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Music Listening as Therapy

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Music Listening as Therapy

by

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Each person whose signature appears below certifies that this project in his/her opinion is adequate, in scope and quality, as a project for the degree Doctor of Psychology.

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ABBREVIATIONS

ACT	American College Test
ACT	Acceptance and Commitment Therapy
ADHD	Attention-Deficit/Hyperactive Disorder
ANS	Autonomic Nervous System
BCE	Before Common Era
BPD	Borderline Personality Disorder
CBT	Cognitive Behavior Therapy
CNS	Central Nervous System
DBT	Dialectical Behavioral Therapy
EEG	Electroencephalogram
EMMA	Engineering Model of Music Audition
ERAN	Early Right Anterior Negativity
ERP	Event-Related Potential
fMRI	Functional Magnetic Resonance Imaging
GFFRP	Gestalt Figure Formation and Resolution Process
GTT	Gestalt Therapy Theory
Hz	Hertz
IED	Improvised Explosive Device
I-R	Implication Realization
K.	Köchel catalogue
LAN	Left Anterior Negativity
LPP	Late Positive Potential

MAAS	Mindfulness Attention Awareness Scale
MBCT	Mindfulness-Based Cognitive Therapy
MBRP	Mindfulness-Based Relaxation Program
MBSR	Mindfulness-Based Stress Reduction
MBT	Mindfulness Based Therapy
MinMuList	Mindful Music Listening
MRI	Magnetic Resonance Imaging
MRT	Medical Resonance Therapy
ms	Millisecond
MT-BC	Music Therapist - Board Certified
N2	Event-Related Potential component
N400	Event-Related Potential