Researchers Stefano, Zhu, Cadet, Salamon, and Mantione (2004) studied the potential connection between the sensations of euphoria while listening to music and the opiate circuits in the brain. The researchers concluded that the *"mu* opiate receptor … showed a statistically significant increase [in activity] in subjects in the music group compared to the control" (p. 18). The advances of neuroscience continue to provide empirical evidence about how music causes neuroplastic brain changes. As such, it is likely that music can be used explicitly to affect individuals' subjective evaluation of experiences and influence internal psychophysiologic flexibility.

Music has been associated with the uniquely intense, euphoric psychophysioloical response of shivers-down-the-spine. Blood & Zatorre (2001) sought to elucidate the earlier work of Panksepp (1995) by having subjects listen to self-selected classical music to produce the psychophysioloical euphoric experiences of "shivers-down-the-spine" or "chills" (p. 11818) to study the musical effect on the reward/motivation areas of the brain including the ventral striatum, midbrain, amygdala, orbitofrontal cortex, and ventral medial prefrontal cortex. Blood

and Zatorre (2001) found that the levels of regional cerebral blood flow (rCBF) increased in the "left ventral striatum and dorsomedial midbrain … and decreased in the right amygdala, left hippocampus/amygdala and the [ventral medial prefrontal cortex] VMPF" (p. 11821) during musically induced chills. While past reports have shown that modulation of the amygdala during states of euphoria is inconclusive (Schilström, Svensson, Svensson, & Nomikos, 1998), Blood and Zatorre's work suggests a possible "mechanism for decreasing activity in these regions as a consequence of … emotional responses to music" (p. 11823). Brown et al. (2005) sought to study the psychophysioloical euphoric experiences of shivers-down-the-spine to substantiate that music can elicit powerfully positive feelings activating the reward systems of the brain without an intentional therapeutic goal. Their research demonstrates that passive musical listening has the power to stimulate unprompted activation of the limbic and paralimbic areas (Brown et al., 2004) and supports the view of Panksepp and Trevarthen (2009) who suggest that musical exposure may promote neuro-genesis in the hippocampus.

Specific physiologic responses to music have been researched. In the study "Musical consonances and dissonances: Are they distinguished independently by the right and left hippocampi?" Wieser and Mazzola (1986) concluded that the left and right hippocampus respond to the consonance and dissonance of tonal music intervals in specific and distinctly different patterns. The EEG results revealed that only the left hippocampus responded to differences in consonance and dissonance, while the right hippocampus showed a more specific response, reacting to intervals that naturally exist in a major scale (major 2^{nd}, major 3^{rd}, perfect 4^{th}, perfect 5^{th}, major 6^{th}, major 7^{th}) found typically in Western diatonic music. Another study by Fujioka et al. (2009) demonstrated that when passively listening to music, the naturally occurring electrical currents of individuals' auditory cortices began to oscillate in rhythm with

the musical beat. These studies verify Christian Huygens earlier notion of entrainment. **B**y magnetoencephalography (MEG), Fujioka et al. (2009) demonstrated entrainment between the parts of the auditory cortex that received the musical stimuli and parts that had learned to anticipate the stimuli. The researchers concluded that this was the result of "underlying endogenous anticipatory processes" (p. 89). The results reveal the plasticity of the cortex and suggest a possible avenue of therapeutic response modification through musical entrainment. Moreover, these studies suggest that tonal and rhythmic music in some way become integrated into our memory systems facilitated by the hippocampus. Importantly, Wong et al. (2009) demonstrated that the influence of musical exposure on individuals' nervous systems and on affective behaviors is most powerful "particularly [when listening to]… music of their own culture" (p. 157). In the Wong et al. (2009) study, the participants' familiarity with the music facilitated both language development and the development of neural pathways enhancing memory ability. Their findings suggest that the use of music in the therapeutic environment is more effective when musical experiences are culturally relevant, client centered and co-created by both therapist and client. As the research shows, the use of culturally congruent music and music education may be an important tool in directly accessing individuals' emotions, promoting neuroplastic changes in the brain, and uniquely engendering internal metabolic flexibility.

The research of neurotransmitters affected by music is striking, as many are the same neurotransmitters that have been found to be affected by PTSD. Changes in the neurotransmitters (chemicals that enable the transmission of messages and signals) dopamine, norepinephrine, serotonin, and the neuromodulator oxytocine have been observed in both music and PTSD research. Blood and Zatorre (2001) have demonstrated that listening to self-selected classical music can employ neural systems associated with the reward and emotion centers of the

brain thought to be associated with the neurotransmitter dopamine (Boeree, n.d.). A recent study of individuals who had a preference for classical music revealed significant neurological results after listening to self-selected compositions for two hours. The researchers suggested that the musical experience causes an increase of dopamine synthesis in the brain and may help to regulate various brain functions through dopaminergic neurotransmission (Sutoo & Akiyama, 2004). Listening to rhythmically fast paced music has been found to increase norepinephrine in participants (Gerra et al., 1998), while listening to slow paced music has been found to decrease levels of norepinephrine (Yamamoto et al., 2003). Levels of serotonin, in both the level released and in the overall density, are known to be affected by listening to self-selected pleasant music, suggesting that listening to music subjectively perceived as pleasant helps to regulate serotonin levels (Evers & Suhr, 2000). Recently, a study by Kirsch et al. (2005) established a link between the peptide hormone oxytocin and general feelings of wellbeing and is now implicated in the modulation of feelings of fear and stress in men, women and children (Kirsch et al., 2005). Grape, Sandgren, Hansson, Erikson, and Theorell (2003) explored the possible positive effects of singing on the individual's wellbeing. In their study, the authors observed two groups: one group with no vocal training and another group comprised of professional singers who had been attending singing lessons for at least six months. In their observations, the authors found that oxytocin levels increased significantly in both groups; however, the amateur group reported significant feelings of happiness and elation. The study concluded that singing increased oxytocin for both groups with greater results for amateur singers. The study leads us to recognize that musical experiences appear to effect individuals on a biochemical level. This conclusion is of particular interest because neurotransmitters are known to be dysregulated due

to PTSD. As the research suggests, musical stimuli may enable therapeutic experiences that could exercise physiological flexibility at the biochemical level.

In an acute, stressful experience the series of physical responses that become activated to enable the body to handle a perceived emergency are governed by the hypothalamic-pituitary-adreanal axis (HPA) (Berger & Schneck, 2006). One of the physiological reactions is the release of the steroid cortisol into the general blood stream. The increase of cortisol boosts the level of sugar in the blood traveling to the organs associated with fight or flight and suppresses the immune system to provide the most energy during a life threatening event (Swallow, 2002). Substantial evidence indicates that music can affect the HPA axis by modulating cortisol levels, a critical physiological reaction to stress and fear (Gerra et al. 1998; Hebert, Beland, Dionne-Fournell, Crete, & Lupien 2005; Miluk-Kolasa, Obminski, Stupnicki, & Golec, 1994; Schneider, Schedlowski, Schurmeyer, & Becker, 2001). Miluk-Kolasa et al. (1994) measured the levels of cortisol of patients who were having surgery the following day. In the course of the study, one group received one hour of individually selected musical stimuli, another group received no musical stimuli, and the third group with no planned surgery acted as the control. Findings showed that the stressor, which consisted of the description of the surgery, caused a 50% rise in salivary cortisol in both surgical groups. The group not exposed to musical stimuli displayed significantly higher levels of cortisol while the group exposed to post stressor musical stimuli had levels of cortisol similar to the control group (Miluk-Kolasa et al., 1994). Thus, the authors concluded that the musical stimuli contributed to lower cortisol levels in patients after receiving stressful information. Another study demonstrated that self-selected, fast paced *techno-music* produced a significant increase of cortisol (Gerra et al., 1998). These results indicate that music has the ability to increase or decrease cortisol in individuals. In another study, patients

undergoing a cerebral angiography maintained a stabile level of cortisol by listening to self-selected music during the procedure while the control group which was not offered music showed rising levels of cortisol and reported a higher level of stress (Schneider et al., 2001). Finally, a study comparing two groups of video game players, one with background music and one without, found significantly higher levels of cortisol in the group of videogamers with music (Herbert et al., 2005). The unique ability of music to regulate, stimulate and/or reduce levels of cortisol in the body, either purposefully or indirectly, as in the case of the Herbert et al. (2005) study, suggests that music may play an important role in individuals' mental and physical health, and therapeutically may be a significant agent in the fostering and rebuilding of individuals' internal metabolic flexibility.

As the research conclusions reviewed above imply, music appears to have a substantiated physiological effect on the body. Music has been shown to effect the HPA axis by modulating cortisol levels (a critical physiological reaction to stress and fear), stimulating some of the same neurotransmitters - dopamine, norepinephrine, serotonin, and the neuromodulator oxytocine - that PTSD dysregulates and promoting neuroplastic changes in the brain, potentially playing a role in stimulating the development of new neurological pathways that can become reticent due to trauma.

Music – the heart and the nervous system.

As noted by Shalev (2000), PTSD can lock the heart into unhealthy patterns of autonomic dysregulation, causing the individual to be stuck in modes of hyperactivation and hyperarousal. The imbalance between arousal and relaxation in war veterans has been documented by a significant body of research on the effect of PTS on the heart (Green et al., 1990; Shalev, 2000). The ability of the heart to flexibly fluctuate between states of stimulation and relaxation is

regulated by the autonomic nervous system (ANS). The ANS is divided into two subsystems: during times of stimulation or arousal, the sympathetic nervous system is responsible for the body's increased heart rate and during times of relaxation, the parasympathetic nervous system slows down the heart to prepare the body for energy storage, digestion, immune responses, salivation, urination, defecation and lacrimination (Ellis & Thayer, 2010). A unique and diverse body of research elucidating music's effect on the heart suggests a possible hypothesis: musical stimuli may be a vital tool in a co-created therapeutic reorganization of psychophysiological flexibility when an individual suffers from chronic PTSD.

The evidence from research studies demonstrates that music affects the heart; however, the effective variables have been greatly debated. Ellis & Thayer's (2010) meta analysis detailed music's many effects and concluded that the ANS (the ANS connects the CNS to the endocrine system and immune system) may serve as a fundamental pathway by which music exerts its therapeutic effect. The article proposes future research that examines music's multivariate affect as a means to promote psychophysioloical flexibility and provides a conceptual springboard calling for future studies focusing on the holistic therapeutic affect of music.

Depending upon the context, music has been found to speed up, slow down, or regulate the heart, raise or lower blood pressure, stimulate the sympathetic and parasympathetic nervous systems, and reinforce and prolong the effects of movement and exercise (Anttonen & Surakka, 2007; Aragon, Farris, & Byers, 2002; Bartlett, 1996; Ellis & Thayer, 2010; Gerra et al., 1998; Iwanaga, 1995; Iwanaga, Kobayashi, & Kawasaki, 2005; Iwanaga & Tsukamoto, 1997; Labbe, Schmidt, Babin, & Paharr, 2007; Nakahara, Furuya, Obata, Masuko, & Kinoshita, 2009; Osborne, 2009a; Schneider, Schedlowski, Schurmeyer, & Becker, 2001; Swallow, 2002; Urakawa & Yokoyama, 2005). Gerra et al. (1998) demonstrated that fast and exciting music

induced neuroendocrine changes in healthy participants who did not specify any specific musical education or preference. The authors suggest that the "high frequency of beats, the strident tonal clusters and the duration of techno-music utilized … were able to induce in most of the subjects a stressful condition" (p. 108) causing a significant increase in heart rate and systolic blood pressure and changes in subjective emotional states. This is not surprising, as humans have been utilizing the somatoaffective qualities of music to affect physical states of being for many years. Urakawa and Yokoyama (2005) studied musical affects on the ANS during physical exercise and reported that self-selected musical stimuli while exercising is "not only enjoyable in terms of mood but also may promote physiological excitation and enhance physical activation" (p. 213) of the sympathetic nervous system. Interestingly, Iwanaga (1995) found that individuals show a preference for musical selections that have a tempo in relationship to their own heartbeat. Also referred to as the "pulse" of music, the authors reported that individuals' "preferred tempi were distributed mostly one, one and a half, and two times as fast as heart rate" (p. 435) showing a synchronicity in the pattern of relationship. This unconscious gravitation towards music that has a relationship with one's heart beat cycle is in line with the choice of faster passed music while exercising or engaging in aerobic activity.

While fast tempo music can increase ANS activity, some studies have concluded that sedative music (slow tempo, music with long smooth musical phrasing referred to in musical notation as legato and with minimal dynamic changes) can reduce, regulate and entrain individuals' heart rates and blood pressures (Bartlett, 1996). For instance, in their study on the effects of music on heart rate, researchers Aragon et al. (2002) measured the effects of live harp music on the heart rate of individuals awaiting vascular and thoracic surgical procedures known to produce high levels of anticipatory stress. The researchers found that the patients who

experienced a single 20-minute music session experienced a statistically significant difference in systolic blood pressure and oxygen saturation as compared to the control group who had no music exposure while awaiting surgery (Aragon et al., 2002). Similarly, Labbe et al. (2007) found that students who listened to self-selected classical music after taking a stressful test experienced greater reductions in heart rate than the control group. In another study, researchers Schneider et al. (2001) studied the influence of self-selected music on heart rate during a cerebral angiography (a diagnostic procedure to see how blood flows through the brain), a medical procedure known to produce high levels of anticipatory stress. The patients examined while listening to self-selected music showed systolic blood pressure that was significantly lower than the patients who were examined without music (Schneider et al., 2001). Another study, as cited by Swallow (2002), showed that music could slow the heart rate and could act as a pace setter, entraining the heart to the tempo of the music. Swallow observed that the individual's emotional connection to the music seemed to be more important to slowing the heart rate than simply the slow tempo of the music. However, in this particular study, the author found that if the tempo of the music was one beat-per-minute slower than the current heart rate of the listener, the listener's heart rate adjusted to the speed of the music. Sutoo & Akiyama (2004) linked the listening of classical music to an increase in "calcium/CaM-dependent dopamine synthesis in the brain, thus causing a reduction in blood pressure" (p. 255). As observed by both Osborne (2009a) and Schneider et al. (2001) relaxing music not only may slow the heart rate down but may also significantly regulate its excitation and variability.

Music has been shown to impact the heart in a number of ways. Interestingly, and not all that surprisingly, musical valence (the degree to which an individual subjectively enjoys the music) is a significant variable in the use of music as a stress management strategy (Labbe et al.,

2007). Generally, the therapeutic aspects of sedative music seem to have a closer relationship with the parasympathetic nervous system rather than the sympathetic nervous system (Iwanaga & Tsukamoto, 1997; Labbe et al., 2007). With that being said, listening to excitative music has been shown to decrease perceived tension and increase perceived relaxation. However, and inline with the previous study, measuring heart rate variability, the researchers found that the heart rate was higher while listening to sedative music than during excitative music which suggests that excitative music decreases activation in the parasympathetic nervous system (Iwanaga et al., 2005). Researchers Nakahara et al. (2009) examined the differences between heart rate variability during a unique musical performance as opposed to listening to the same piece of music repetitively. The researchers found that the unique musical performance provoked greater heart rate variability than musical repetition, causing "reciprocal modulation of sympathetic and parasympathetic nervous activities" (p. 361).

The research is overwhelming in its breadth and scope. While the common misconception is that music and its effects on the heart are controversial (Ellis & Thayer, 2010), a potentially more effective formulation could be that music affects the heart in a number of unique and diverse protocols. For this reason, musical stimuli could be a vital tool in a co-created therapeutic reorganization of psychophysiological flexibility when an individual suffers from chronic PTSD.

Music – breath and respiration.

A well-developed body of research draws connections between respiration patterns and anxiety disorders - such as PTSD. PTSD has been implicated in biological changes to normal respiratory functioning: sleep apnea, upper respiratory tract infection, asthma, pulmonary emphysema, chronic hyperventilation, changes in behavioral breathing patterns and an increase

in susceptibility to allergies (Donker et al., 2002; Ocasio-Tascon et al., 2006; Suess, Alexander, Smith, Sweeney, & Marion, 1980; Van Diest et al., 2009). Etzel, Johnson, Dickerson, Tranel, and Adolphs (2006) report that short periods of hyperventialation could be considered a normal coping response during times of trauma, such as "pain, apprehension, anxiety, or fear" (p. 58). In the same article, these authors propose that voluntary or conscious changes in respiration and breathing patterns can effectively change the individual's subjective emotions and behavior. Music has also been studied to have similar abilities to modulate and regulate both individuals' unconscious metabolic breathing patterns and conscious behavioral breathing patterns.

Listening to music, in particular self-selected music, after exposure to a stressor has been shown to cause physiological changes in unconscious breathing patterns. Not surprisingly, music effects breathing patterns in similar ways as it does the heart and cardiovascular system. Labbe et al. (2007) measured the differences in breathing patterns of two groups of college students after taking a stressful test - one group listened to self-selected classical or heavy metal music; the other group did not listen to music. Interestingly, respiration rates decreased more for individuals who chose to listen to either musical style more so than those who chose to sit in silence. Bernardi, Porta, and Sleight (2006) sought to measure unconscious cardiovascular and respiratory changes while listening to music. In the study, the authors matched practicing musicians of similar ages with non-musicians in the control group. The researchers first asked the individuals to rest for 20 minutes in silence, then for a five minute period the researchers gathered baseline information including breathing rate, ventilation, carbon dioxide (CO2), respiration interval, blood pressure, mid cerebral artery flow velocity, and baroreflex. The researchers next presented six different musical styles (slow classical, fast classical, techno, rap, dodecaphonic, and raga music) in random order, first for two minutes each followed by a two

minute break of silence, and then again for four minuets, again followed by two minutes of silence. The study results demonstrated that music with a faster tempo increased listeners' ventilation, while slower music appeared to induce a relaxing effect and lower ventilation, and, notably, the largest decrease in ventilation occurred during the two-minute pauses of silence between songs. This study illustrates how the rhythms of music can influence strong internal organ response. It also showed that, while all participants experienced an arousal effect related to tempo, musicians had a stronger change in breathing patterns than non-musicians. The Bernardi et al. (2006) study results were essentially replicated in another, similar study focus. Aragon et al. (2002) showed similar results when evaluating the changes in oxygen saturation levels as the result of a 20-minute live harp playing session of relaxing music for patients in postoperative recovery in an acute clinical care setting. The researchers found a statistically significant difference in oxygen saturation levels 10 minutes after the harpist stopped playing. This study along with other similar studies, demonstrates that music can be a powerful tool in the recovery of trauma because of the associated effect of the unconscious metabolic respiratory patterns shown in the above studies.

As trauma can significantly affect an individual's behavior, it is worthwhile to consider the research on music and mood induction. It has been hypothesized that music can induce different mood states. Moreover, Etzel et al. (2006) suggest that it is possible to discriminate which mood state has been induced by measurements of cardiovascular activity and respiration patterns. While their findings of cardiovascular activity were inconclusive, their measurements of respiratory activity statistically supported their hypothesis - each listener's respiration pattern consistently varied depending upon the mood of the music. Etzel et al. (2006) summarize,

> Respiratory activity was measured by total, inspiration, and expiration lengths as well as changes in mean respiration rate during each [musical] clip … The mean breath length was longest for the sad induction, intermediate during fear, and shortest during the happiness induction (p. 57).

The authors went on to say that the listeners' breathing patterns may have been more accurately attributable to a physiological entrainment between breathing patterns and musical tempo, rather than correlated to mood induction. Entrainment between the body's perception of external stimuli and the internal reaction was previously researched by Haas, Distenfeld, and Axen (1986) when they studied "the effects of rhythmic input on breath period" (p. 1185). The participants first listened to a metronome set at 60 beats per minute for five minutes while being asked to tap their fingers to the pulse of the metronome. After this, one group was asked to listen to four separate musical pieces of varying tempi and rhythmic design while tapping to the pulse of the musical selections. The other group listened to the musical selection without tapping and then listened to the same musical piece a second time while tapping to the pulse of the musical selection. Entrainment was reported as the subjects were observed to have unconsciously synchronized their respiration to the tempo and rhythm of the musical selections which supported the hypothesis as stated by Haas et al. (1986):

> Musical rhythm can be a zeigeber (i.e. pacemaker), with its ability to entrain respiration dependent on the strength of its signal relative to spurious signals from the higher neural centers that introduce noise into the central pattern generator. Tapping reinforces the zeitgeber, increasing its signal-to-noise ratio and thereby promoting entrainment (p. 1185).

While the previous studies highlighted the use of music to unconsciously effect metabolic breathing, Fried (1990a) posits that particular styles of music have reliable and profoundly beneficial results on relaxation when paired with conscious breathing retraining exercises. Fried states that while the use of music in conjunction with anti-anxiety strategies is widespread, solely focusing on the evenness of inhalation and exhalation or the slowness of the breath does not promote proper therapeutic breathing. Fried went on to say that the primary objective of breathing retraining is to increase tidal volume without causing excessive loss of CO2 in the blood, called hypocapnia, which is associated with dizziness. Fried states that when taught to breathe using deep-diaphragmatic breathing, music can deepen breathing, quicken relaxation, normalize CO2 concentration and decrease the respiration rate. Moreover, Fried (1990a) was able to repeatedly produce the same results in his studies reporting, "Individual response to music is highly stable and reproducible with repetition of the same piece of music" (p. 166). Fried concluded that consciously slowing down respiration while maintaining normal tidal volume is an essential component of any therapeutic counter arousal protocol. The author hypothesized that respiratory regulation is more consistently achieved while listening to music due to music's abstract nature that bypasses conscious intellectual control and simulates the lower centers of the brain, thus activating the deeper diaphragmatic breathing muscles - opposite to those activated during stress and hyperventilation (Fried, 1990a).

Fried (1990b) suggests that music may play a role in breathing retraining exercises; however, voluntary breathing has a much deeper relationship with music – it underpins all musical performance. Breath is what supports the vocalist's melody and enables all performers, especially wind instrumentalists, the ability to perform. The conscious, evenly sustained, control of inspiration and expiration creates musical phrasing and affects the timbre of the musical

phrase. Singing is arguable the most natural human activity that offers us a comprehensive exercise regulating voluntary respiration. Besides the behavioral aspects of singing, Grape et al., (2003) have researched the endocrinal aspects of singing. The researchers found that singing increases the potential for a general feeling of wellbeing and has implications in the modulation of fear and stress.

Music – hearing and the perception of sound.

As shown by Jourdain (2002), the experience of music is primarily facilitated by the individual's ability to hear. The ear principally controls the ability to hear acoustic stimuli; however, perception of musical stimuli is multimodal engaging multiple sensory systems. Arousal by and subjective perception of musical stimuli can be augmented by physical bodily sensations (such as sonic vibrations or the touch of a guitar string) or by visual stimuli (such as a video game or a laser-lightshow at a concert). As a result of PTSD, combat veterans who also experienced heavy auditory stress may experience difficulty hearing and listening and may suffer from vestibular related symptoms including loss of balance, motion sensing, loss of spatial orientation, compromised muscle tone, compromised posture, vertigo, tinnitus, impaired auditory memory, and may have an exaggerated startle response (Cassandro et al. 2003; Koelsch, 2009; Okamoto, Stracke, Stoll, & Pantev, 2009; Roy, Mailhot, Gosselin, Paquette, & Peretz, 2008). Music may provide a unique opportunity to exercise the veterans' ability to hear, listen and interact *in vivo* with their surrounding environment.

Combat veterans with PTSD have a notably strong auditory startle response (Butler et al., 1990), which could be related to the hyperarousal cluster of a PTSD diagnosis (criterion D in the DSM-IV-TR). This automatic reaction to startling auditory stimuli provides individuals in extraordinary situations, such as combat, an instinctually driven survival mechanism, enabling

them to react in life threatening situations almost immediately. However, away from the theater of combat, the veteran may be subject to many false alarms and be repeatedly triggered, causing a chronic mobilization of the body's emergency stress response. This inflexibility caused by PTSD can allow particular sounds to trigger a traumatic recall of events potentially becoming part of a ridged belief that the world is a dangerous place (Foa et al., 2006). As a result of PTSD's auditory inflexibility, music may provide a unique experience for individuals with PTSD to practice auditory flexibility and may directly help in therapeutically addressing certain auditory disorders often comorbidly diagnosed in individuals with PTSD. Roy et al., (2008) studied the effects of music as a therapeutic means to modulate individuals' startle reflexes. The researchers asked participants to choose pleasant music from the classical or jazz/pop genres to listen to while the researchers sounded an "acoustic startle probe" (p. 39) of white noise every 2.3 seconds. The researchers found that they were able to modulate the severity of the defensive startle reflex by repeated exposure to pleasant music with unpleasant sounds interjected throughout the listening experience.

Another common comorbid diagnosis of PTSD related to hearing is tinnitus. Fagelson (2007) found a positive correlation between veterans with a PTSD diagnosis and tinnitus severity, sudden onset of tinnitus, and sound volume intolerance. The author suggests that the symptoms of tinnitus (ringing, buzzing, roaring, hissing, clicking, or whistling) are also symptoms that can trigger fear and anxiety in individuals with PTSD. Eggermont (2007) reports that the generation and maintenance of tinnitus is thought to be the result of a maladaptive cortical reorganization of the central auditory system. Specifically, the author posits that auditory neurons become rewired after they have been deprived of sonic input caused by hearing loss due to auditory or physical trauma. As a result, the auditory cortex neurons become rewired,

interacting with neighboring neurons, and become more sensitive to the frequencies of the neighboring neurons (Buonomano & Merzenich, 1998; Eggermont, 2007). Interestingly, researchers Okamoto et al. (2009) found that through sonic behavioral training, tinnitus can be significantly diminished. A low-cost, enjoyable, patient specific musical listening experience has been developed by Fountain (2010) that effectively promotes neural audio cortical reorganization. In a longitudinal double-bind study, the researchers reported that the patients who regularly listened to specifically manipulated "notched" (¶ 3) music for 12 hours a week for 12 months subjectively reported significantly diminished volume and frequency of tinnitus symptoms as compared to the control group (Fountain, 2010).

Since music is generally listened to for pleasurable purposes, employing music as a therapeutic agent may be an important component of a multivariate therapeutic treatment plan for PTSD. As demonstrated by Pantev et al. (2009), music may be a critical tool encouraging concentration, attention and listening, may promote auditory cortical reorganization, and may help individuals develop adaptive and regulation skills to better cope with an exaggerated startle response.

Psychosocial of Music - the Relationship to PTSD

As a therapeutic agent, music has a complex and allusive impact on individuals (Ortiz, 1997). As such, music may be a unique and complimentary method of care aiding the primary therapeutic modalities of PTSD treatment (Pavlicevic & Ansdell, 2009). The clinical complexity of PTSD symptoms is vastly dysregulating, influencing individuals' internal and external systems. The micro symptomotology of PTSD is thought to cause psychological inflexibility, maladaptive avoidance and control strategies, social isolation, re-experiencing symptoms, depression, a sense of shortened future and a hyperawareness that can border on paranoia

(Walser & Hayes, 2006). Sutton (2002) observes that it is common for individuals to psychologically employ protective defenses during times of trauma. Sutton (2002) states, "In order to survive, we tend to minimize the nature of the threat…because in living with potential, identifiable threats to survival it would be impossible to fully realize and process such experiences every day" (p. 33). The author elucidates the adaptive nature of dissociation during times of overwhelming fear and helplessness. During times of extraordinary events, dissociation is in the service of the ego; however, in every day life, dissociation or avoidance becomes maladaptive (Walser & Hayes, 2006). As music is said to engage our emotional states at a pre-conscious level, and if these traumatic memories are repressed or disavowed from the ego and stored in the unconscious, can music compliment the therapeutic process of experiential exposure? PTSD further dysregulates relational capacities - causing diffuse and negative object relational beliefs, including loss of trust, sense of self, faith, imagination, self-confidence, motivation and an ability to form secure attachments with others (Renaud, 2008; Haft & Slade, 1989). These negative object relational beliefs can have macro implications, affecting the social fabric of humanity including loss of social cohesion and civic participation and can cause an individual to become out of sync with societal norms (Carey, 2010).

Healthy and moderate exposure to something that has been chronically avoided is a trademark of experiential therapeutic interventions for PTSD. As music is a multivariate stimulus, it has an allure that evokes powerful associations for listeners. For example, the potential for iconic musical stimuli to conjure powerful psychosocial emotions related to Vietnam veterans' war experiences is strong (Blake & Bishop, 1994). While exposure is healthy therapeutically, the group/clinician must be able to contain the powerful emotions that may become evoked. The evocations are often powerful points for therapeutic intervention and

fodder for challenging the stuck points, social biases, hindsight biases, isolation, avoidance and control strategies of PTS associated stimuli that take the individual out of the here and now, leading to re-evocation of traumatic moments and other common psychological symptoms of PTSD (Foa et al., 2006). As such, musical stimuli may be a safe medium emboldening the individuals to more willingly subject themselves to feelings and thoughts typically avoided (Blake & Bishop, 1994).

Veterans who had a long unfulfilled desire to play an instrument could, potentially, benefit from the opportunity to engage in an activity that is of personal value (Cornelius, 2010). As such, music may act therapeutically as a *third space*, potentiating a reconnection with the disavowed part of self and functioning as a benign vehicle that can expose veterans to evocative material in a safe and contained method. The research explored earlier in this chapter suggests that learning to play a musical instrument or engaging in listening exercises with client-selected, rather than clinician-selected music, has been shown to produce substantial results (Wong et al., 2009). A sense of agency is engendered during this process - which seems likely to be a crucial variable in the psychological efficacy of musical stimuli in the therapeutic environment. As a result, groups that either create or select their own musical stimuli are more likely to manifest a greater sense of ownership in the material, cultivating pride, self-esteem, hope and, potentially, a greater possibility for change. Interestingly, individuals' choice in music is thought to communicate something about how they see themselves in the world. McFerran-Skewes (2004) states, “Research tells us that [people] choose music that reflects their life experience” (p. 144). McFerran-Skewes’s (2004) observations help to explain how music can play a role in group therapeutic interventions by fostering development in veterans' social lives and elucidate the role music plays in the veteran’s self-view and self-defined social schema.

During deployment, the average age of veterans of the Afghanistan (OEF) and Iraq (OIF) wars is 27 years old (Bolger, n.d.). OEF and OIF veterans are returning from these theaters in life cycle stages that include foci of self-identity, self-discovery, career development, and establishment and maintenance of relationships. The Vietnam era veterans' average age of deployment was 23 years old (Bolger, n.d.). Now in a later life cycle stage, Vietnam veterans are facing life cycle foci that include retirement, fully grown children, grandchildren and realities of the aging process (Brown, 2009). McFerran-Skewes (2004) comments that developmentally, normal life cycle changes do not "occur in isolation, rather through a comparison of who they consider [to be mirrors] of themselves" (p. 148). As avoidance and isolation are clinically significant symptoms of PTSD, which makes personal comparison difficult, musical group experiences may provide a powerful vehicle for veterans in various life cycle stages. Haack and Hodges (1996) elucidate this potential: "One of music's social functions is to reflect the society of which it is a part" and that in various ways "the musical microcosm replicates the social macrocosm" (p.502). Interestingly, the symmetry of McFerran-Skewes' (2004) observation on a micro level was an echo of what Haack and Hodges (1996) observed on the macro level – people's choices in music are psychosocially reflective by nature. As such, the musical content of the group should mirror the diversity of the group members and should provide them a sense of safety, grandiosity, and individual and social agency.

Throughout the process of music making, individuals become aware of the physical and mental flexibility needed to play an instrument (Ortiz, 1997). Individuals may become more aware of behavioral breathing changes when singing, metabolic changes such as increases in perspiration or increased heart rate, or of experiences of new physical sensations related to body movements such as the sensations of pressing down strings on a guitar (Emerson et al., 2009).

As the group progresses, memory cognition is exercised as individuals collectively reinforce the group content– such as lyrics to songs, specific repertoire, past didactic exercises or interpersonal interactions. Participants may become aware of physical sensations and, with repeated exposure, may become more tolerant of the uncomfortable sensations (Rothchild, 2003). Decidedly, the choice to experience whatever physical feelings or thoughts arise, while maintaining a desire to participate, is instrumental. This willingness to tolerate and accept the uncomfortable physical sensations of learning something new while engaging in something of self-determined value provides an essential point for intervention - facilitating the overcoming of the avoidance symptoms related to PTSD (Cornelius, 2010).

Willingness to tolerate affect and changes to affective states is one of the most fundamental competencies of not only PTSD recovery but also to overall healthy living (Davies, 2004). Interestingly, the inability to manifest a workable strategy for managing relational stress is a characteristic of both disorganized insecure attachments and of PTSD (Schore, 2000). As PTSD seems to affect the foundational attachment mechanisms of humans, therapeutic interventions of PTSD must focus on rebuilding those capacities. Communicative musicality (Malloch, 2000) posits that the capacity to function musically is an innate aspect of humanity that uniquely provides individuals with a means to affectively move and communicate in time. Musicality - as pertaining to the seemingly innate melodic and rhythmic interactions between caregiver and infant - is the modus operandi of attunement and is the conduit by which individuals learn the meaning of culturally relevant stimuli (Trevarthen & Malloch, 2000). Through the co-created interactions with the caregiver, affect regulation is achieved by the rhythmic and vocal interactions of the child/caregiver. Based on the analysis of audiovisual recordings of infant/caregiver interactions, Trevarthen and Malloch (2000) named three

underpinnings of communicative musicality: Pulse, Quality, and Narrative. Pulse refers to the underlying rhythmic interactions between individuals that provide the space to verbally or non-verbally communicate. Quality refers to the acoustic qualities of vocalizations – pitch, timber, volume, and/or, of physical gestures of the body such as hand gestures or facial expressions. Narrative is the product of the collaboration of quality and pulse, creating a sense of intentionality, sense of self and sense of place in time. Communicative musicality posits that musicality is in the service of the individual attachment qualities: the need for companionship and the ability to engage one-on-one or one-with-many. As such, musical stimuli may provide a means to stimulate and exercise psychosocial attachment skills.

Music engages a uniquely holistic biopsychosocial process. For example, when people engage in an experiential activity such as a group guitar class, the gestalt of the therapeutic moment is dynamically experienced (Patel et al., 2005). At first, the group can provide a state of intersubjective symbiosis - a holding environment where individual participants can experience themselves engaged in a unique process while simultaneously witnessing others engaged in the same process. The group lesson becomes a co-created space, both temporally and physically, dependent upon the synchronization of the whole. This synchronization is a powerful element of communicative musicality, potentiating the object relational attachment process and creating and/or reinforcing social belonging. By the group members' support of one another, the experience becomes a catalyst for greater social cohesion, which in turn can enable the individual to rebuild a positive sense of self by exercising healthy communication skills and engaging in empathic and sympathetic interactions (Ansdell, 2002). As such, the group guitar lesson becomes a catalyst for behavioral change where the symptom picture of PTSD can be observed to change. Avoidant behaviors can begin to dissolve in the simple act of showing up to

the group lesson and doing the best that the client can (Bryant, 2006). Arousal symptoms can be worked with *in vivo*, as the physical sensations related to anxiety can be fodder for meaning making and understanding of the lived experience (Allen, 2003). A positive experience during the guitar lesson can potentially cause a loosening of rigidity and trigger curiosity, even the direct question, "To what degree could this lesson be part of a vital, workable way of living?" Willingness to experience whatever was experienced during this lesson (including unwanted feelings or thoughts) while maintaining focus on learning something new about the guitar allows the veterans to make meaning and integrate their evocations while engaging in purposeful, value driven activities (Cornelius, 2010). As this process continues to unfold, the social identity that was once splintered and destabilized by trauma may slowly become unyielding to the psychological suffering of PTSD.

As has been well established by Brattico and Jacobsen (2009), music has a magnetism that can transcend intellectual and cognitive tendencies. Without much effort the sound of music can conjure feelings of happiness, sadness, togetherness, isolation, can move us to dance, and can activate our memories – musical affect is a common and ubiquitous experience (Trevarthen & Malloch, 2000). Music provides a medium that can re-stimulate object relational attachment skills, where humans can transmute affect and emotion and transmit cultural and ethnic traditions and values. For these reasons musical stimuli can evoke an acceptance and willingness to engage in an *in vivo* therapeutic experience while containing the powerful evocations and providing security during exposure to traumatic reminders. The lived musical experience can provide an opportunity to notice changes in individual/group affective states, an acceptance of those sensations and, with repeated exposure, an opportunity to practice regulating changes in

affect. With time a greater understanding and acceptance of affective states can become internalized, improved adaptive behaviors achieved, and lives of vitality can again be lived.

Chapter V

Discussion/Conclusion

PTSD is a complex illness that affects individuals and their interlocking biological, psychological, social, spiritual, political and cultural systems. It has profound implications on the capacities of individuals to function in relationships, which can cause social fragmentation and loss of trust and intimate social connection with others. This complexly dysregulating disorder has seemingly ubiquitous effects on individuals' overall functioning - affecting individuals from the inside out and the outside in. As such, the pervasiveness and complexity of PTSD dysreguation calls for equally ubiquitous and holistic therapeutic experiences – of which cognitive, behavioral and acceptance-based therapies are highly effective. Interestingly, cognitive-behavioral treatment approaches used in conjunction with other therapeutic approaches have been observed to be uniquely effective and complimentary (Follette & Ruzek, 2006). Pavlicevic and Ansdell's (2009) analysis of the use of music in the therapeutic process led to their assertion that music has historically been a successful foil to other therapeutic modalities and has been found to be a highly affective adjunct therapy. Pavlicevic and Ansdell (2009) propose that the therapeutic use of music has been found to distinctively compliment modern treatment modalities:

> Historical and metatheoretical work on music therapy has shown just how flexible and pragmatic music therapy has been down the ages in matching practice to theory, or theory to practice… By relating itself to current treatment theories, modern music therapy … borrow[s] theory to account for. …link[s] between music, human relatedness, society and culture, and their connection to health and well-being (p. 358).

This chapter presents information suggesting therapeutic musical experiences can potentiate behavioral activation activities and social reengagement opportunities for trauma survivors. First, behavioral and social experiences involving music are discussed in relationship to the biopsychosocial symptoms of PTSD. Next, experiences of trauma survivors participating in didactical listening experiences and therapeutic music lessons will be examined in relationship to acceptance and exposure-based therapies. In conclusion, a particular protocol for teaching therapeutic guitar lessons is suggested, potential future areas of research are offered, and implications for clinical practice are discussed.

Behavioral and Experiential Musical Interactions - Relationship to PTSD Symptomology

Fundamentally individuals interact with music by hearing/listening to and/or participating in the generation of music. While the qualities of music can be experienced through vibrations as well as sight (e.g. synesthesia is the phenomenon of the automatic generation of visual colors to sound stimuli) consideration of such experiences are outside the scope of this paper. The following paragraphs illuminate the biopsychosocial effects of music on trauma survivors either by listening to or creating music.

Experiential interactions - listening to music and the relationship to PTSD.

Listening to music - the effects of PTSD and music on the brain.

The limbic system, especially the amygdala, plays a significant role in the unconscious regulation of fear - functioning to process and regulate fear, emotions, memory, and arousal. When a sight or sound triggers an individual, the amygdala sends out an instantaneous alarm to the other brain structures ultimately resulting in the classic fear responses of increased heart rate and blood pressure, sweaty palms and adrenaline release. During an acute, stressful experience, the series of physical responses that become activated to enable the body to handle a perceived

emergency is governed by the hypothalamic-pituitary-adrenal axis (HPA) (Berger & Schneck, 2006). A series of hormones are released in the body that ultimately trigger the kidneys to react by releasing the steroid cortisol into the general blood stream. The increase of cortisol boosts the level of sugar in the blood traveling to the organs associated with fight or flight and suppresses the immune system - providing increased energy during a life-threatening event. Conclusive evidence pointing to one pattern of HPA dysregulation in PTSD has been incomplete with some researchers finding higher levels of cortisol in clients with PTSD and some finding lower (Rasmusson et al., 2003). Studies have indicated after an acute traumatic event, individuals with PTSD have typically displayed higher levels of cortisol than individuals without a PTSD diagnosis (Lemieux & Coe, 1995). Significantly lower cortisol levels in complex or long-term trauma cases compared to individuals without a PTSD diagnosis are associated with emotional numbing or adrenal exhaustion typical with chronic PTSD symptomotology (Mason et al., 1986; Yehuda et al., 1990). Substantial evidence indicates that music can affect the HPA axis and manipulate cortisol levels. The unique ability of music to regulate (Schneider et al., 2001), stimulate (Gerra et al., 1998) and/or reduce levels of cortisol in the body (Miluk-Kolasa et al., 1994), either purposefully or indirectly (Herbert et al., 2005), suggests that music may play an important role in individuals' mental and physical health, and therapeutically may be a significant agent in the fostering and rebuilding of individuals' internal metabolic flexibility in relation to PTSD.

Numerous studies have shown that listening to music can trigger activity in parts of the limbic system, particularly the amygdala and the hippocampus (Brown et al., 2004). Harikumar et al. (2006) demonstrated that listening to music during a painful medical procedure significantly helped to reduce the amount of sedative medications requested and decreased the

subjective discomfort of the patients. Stefano et al. (2004) found that opiate circuits in the brain were activated during euphoric experiences while listening to self-selected classical music. Brown et al. (2005) demonstrated that passive musical listening has the power to stimulate unprompted activation of the limbic and paralimbic areas (Brown et al., 2005) suggesting a possible mechanism to modulate the amygdala driven fear-response (Blood & Zatorre, 2001).

Dysregulated glutamate levels, considered to be central to the phenomena of synaptic plasticity and the use-it or lose-it model of synaptic brain development, may be associated with dissociative episodes and reduced hippocampus volumes related to trauma (Coupland, 2000). Fujioka et al. (2009) demonstrated that passively listening to music might therapeutically benefit neurological memory systems. Specifically, music listening was found to modify the glutamate receptor increasing glutamate levels in the hippocampus and the hypothalamus (Särkämö et al., 2008).

Noradrenalin is a neurotransmitter that, among other functions, releases norepinephrine (adrenalin) during a stressful event. PTSD is associated with a loss of flexibility in the brain causing individuals to become locked into an inflexible hypervigilant state which results in the hyperactive release of norepinephrine - associated with hypervigilance, the disruption of attention and fear reinforcement (Coupland, 2000). Listening to diverse music may be a tool in regaining basic metabolic flexibility as rhythmically fast paced music has been found to increase norepinephrine in participants (Gerra et al., 1998), while listening to slow paced music has been found to decrease levels of norepinephrine (Yamamoto et al., 2003).

Norepinephrine is synthesized from dopamine, which research has found may also be affected by PTSD. PTSD may disrupt the dopamine firing system by entraining the amygdala, resulting in diffuse paranoia when evaluating external sensory stimuli. A healthy dopamine

firing system is associated with subjective motivation and reward centers while an impaired system is associated with loss of motivation, emotional distancing, and social estrangement (Coupland, 2000). Blood and Zatorre (2001) demonstrated that listening to self-selected classical music could consistently trigger the dopamine neural systems and may be employed as tool to naturally exercise the reward and emotion centers of the brain.

Serotonin deficits may be related to the difficulty individuals with PTSD have in habituating an adaptive fear response (Coupland, 2000). Coupland (2000) states that a serotonin deficiency is associated with impulsivity, irritability, and aggressive and suicidal ideations – all symptoms of PTSD. Levels of serotonin, in both the level released and in the overall density, have shown to be affected by listening to self-selected subjectively pleasant music, suggesting that listening to music subjectively perceived as pleasant helps to regulate serotonin levels (Evers & Suhr, 2000).

Chronic PTSD can disrupt the natural neurological balance of brain structures employed during perception and evaluation of danger. The brain transmits its decision via the automatic nervous system (ANS) to the body affecting the heart.

Listening to music - the effects of PTSD and music on the heart and nervous system.

Trauma can lock the heart into an unhealthy, inflexible dysregulated pattern causing individuals to be stuck in modes of hyperactivation and hyperarousal (Green et al., 1990; Shalev, 2000). The ANS regulates the ability to healthily fluctuate in balance between states of stimulation and relaxation. During times of stimulation or arousal the sympathetic nervous system is responsible for the body's increased heart rate. During times of relaxation the parasympathetic nervous system slows down the heart to prepare the body for rest and restoration. Buckley and Kaloupek's (2001) meta analysis reveals studies that show an

imbalance between arousal and relaxation in war veterans with PTSD. The studies indicate that veterans with a PTSD diagnosis have a higher resting heart rate and elevated blood pressure as compared to veterans without a PTSD diagnosis (Buckley & Kaloupek, 2001). PTSD also has been found to effect the recovery time for the heart to return to a normal resting rate after a sudden shock (Blechert, Michael, Grossman, Lajtman, & Wilhelm, 2007). Significantly, when observed during sleep, combat veterans with PTSD had on average a high resting heart rate (Muraoka et al., 1998).

Music has been found to affect the heart in numerous ways. Subjectively defined exciting or fast paced music has been found to speed up the heart rate (Gerra et al., 1998). In the short term, fast paced music decreases activation in the parasympathetic nervous system, and, in the long term, decreases subjectively perceived tension and increases subjectively perceived relaxation (Iwanaga et al., 2005). When combined with exercise, fast paced music increases the activity of the sympathetic nervous system (Urakawa & Yokoyama, 2005). On the other hand, subjectively defined relaxing or slow paced music has been found to slow down the heart rate by both lowering blood pressure and significantly regulating variability of the heart rate (Osborne, 2009a). In general, slower music has a closer relationship with the parasympathetic nervous system than the sympathetic nervous system (Iwanaga & Tsukamoto, 1997). Finally, at slow beats per minute (bpm), music has been found to entrain the heart - causing it to beat in rhythm with the pulse of the musical selection (Osborne, 2009a).

Trauma can disrupt the natural flexibility of the ANS causing severe dysregulation of balanced heart functioning. The inflexible dysregulated pattern of the heart behaviorally manifests in modes of hyperactivation and hyperarousal and effects individuals respiratory patterns.

Listening to music – the effects of PTSD and music on respiratory patterns.

Individuals who struggle with PTSD symptoms have been reported to suffer from high rates of irregularities related to breathing including sleep apnea, upper respiratory tract infection, asthma, pulmonary emphysema, hyperventilation and an increase in susceptibility to allergies (Donker et al., 2002; Ocasio-Tascon et al., 2006). Changes in unconscious respiratory patterns have been linked to fear and anxiety, which are governed by the brain's fear center, the amygdala. Masaoka and Homma (2004) state that when the amygdala is triggered it changes the way individuals draw air, using the muscles in the chest rather than the abdomen to inhale. Van Diest et al. (2009) state that individuals in a state of fight, flight or freeze have a tendency towards hyperventilation causing individuals to feel more stimulated and lightheaded. Masaoka and Homma (2001) find that chronic anxiety and hypervigilance dysregulates homeostatic breathing as the perception of an imminent threat is found to increase respiratory frequency. Fortunately, the dysregulation of breathing patterns caused by PTSD can be manipulated and even consciously retrained. Etzel et al. (2006) found that conscious changes in breathing patterns can effectively change an individual's perceived level of fear and anxiety.

Music has been shown to have similar abilities to modulate and regulate both the individuals' unconscious and conscious breathing patterns. Listening to self-selected music has been shown to cause changes in unconscious breathing patterns (Labbe et al., 2007). Bernardi et al. (2006) demonstrated that music with a faster tempo unconsciously increases listeners' ventilation while slower music appeared to lower ventilation. Aragon et al. (2002) showed similar results - individuals in an acute clinical care setting who heard live relaxing music performed during postoperative recovery benefited from an increase in oxygen saturation and subjective relaxation.

The dysregulation of healthy respiratory patterns have been implicated in PTSD symptomotology. Hypervigilance causes rigid changes to unconscious breathing patterns due to chronic anxiety and perception of stimuli. As sound plays a major role in an individual's perceptions, the auditory conditions associated with PTSD impact the hearing experience.

Listening to music – the effects of PTSD and music on listening.

Combat veterans who experienced heavy auditory stress, such as blast overpressure, may experience difficulty hearing and listening and may suffer from other vestibular related conditions including loss of balance, motion sensing, and spatial orientation, compromised muscle tone and posture, and vertigo (Cassandro et al., 2003). Fligor (2010) indicated that without ear protection combat veterans could suffer hearing loss as the peak sound level of many firearms exceeds the maximum decibels considered safe for the human ear. Patterson and Hamernik (1997) found that the two military situations related to auditory dysregulation are the firing of heavy weaponry and the detonation of explosives and incoming mortar rounds. Fagelson (2007) found a high correlation between veterans with a PTSD diagnosis and tinnitius. The author went on to suggest that tinnitus (ringing, buzzing, roaring, hissing, clicking, or whistling) could trigger fear and anxiety in individuals with PTSD. Eggermont (2007) found that the generation and maintenance of tinnitus is thought to be the result of a maladaptive cortical reorganization of the central auditory system rather than blast overpressure. Psychologically, the perception of sonic stimuli related to PTSD can cause combat veterans with PTSD to have a notably strong auditory startle response (Butler et al., 1990). The discomfort of certain sounds can become associated with particular traumatic moments and can become habituated - sounds such as helicopters, planes, fireworks, loud horns, and alarms may be particularly difficult for combat veterans.

Recently, Okamoto et al. (2009) found that through sonic behavioral training, the use of individualized *notched* music significantly diminishes subjective tinnitus symptoms by promoting neural auditory cortical reorganization. Meloni and Davis (1998) found the acoustic startle response may involve a direct pathway from the dorsal cochlear nucleus of the amygdala to the spinal system and suggest that the habituation of the acoustic startle response may be achieved by repetitive exposure to startling sonic stimuli. Roy et al. (2009) were able to decrease the severity of the defensive startle reflex by repeated exposure to pleasant music with unpleasant sounds interjected throughout the listening experience.

Individual reaction to sonic stimuli and the untreated symptoms of tinnitus can play a role in the maintenance of PTSD symptoms. Interesting research and novel therapies have been developed in relation to auditory treatment for symptoms with high co-morbidity to PTSD symptoms. Extending the experience of sound to the experience of the creation of music reveals potential PTSD symptom treatment possibilities.

Behavioral activation - creating music and the relationship to PTSD.

Chronic stress and fear are central to the diagnosis of PTS and are implicated in the dysregulation of the structure and function of particular brain systems. Chronic fear and stress have been found to have a cumulative effect on the neural fear network. Kolassa and Elbert (2007) state,

> Network connections are strengthened through synchronous activation via long-term potentiation: Neural assemblies firing repeatedly in synch will tend to become associated, so that activity in one facilitates activity in the other. When the fear network is fully formed, the activation of a single memory item will cause the whole network to be activated in a cascade (p. 322).

Fortunately, as these brain pathways are *plastic*, there is potential to change the brain's neuropathways based upon behaviors and actions taken in life.

Over the past decade, promising research has revealed that learning how to play a musical instrument can promote neuroplastic changes in the brain. Pantev et al. (2009) demonstrated that learning to play an instrument causes reorganization of auditory and cortical brain structures. Chakravarty and Vuust (2009) found that individuals who learn to play musical instruments have an increased grey-matter volume density in the cortex. Trainor et al. (2009) found that the processes of top-down and bottom-up brain cognition were greater because musical training enhances the oscillatory networks of the brain that control executive functioning. Hyde et al. (2009) found that long-term instrumental training changes the neuropathways of the precentral gyri, corpus callosum, and the auditory cortex brain regions of the brain. The musical effect on neuroplasticity calls for future research to gain a greater understanding of the therapeutic potential of music to stimulate brain structures that may have been dysregulated due to PTSD by trauma.

The peptide hormone oxytocin has been linked generally to feelings of wellbeing (Kirsch et al., 2005). Higher levels of oxytocin may increase the treatment efficacy of PTSD therapy by naturally reducing the fear response and causing a greater sense of safety - increasing the potential for greater social functioning (Oiff, Langeland, Witteveen, & Denys, 2010). Grape et al. (2003) found that singing greatly increased oxytocin levels particularly in individuals who considered themselves amateur singers.

Specifically, the act of singing and more generally the act of playing music relies heavily on the proper use of breath control and the conscious manipulation of respiratory patterns.

Haas et al. (1986) posits that musical rhythms can be used as pacemaker to synchronize respiratory patterns by entraining the breath. When paired with conscious breathing retraining exercises, Fried (1990b) found that particular styles of music have reliable and profoundly beneficial results on relaxation. Furthermore, musical activities such as singing can provide a comprehensive exercise potentiating the regulation of voluntary respiration. Grape et al. (2003) found that singing greatly increased individuals' subjective state of wellbeing, potentially reducing the fear response, causing a greater sense of safety and increasing the potential for greater social functioning (Oiff et al., 2010).

In sum, PTSD and music affect similar physiological systems. Due to this relationship, the psychological and social implications of musical experiences as related to the mechanisms of therapeutic change in modern PTSD treatment are worthy of exploration.

Experiential & Behavioral Musical Interactions – Relationship to Exposure-Based Therapy and the Mechanisms of Therapeutic Change

Didactical listening experiences and therapeutic music lessons can have a relationship to exposure-based therapies. Current evidence based exposure treatment modalities for PTSD use interventions designed to cause moderate, but safe, arousal in clients. Exposure based interventions theoretically provide a safe experience for clients to work with their traumatic recollections in order to habituate arousal to workable levels. Exposure treatment modalities, such as Prolonged Exposure (PE), have been scientifically substantiated as an effective treatment for PTSD. However, PE's direct work with traumatic material has raised ethical concerns between the treatment approach and the principal precept of medical ethics *primum non nocere* (in English first, do no harm), leading some to call it the cruelest cure (Slater, 2003; Olatunj et al., 2009) and, potentially, contributing to the low rate of exposure therapy being conducted in

Veterans Affairs clinics (Foy et al., 1996). In light of this viewpoint, the benefits of therapeutic interventions that could complement exposure therapies and provide self-regulatory support during the practice of exposure activities are worth consideration. As listening to music has been found to regulate arousal symptoms, it is proposed that music could be used in tandem with direct exposure therapies. Furthermore, it is proposed that playing music can be therapeutically beneficial when working with secondary symptoms of PTSD such as defuse fear, loss of enjoyment, difficulty modulating affect and sleep disturbances. The subsequent paragraphs will elucidate how musical interactions can compliment the mechanisms of therapeutic change in exposure-based therapies.

Experiential musical interactions – the relationship to exposure.

The implementation of musical exercises as experiential adjuncts to PTSD exposure therapy can be facilitated by consideration of the research on guided imagery and music interventions. Blake and Bishop (1994) note that in inpatient group settings, guided imagery and music have been used effectively with Vietnam veterans with combat PTSD. Blake & Bishop (1994) note,

> Veterans … were able to reconnect with feelings, increase self-understanding, improve concentration, and/or achieve a sense of relaxation… guided imagery and music therapy gave the patient control of images, opportunities to release fears and begin verbalizing [the] traumatic experiences (p. 126).

Guided imagery and music is a process that uses classical music, relaxation techniques and verbal sensory prompts to provide a therapeutic experience for clients. Diagnostic symptoms of PTSD including intrusive thoughts, hypervigilance and hyperarousal can be conceptualized as a

biopsychosocial response to traumatic experiences leading to maladaptive efforts of experiential avoidance. As such, clients with PTSD may have a difficult time letting their guard down affecting the clients' ability to relax. Furthermore, clients may adopt a defensive posture towards others in an effort to feel safe, which can lead to social estrangement and detachment from others. During the didactical group listening exercises, common themes such as trust or safety can be used as a framework of the imagery experience. Blake and Bishop (1994) state, "Goals may include exploring the patient's inner world with a sense of choice and control, reconnection with positive aspects of the self, focusing on specific internal struggles, remembering trauma, grief work, or work with current life problems" (p. 127).

Through such exposure work clients can safely oscillate between states of arousal and relaxation in a therapeutically contained space (Blake & Bishop, 1994). The psychological flexibility created by the oscillating physical states may enable clients to practice the psychological skills of willingness, affect regulation, mentalization and develop relational connections with others potentiating attachment capacities. The experience provides opportunities for the client to mentalize by making meaning out of emotional and bodily sensations and the affect regulation associated with those sensations. Decidedly, the use of imagery and music has been found to significantly decrease cortisol levels, one of the biological indicators of anxiety, and may positively affect mood and decrease mood disturbances (McKinney, Antoni, Kumar, Tims, & McCabe, 1997). Moreover, the group musical experience may develop object relational capacities potentiated by supportive group experiences where all participants can witness a client's experience (Blake & Bishop, 1994). This speaks to Stern's (1985) observation that music can provide a communal group experience where individuals can "be with" and "share," as well as "participate," and "join in," (p. 148) the experience of another.

In other words, music can become a metaphorical space, such as Ogden's (1994) conceptualization of the analytic third, where the individual can understand one's self in relationship to another (Thompson, 2009).

When implementing guided imagery and music with clients on an inpatient PTSD unit, Blake and Bishop (1994) made the following recommendations:

> Adaptations recommended for hospitalized PTSD patients include (a) short duration of relaxation (1-2 minutes), (b) remaining in a sitting position, (c) high level of specificity of image and goal for the induction, (d) short duration of music (no more than 10 minutes), (e) experiencing of music/imagery development with eyes open and supported by writing, drawing, or movement (writing maintains a greater level of cognitive involvement than drawing or movement), and (f) emphasis on safety, validation, and reinforcement of efforts to create solutions (p. 128).

Blake and Bishop (1994) postulate that these adaptations are important to the generation of a controlled environment, fostering safety and trust within the group. Guided imagery and music uses a protocol for both individual and group formats and has been proven to be a highly malleable and effective therapeutic medium (for descriptions of various protocols see Meadows, 2010; Blake & Bishop, 1994). Some of the variations to the guided imagery and music protocol include a client-centered approach, with the client selecting the musical soundtrack. This is indicative of the evidence suggesting clients have a more cathartic experience when they have a role in the decision of which piece of music to listen to (Haack & Hodges, 1996). Empowering clients to have a choice in the musical selection may foster a greater degree of safety and trust

among group members, as well as the opportunity for individuals to share a part of themselves with others (McFerran-Skewes, 2004).

Using music to aid in the therapeutic process of imagery and relaxation is one potential use of music in the therapeutic process of change. This chapter now turns to the relationship between learning to play the guitar and the relationship to exposure therapy.

Behavioral musical interactions - the relationship to exposure.

The stress of learning to play an instrument can manifest in brief arousal, temporarily increasing PTSD symptoms. When receiving guitar lessons as a therapeutic adjunct to PTSD treatment, Miksza (2007) notes, "The mere presence of an observer can influence individual's behaviors and/or emotions by increasing arousal" (p. 6) (also see Martens, 1969; Zajonc, 1965). The clinician must be attuned to the client's affect throughout the guitar lesson. Understanding this point provides an opportunity for the client and clinician to work with affect *in vivo*. Clinicians should be ready and well suited to understand and work with anxiety as it manifests during the course of the lesson, as it is a catalyst for the client's mentalization and the re-fostering of attachment skills. Clinicians can encourage clients to use the measurement of subjective units of distress (SUD) to monitor anxiety throughout the lesson (Benjamin et al., 2010). If a client is highly aroused and/or dissociating, breathing exercises and other grounding experiences may help the client to reconnect to the present moment and may lead to the development of greater internal flexibility and adaptive means to regulate affect (Blake & Bishop, 1994).

Experiential & Behavioral Musical Interactions - Relationship to Acceptance-Based Therapy and the Mechanisms of Therapeutic Change

Didactical listening experiences and therapeutic music lessons can have a relationship to acceptance-based therapies. The Acceptance and Commitment Therapy (ACT) approach is an example of acceptance-based therapy that endeavors to develop willingness to engage in activities that are of personal value. ACT uses mindfulness techniques as a means to develop psychological flexibility and the developmental achievement of defusion from thoughts. The development and application of mindfulness techniques provides a medium by which clients can reengage with the present moment through a variety of activities (e.g. walking, singing/chanting, breathing, eating, playing an instrument, et cetera) with the goal to become re-engaged in life and to practice noticing how thoughts can be a distraction from fully participating in the present moment. ACT therapists understand the development and practice of mindfulness skills as a means to foster individuals' willingness to make behavioral decisions rooted in personal values. In other words, acceptance is the theoretical construct that manifests in willingness, which can be observable in clients' behaviors and actions. Willingness is practiced through mindfulness exercises that psychologically create space for new activities that are subjectively important. As such, a commitment to action is a treatment goal in ACT, with the client's attention turned toward activating behaviors that are self-defined as important (Deliberto, 2008). In this regard, it is suggested that adjunct therapies, such as music, can provide a bridge from the psychological principles of ACT to the ultimate goal of behavioral activation. Behavioral and experiential musical encounters can compliment acceptance and commitment therapy (ACT) providing client opportunities for mentalization, acceptance, re-fostering of attachment skills, and practice of mindfulness techniques through exposure to musical stimuli.

Experiential musical interactions - the relationship to ACT.

When facilitating musical listening exercises as experiential adjuncts to acceptance-based therapies for PTSD it is helpful to consider the development and practice of mindfulness in relation to music. Barry Green's "Inner game of music" is particularly illuminating. Green (1988) writes,

> The Inner Game when applied to music is about overcoming distractions that stand between us being at our best in listening, learning, practicing, teaching or performing. Distractions take the form of an inner voice attempting to control our actions and keep our attention away from the music. These diversions can be overcome by letting go... (¶ 7).

The development of musical mindfulness experiences can be conceptualized similarly to Miehls' (2011) formulation of surrender. Musical mindfulness can be understood as a practice that promotes active surrender, particularly of efforts to control unwanted internal sensations. By letting go of the mind's attempt to control, 'figure out,' or manipulate the experience, musical mindfulness activities provide an opportunity for participants to notice their minds in flight while focusing on the 'here and now.' As music is demonstratively evocative it provides a rich therapeutic experience. Clinicians can play a piece of music and encourage clients to focus only on grounding experiences existing in the 'here and now' – examples include the sounds in the room, a particular instrument, physical sensations, breath, vibrations, smells or visual sights in the room. Everything else but the experience happening in the room is an example of the mind's attempt to control or distract from the current moment. (See Appendix B: Music & Mindfulness.) From an ACT perspective individuals gain greater behavioral control by actually

letting go or surrendering attempts at cognitive control - feelings, memories, preconceptions, criticisms, evaluations, mistakes, emotions, et cetera (Green, 1988).

Mindful listening exercises can be a strong adjunctive experience to ACT treatments. Musical exercises can be constructed around the critical ACT components of *creative hopelessness*, *control as the problem*, *cognitive defusion*, *self as context*, *willingness and acceptance as an alternative*, *barriers to emotional acceptance*, and *commitment to action* (Gifford et al., 2005). For example, a particular exercise was developed to compliment the ACT concept of defusion. Since music is powerfully evocative individuals are bound to have associations to a piece of music. This should be reinforced as a normal experience – indeed this is why many people listen to music. The exercise is designed to deconstruct the complexity of the internal experience and is explained as being comprised of multiple phases. As the music begins, clients are instructed to focus attention on the present moment, 1) the here and now experience, which can include sounds, bodily sensations or physical vibrations. While listening to music, it is common for individuals to move in and out of the here and now and the other phases of the listening experience which include: 2) memories, thoughts or emotions; 3) evaluations or judgments about the piece of music, and; 4) a conceptualization about the self in relationship to the music, usually manifesting in a *story*. From an ACT perspective, our story is ultimately how one identifies or relates to an experience – personal history, cultural connection, personality traits, current mood, et cetera. In relation to defusion, phases two through four are examples of the mind fused to thoughts that may have little to do with the present moment. The defusion exercise is a chance for participants to notice their mind in flight and to bring their attention back to the here and now with non-judgmental focus on the present moment. This exercise also complements the ACT concept of self as context, which is the premise that within

an experience one's thoughts exist separately from the choice to entertain those thoughts and subsequent reactions to those thoughts. From an ACT perspective defusion creates psychological flexibility and behaviorally manifests in greater individual choice and less reactivity to impulses and thoughts. (See Appendix C: Music & Defusion.)

Behavioral musical interactions - the relationship to ACT.

The therapeutic process of making meaning out of one's arousal symptoms can become a vehicle potentiating the development of acceptance and value-based decision-making skills. As such, the behavioral elements implicit in learning how to play the guitar pair nicely with the acceptance based therapies. By practicing exercises aimed at developing skills for guitar playing, individuals are required to constantly focus and re-focus their attention on the exercises. The practice of focusing and re-focusing over and over again provides an individual with a self-determined valued behavioral exercise and a forum to actively notice thoughts and bodily sensations that emerge during the course of practice. Effectively, to develop the skills necessary to become competent on the instrument, the client has to let go of attempts to control unwanted thoughts and feelings to be able to complete the exercises.

While developing the ability to effectively defuse from one's thoughts and emotions is a developmental achievement in the creation of therapeutic change, strong feelings and emotions during the lesson can also be conceptualized as a means to foster the emotional vitality often blunted by PTSD symptomotology - emotional numbing and dissociation. In this sense the re-fostering of attachment skills can be the result of a positive therapeutic intervention during a music lesson. The following clinical composite exemplifies the potential of music to foster a sense of emotional connection with another. This clinical composite is reflective of a typical

encounter and represents the aggregated experiences of numerous clients. The material is from a non-disclosed clinical setting.

Composite Clinical Experience

Working with veterans, clinicians are often engaged with clients who are mourning losses of companions and of self. During PTSD treatment individuals told stories about their friends whom they lost. For example, a veteran lost a comrade in theater who was a musician and had offered to teach him to play the guitar after returning stateside. Over the years the veteran continued to not only grieve the loss of his comrade but also the loss of ambition to learn to play the guitar. This client expressed a sense of personal failure toward his lost friend - if he could learn to play the guitar he would be able to reconnect with his lost friend and himself. Often times therapeutic guitar lessons started with the client expressing joy at the prospect of learning to play the guitar and the aspiration to learn a particular style of music. In several sessions veterans became very emotional as the clinician verbally and musically reflected back what the client stated as the personal and stylistic motivation for learning to play the guitar. During initial sessions this clinician demonstrated an example of the type of music the client stated was of interest and possible avenues toward actualizing goals were suggested. Some veterans stated that being heard caused them to be moved emotionally and had felt empowered by the accurate musical reflection of the specific musical interest. Stylistic interest ranged from finger-style, delta-blues guitar using open ‘D’ tuning, to traditional American music such as swing, bluegrass and old time, to traditional music of Puerto Rico, to popular music such as The Beatles, Otis Redding and Sublime. While beginning students are often only able to communicate an implied stylistic interest, the role of the experienced teacher is to explicitly reflect the client's implied

musical interest, which further strengthens the sense of being heard and reinforces the sense of self.

The guitar lesson sessions facilitated the reconnection of the veterans to their pasts as well as connection to the present. Moreover, beginning the act of learning how to play the guitar is very much an in vivo exercise. The act of sitting with someone learning to play the guitar, something that may have been avoided for 40 plus years in the cases of Vietnam veterans, can bring up acute anxiety. Using ACT language, the clinician talked about the idea of struggle with anxiety and the behavioral cost of avoidance, also known in ACT as creative hopelessness. At this point in the process veterans frequently experienced conflict and had a choice to make: discontinue the lesson, costing the individual the possibility of actualizing a valued life choice or continue with the lesson with the anxiety that the client was feeling and focus on what was personally important – learning how to play the guitar. For example, it was not uncommon for a veteran who stated to have wanted to learn to play the guitar for his whole life to suggest he should stop taking lessons after the first week. At this point the clinician sat with the veteran to assess the level of anxiety and determine if the behavior was related to the avoidance cluster of diagnostic PTSD symptoms or if there was another explanation for the presentation. The clinical intervention would often expose the client's avoidant behavior and the choice that the client has to either entertain those thoughts or not. Typically, veterans who began to take lessons found it difficult at first to incorporate practice time into their daily lives and would consequently have acute anxiety about attending the lesson the following week. The clinician reinforced that there was no judgment made about their lack of practice in the previous week and that every lesson was another chance for them to reengage in the present moment. The clinician would suggest ways to incorporate practice into their daily schedules which further reinforced a sense of self

that has the ability to make value based decisions rooted in the present moment. For the veterans who made the decision to continue, this concretely made choice helped to psychologically organize the experience, both behaviorally and emotionally, and empowered the clients to actively engage in an activity that was meaningful and important.

Conclusion

As a result of these theoretical underpinnings, an informed approach when teaching therapeutic guitar lessons has manifested. During the experience of working musically with trauma survivors, a number of specific exercises have been found to compliment the therapeutic elements of both ACT and *in vivo* exposure therapy. This conceptual formulation led to the development of a utilized approach.

Sears's (1968) observation, "music demands time-ordered behavior" (p. 33) became a conceptual springboard leading to a series of exploratory musical behavioral exercises for clients with PTSD. The utilized approach was constructed to work musically with clients' anxieties *in vivo* and to practice mindfulness skills by exercising focused, non-judgmental attention to the present moment. Specifically, rhythmic and melodic exercises provide an easily facilitated opportunity to gain critical skills as a musician and also to practice the internal flexibility needed to regulate arousal while maintaining a steady rhythm. Moreover, rhythmic and melodic exercises provide a platform to notice one's thoughts in flight while bringing focused, non-judgmental attention back to the exercise at hand. Several exercises have been developed to provide exposure to mindfulness concepts. For interested readers, four examples of musical rhythm exercises have been provided. (See Appendix D: Guitar Protocol Introduction; Appendix E: Rhythm Subdivision; Appendix F: Crosspicking; Appendix G: 4/4 Rhythm; Appendix H: 3/8

Rhythm.) Three tools are essential to this protocol: a metronome, a timer, and a client evaluation of the experience after each guitar lesson.

The metronome is a devise that provides a steady marker that indicates a set beat-per-minute and allows individuals to maintain a steady pulse while practicing. This is a critical tool; it can act as a pacemaker for clients with PTSD symptoms. The arousal experienced during guitar lessons naturally pulls clients to want to speed up their playing. In this sense, the metronome becomes a tool for regulation and behavioral organization. It also facilitates a marker to consciously integrate steady breathing patterns into the exercise (for empirical study on this concept see Fried, 1990a; Haas et al., 1986).

A timer is used to keep track of the duration of each exercise. For individuals who live with PTSD symptoms - avoidance, attention deficit disruptions, and obsessive-compulsive tendencies - a timer provides an essential parameter to stay focused on one particular exercise for a set amount of time. Moreover, the timer can be a tool for clients to mentalize, or make meaning, out of attention deficit disruptions that are often co-morbid with PTSD.

The client evaluation provides an important opportunity for clients to reflect and mentalize their experience. Specifically, questions developed around ACT's core concepts *suffering, workability, struggle, willingness and values* provide a space for clients to make meaning out of their experiences and to help facilitate and integrate individuals' choices to make behavioral decisions rooted in their values. (See Appendix H: ACT Guitar Lesson Evaluation.)

Recommendations for Future Work

Physiological relationship between music & PTSD.

Since the original PTSD diagnosis in 1978, scientists have made great advances in the understanding of the effects of trauma on the body and mind (Shalev, 2000). However, even

with such accomplishments, experts are far from an exhaustive understanding of the biopsychosocial effects of posttraumatic stress. Likewise, while the effects of music have intrigued some of the greatest minds in history, experts are equally stymied in the effort to find an exhaustive biopsychosocial understanding of music's effects (Haack & Hodges, 1996). As such, future empirical research needs to be conducted to substantiate the suggestion that listening to or playing music has a therapeutic relationship to the physiological symptoms of posttraumatic stress and PTSD.

Psychosocial relationship between music & PTSD.

While research needs to be conducted on these physiological connections, psychosocial research is also needed to further substantiate the relationship between music and PTSD. Notably, as the completion of the PTSD therapeutic guitar lesson program neared, it was anecdotally interesting to observe which generation of veterans was most interested in learning to play the guitar. While veterans from Vietnam and Gulf Wars participated in guitar lessons the cohort with the greatest participation in therapeutic guitar lessons were the veterans of the OIF and OEF campaigns. As VAs across the country are looking for mechanisms to increase therapeutic services for OIF and OEF veterans, the use of music in the treatment of PTSD may be an effective mechanism. Future research could be conducted to further compare clinical impact relative to different groups.

Relationship between music and ACT.

While it is important to research the theoretical mechanisms inherent to music and PTSD treatment, a number of practical exercises could be developed. Similar to the musical defusion exercise previously described, further development of musical exercises could be constructed around the critical ACT components of creative hopelessness, control as the problem, self as

context, willingness and acceptance as an alternative, barriers to emotional acceptance, and commitment to action.

Testimony of veterans engaged in therapeutic guitar lessons.

At the conclusion of a non-disclosed PTSD program, individuals are asked to offer anonymous post treatment program evaluation/feedback about their experiences. As the guitar lessons were introduced during the program, valuable feedback specific to the content of therapeutic guitar lessons was offered as part of the program evaluation. Although the purpose of this study was theoretical and not empirical, it was interesting to review these evaluative comments, particularly as some of the feedback points was helpful. This information reflects impressions of individuals who experienced therapeutic guitar lessons in conjunction with treatment for PTSD. On the basis of the theoretical work and the positive testimonies, further empirical research is needed to substantiate the therapeutic mechanisms of change associated with providing guitar lessons as an adjunct to PTSD treatment – it was clearly a positive experience for these veterans. The following comments reflect evaluations offered via the anonymous feedback process:

> I have completed the six-week PTSD program at [X] facility and have learned and acquired new skills to cope with my PTSD symptoms. One of the major skills that was taught and reinforced throughout the six weeks was practicing staying mindful of your feelings and thoughts and staying in the present moment. This allowed me to accept my PTSD symptoms without limiting me from doing the things I value. One of the easiest ways for me to practice this skill was through music. By taking guitar lessons, I was able to further my education in something I enjoy and practice the same mindfulness techniques taught through the program. It allowed me to focus my efforts and attention

on something that I find value in. While taking lessons and practicing on my own it became easier to stay in the present moment and focus on playing the guitar. From my experience, playing the guitar was extremely beneficial and therapeutic and I would recommend getting involved in music to anyone. It definitely helped me along through this PTSD program. OEF Veteran (personal communication April 19, 2011).

My name is [X] and I am a patient at the [X] program for PTSD. I am writing this letter to make the positive effects of [X]'s musical program known. I walked in this program very nervously almost six weeks ago. In my time here I have learned many valuable lessons about myself to which a newfound sense of direction has availed. Amongst these lessons I would rank [X]'s guitar classes towards the top, a strong runner up to the best thing I will take from this place. I have always been around music but never attempted it personally. But after a few short conversations with [X], I was convinced that it would be a good move to pick up a new hobby, particularly one I was interested in. In the past few weeks I have become very aware of the therapeutic benefits these lessons and this new hobby have instilled upon me. In the course of learning the guitar I have made many mistakes but accept these as just what they are, mistakes. I can process them as momentary and move on with my happiness, as opposed to dwelling on them with negative thoughts and letting those thoughts guide my decisions. I have also found that when I do become stressed I can pick up this instrument and simply strum away most of the superficial stuff and be mindful of what I'm really feeling. There is a peace to be found in what [X] has taught me and I will carry these skills into the real world. In the process of taking lessons I was also asked to fill out surveys about my emotions and the

physiological symptoms of my stress. It was amazing to me to see how my anxiety was consistently lowered after the lesson. The sum of this letter is to point out that what [X] is doing with music and us works. OIF Veteran (personal communication February 28, 2011).

My experiences at [X] pertaining to my guitar lessons with [X] were absolutely necessary, specifically to my PTSD therapy. As a musician prior to PTSD, both playing music and listening to music have always been essential to helping me manage my PTSD symptoms. Having guitar lessons with [X] was ideal in learning all areas of music which include, musical theory, chords in a key, scales, methods to learn songs by ear, etc. And also having a qualified therapist to talk to. [X] taught me and many other Vets how to experience and appreciate the gift of music - to use music as a tool for positive feelings and to ward off negative feelings. I spoke with other Vets who were taking guitar lessons that had never played before coming to the PTSD program and they all had positive feedback about their experiences learning to play the guitar. I feel that without my guitar lessons with [X], I would not have completed the program. It provided me with a hobby I look forward to, filled me with memories I most cherish and brought my spirits up when I was feeling down. I recommend that everyone with PTSD at least try learning to play the guitar, or any instrument. Music is one thing nobody can ever take from me. OIF Veteran (personal communication March 15, 2011).

This is to comment on the music (guitar) lessons being offered at [X]. I know individuals taking lessons and am aware of how much they are learning and how important this activity is to them, both the pleasure and therapeutic benefits. I believe that other Vets

> would avail themselves if the opportunity was offered and expanded. The music is also a real pleasure to those of us non-players who simply listen. The quality of my time here is considerably improved by having this activity in-house. If the program is continued and hopefully, expanded; I am sure that a real benefit would accrue to the entire unit. Korean War Veteran (personal communication February 23, 2011).

Implications for Clinical Practice

As music is a ubiquitous human experience the clinical applications of musical listening exercises as adjunct therapy are limited only by the clinician's imagination, knowledge and skills. However, the effective use of musical listening exercises as an adjunct to specific PTSD treatment modalities requires a thorough understanding of both the particular treatment modality and the psychosocial effects of music. Moreover, implementing therapeutic guitar lessons as an adjunct to PTSD treatment is limited by the skill set of the clinician. Interested clinicians with this skill set are encouraged to explore the services of *Guitars for Vets* to enhance PTSD treatment with adjunctive therapeutic guitar lessons (www.guitars4vets.com). This national program receives referrals from clinicians treating veterans with PTSD in the VA system and provides six free guitar lessons. Excitingly, on May 5, 2011 the VA began recruiting participants for a clinical trial to determine the efficacy of the six-week *Guitars for Vets* training program (Department of Veterans Affairs, 2011).

In conclusion, experiential and behavioral musical interventions are especially complimentary to exposure, acceptance and mindfulness therapeutic practices currently associated with evidence-based practices for treatment of PTSD. The highly malleable nature of musical interventions in clinical practice makes them an accessible and effective adjunct to

PTSD treatment – of which therapies that bridge the mind and the body are uniquely positioned to benefit from the use of music in clinical practice. This study attempts to integrate complementary musical interventions with currently accepted treatment protocols to advance clinical work with persons who suffer PTSD.

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Appendix A: DSM-IV-TR Diagnostic Criteria for PTSD

A. The person has been exposed to a traumatic event in which both of the following were present:
(1) the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others
(2) the person's response involved intense fear, helplessness, or horror. **Note**: In children, this may be expressed instead by disorganized or agitated behavior

B. The traumatic event is persistently reexperienced in one (or more) of the following ways:
(1) recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions. **Note:** In young children, repetitive play may occur in which themes or aspects of the trauma are expressed.
(2) recurrent distressing dreams of the event. **Note:** In children, there may be frightening dreams without recognizable content.
(3) acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur on awakening or when intoxicated). **Note:** In young children, trauma-specific reenactment may occur.
(4) intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event
(5) physiological reactivity on exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event

C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three (or more) of the following:
(1) efforts to avoid thoughts, feelings, or conversations associated with the trauma
(2) efforts to avoid activities, places, or people that arouse recollections of the trauma
(3) inability to recall an important aspect of the trauma
(4) markedly diminished interest or participation in significant activities
(5) feeling of detachment or estrangement from others
(6) restricted range of affect (e.g., unable to have loving feelings)
(7) sense of a foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal life span)

D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following:
(1) difficulty falling or staying asleep
(2) irritability or outbursts or anger
(3) difficulty concentrating
(4) hypervigilance
(5) exaggerated startle response

E. Duration of the disturbance (symptoms in Criteria B, C, and D) is more than 1 month.

F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functions.

Specify if:
Acute: if duration of symptoms is less than 3 months
Chronic: if duration of symptoms is 3 months or more

Specify if:
With Delayed Onset: if onset of symptoms is at least 6 months after the stressor

(APA, 2002, p. 467-468)

Appendix B: Music & Mindfulness

Clinicians can use music as a means to generate *in vivo* experiences for clients to practice mindfulness - focused, non-judgmental attention on the present moment. The development of a mindfulness practice is less about the content or outcome as it is about the process. Noticing - being mindful of the small details of everyday life such as one's breath, pulse, physical sensations, sounds, et cetera - can help ground individuals to the present moment and become more aware of how quickly our thoughts detach us from fully experiencing the present moment.

This exercise can be performed with various types of music. If the musical selection(s) have a mixture of lyrics & non-lyrics, be mindful of the increased impact on the client's experience.

Examples of songs to use with the mindfulness exercise

Bach – Cello Suite #1 in G
Bach – Air On The G String
Brad Mehldau – River Man
George Winston – Cloudy This Morning
Yo-Yo Ma, Mark O'Connor, Edgar Meyer – O'Connor: Appalachian Waltz
Ben E. King – Stand By Me
Otis Redding – That's How Strong My Love Is
Johnny Cash – Folsom Prison Blues
Paul Winter – Canyon Lullaby
David Grier - Impulsive
Cold, Cold Heart – Bill Frisell

A handout can be used to help organize the client's experience. A group discussion should follow. Clients should be praised for every time they are able to bring their attention back to the music after they notice their mind in flight.

1) What I noticed about the song:

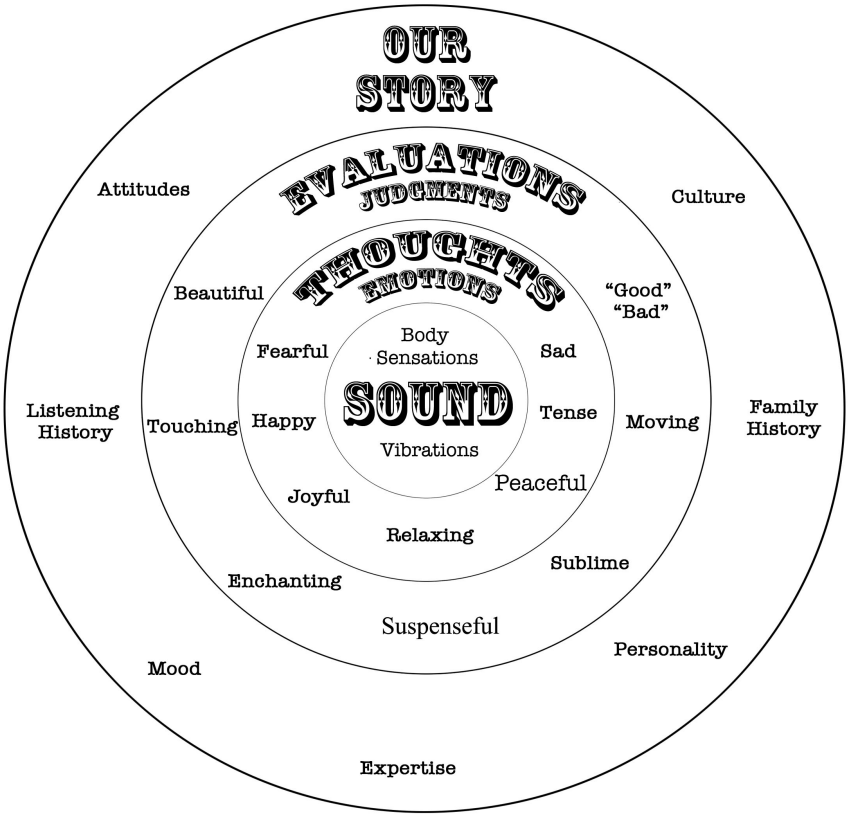
2) I noticed having the thoughts of:

3) I noticed having the feeling of:

4) I noticed having the judgment of:

5) I noticed having the urge to:

Appendix C: Music & Defusion



This diagram represents an example of how we can become fused with our thoughts. The experience of listening to music can provoke many powerful sensations, thoughts, experiences, evaluations, and judgments. Consider that this is what our minds naturally do – this is programming and it is happening all the time.

At the center is the musical event that represents *just the facts* of what *actually happened*. The further away the circles are from the musical event, the more variable and subjective the emotions become. This process accounts for the individual variables and factors influencing our experience becoming *our story*.

As you listen to the piece of music be mindful of the various layers of experience. When the music stops, use the questions below to organize your thoughts and be prepared to talk about your experience in group.

1. What sounds and/or physical sensations did you experience in the room?
2. What thoughts and/or emotions did you notice as you listened to the music?
3. What evaluations and/or judgments did you experience while listening to the music?
4. What's your story? Did you have a memory while listening to the music?

Appendix D: Guitar Lesson Protocol Introduction

The stress of learning to play an instrument can manifest in brief arousal, similar to arousal symptoms of PTSD. Making meaning of the physical sensations associated with arousal can provide individuals with the understanding that PTSD significantly dysregulates the body and is not just a psychological disorder. The clinician must be attuned to the client's affect throughout the guitar lesson. Understanding this point provides an opportunity for the client and clinician to work with affect *in vivo*.

Clinicians should be ready and well suited to understand and work with anxiety as it manifests during the course of the lesson, as it is a catalyst for the client's mentalization and the re-fostering of attachment skills. Clinicians can encourage clients to use the measurement of subjective units of distress (SUD) to monitor anxiety throughout the lesson. If a client is highly aroused and/or dissociating, breathing exercises and other grounding experiences may help the client to reconnect to the present moment and may lead to the development of greater internal flexibility and adaptive means to regulate affect.

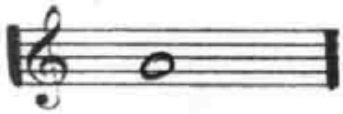
The therapeutic process of making meaning out of one's arousal symptoms can become a vehicle potentiating the development of acceptance and value-based decision-making skills. By practicing exercises aimed at developing skills for guitar playing, individuals are required to constantly focus and re-focus their attention on the exercises. The practice of focusing and re-focusing over and over again provides an individual with a self-determined valued behavioral exercise and a forum to actively notice thoughts that emerge during the course of practice. To develop the skills necessary to become competent on the instrument, the client has to let go of attempts to control unwanted thoughts to be able to complete the exercises. While developing the ability to effectively defuse from one's thoughts and emotions is a developmental achievement in the creation of therapeutic change, strong feelings and emotions during the lesson can also be conceptualized as a means to foster the emotional vitality often blunted by PTSD symptomotology - emotional numbing and dissociation. In this sense the re-fostering of attachment skills can be the result of a positive therapeutic intervention during a music lesson.

It is not uncommon for a client who stated to have wanted to learn to play the guitar for his/her whole life to suggest (s)he should stop taking lessons after the first week. At this point the clinician should sit with the client to assess the level of anxiety and determine if the behavior is related to the avoidance cluster of diagnostic PTSD symptoms or if there is another explanation for the presentation. The clinical intervention often exposes the client's avoidant behavior and the choice that the client has - to either entertain those thoughts or not. Typically, clients who begin to take lessons find it difficult at first to incorporate practice time into their daily lives and consequently have acute anxiety about attending the lesson the following week. The clinician should reinforce that there is no judgment made about their lack of practice in the previous week and that every lesson is another chance for them to reengage in the present moment. The clinician should suggest ways to incorporate practice into the client's daily schedule which could further reinforce a sense of self that has the ability to make value based decisions rooted in the present moment. For the clients who make the decision to continue, the concretely made choice helps to psychologically organize the experience, both behaviorally and emotionally, and empowers these clients to actively engage in an activity that is meaningful and important. The following 4 exercises are provided as a experimental protocol that incorporates guitar lessons into the therapeutic environment of PTSD recovery.

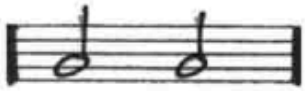
Appendix E: Rhythm Subdivision

- Set metronome at 40 bpm (this can be increased as proficiency develops).
- Practice each exercise for one minute.
- Play all exercises on one string (low E for example).

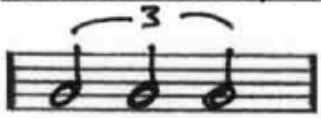
Exercise one: Play one note per click.



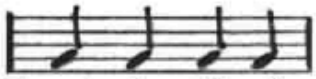
Exercise two: Play two notes per click.



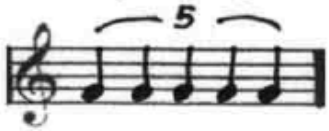
Exercise three: Play three notes per click.



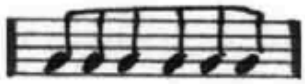
Exercise four: Play four notes per click.



Exercise five: Play five notes per click.

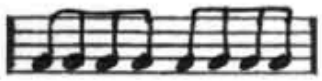


Exercise six: Play six notes per click.



Exercise seven: Play seven notes per click.

Exercise eight: Play eight notes per click.



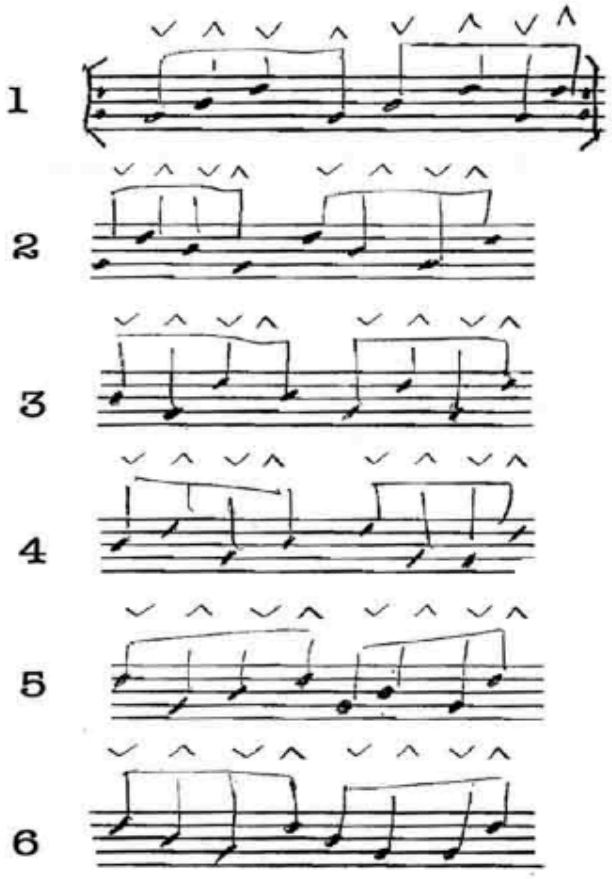
Appendix F: Crosspicking

Note [1]: Choose 3 consecutive strings (example: G, B, E)

Note [2]: Allow all strings to ring open

Note [3]: Refer to the patterns below, each open string is indicated by an eighth note

Pattern 1 reads: Low, Middle, High, Low, Middle, High, Low, High
or with our example strings:
G, B, E, G, B, E, G, E



Note [4]: Pick a new set of three strings and do the patterns again, continue until you exhaust all possible 3 string combinations. Remember, the "notes" above are NOT NOTES, they are just "place holders" that apply to your chosen sets of strings.

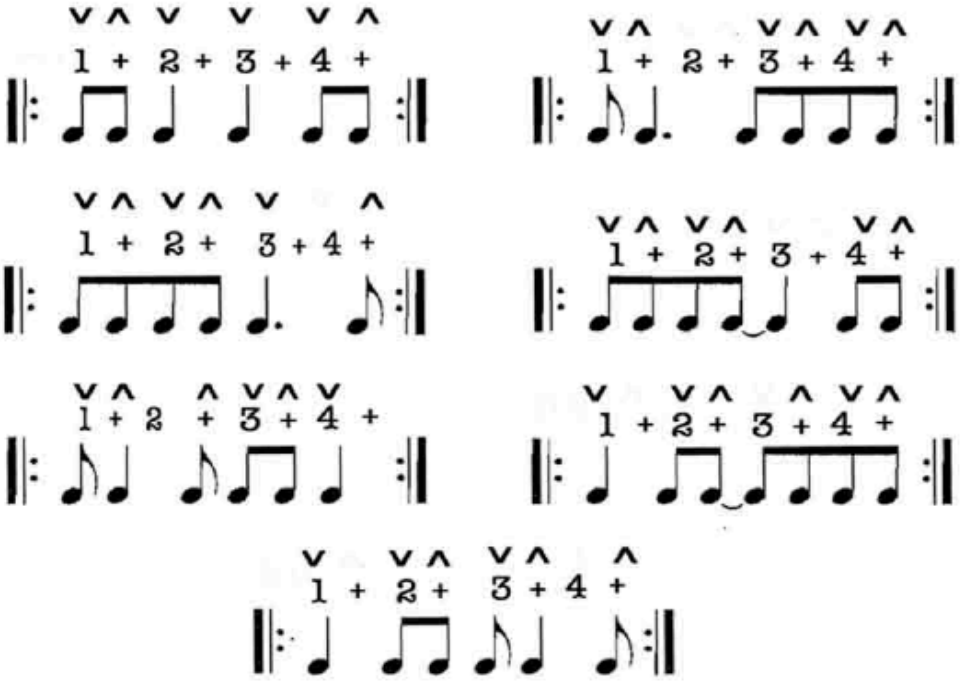
Note [5]: Each measure should be played over and over again and ALWAYS with a METRONOME. If you want to flat pick well, then here is your ticket to ride.

Appendix G: 4/4 Rhythms

Note [1]: 4/4 time means: there are 4 beats in each measure an quarter note is equal to one beat.

Note [2]: Strum down on the down beats (1,2,3,4) strum up on the up beats (+, +, +, +)

Note[3]: I encourage people to mute the strings with the hand that isn't strumming.

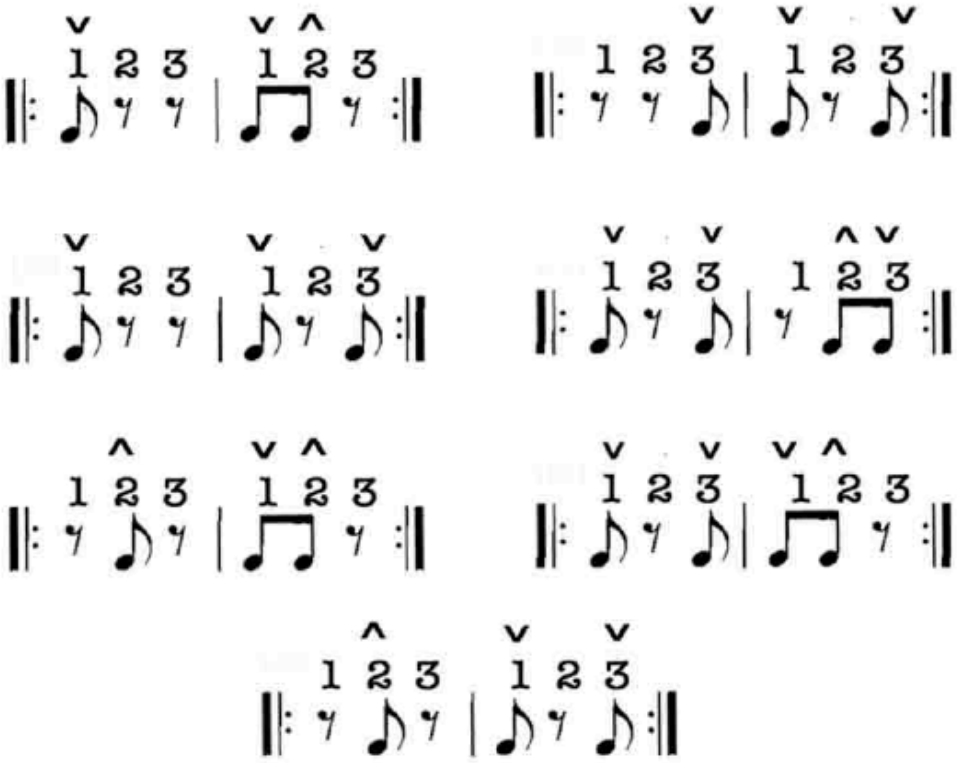


Appendix H: 3/8 Rhythms

Note [1]: 3/8 time means: there are 3 beats in each measure an eighth note is equal to one beat.

Note [2]: Strum down on beats 1 and 3 strum up on beat 2

Note[3]: I encourage people to mute the strings with the hand that isn't strumming.



Appendix I: ACT Guitar Lesson Evaluation

Date: _____ Week: _____ Lesson: _____

1. ***Please make a rating for each of the following questions using the scale below. Ratings for each question can range from 0 (not at all) to 10 (extreme amount):***
   0 1 2 3 4 5 6 7 8 9 10

Suffering: How upset and distressed were you today overall? ____

Workability: Generally, if life was more like what you experienced during this lesson, to what degree would this lesson be part of a vital, workable way of living for you? ____

Struggle: During this lesson, how much effort did you put into making unwanted feelings or thoughts go away today (for example, by suppressing them; distracting yourself; reassuring yourself or seeking reassurance from someone else)? _____

Willingness and values: How willing were you to experience whatever you were experiencing during this lesson (including unwanted feelings or thoughts) ***and*** focus on learning something new about the guitar during this lesson? _____

2. ***How much were you aware of your breath during the lesson?***
   1 2 3 4 5 6 7 8 9 10 More ___
3. ***Please describe any physical sensations that you had during the lesson***
   - ☐ Shortness of breath
   - ☐ Sensations in the fingertips
   - ☐ A sense of calm or relaxation
   - ☐ Tightness in the chest
   - ☐ Other (please describe):
4. ***Which of these statements best describes your objective for this guitar lesson?***
   - ☐ To take a guitar lesson because I'm genuinely interested in learning to play the guitar.
   - ☐ To take a guitar lesson because I'm trying to find something to distract myself from unwanted thoughts or feelings

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5. ***How do you describe your current attitude? (circle all/none that apply)***

   Anxious Insecure Judged Excited Depressed Sad Hopeful Happy
   Useless Embarrassed Positive Grounded Proud
6. ***Today we learned: (Check all that apply)***
   - ☐ New chords
   - ☐ New theory concepts
   - ☐ New scales
   - ☐ A new song (title):
   - ☐ New guitar technique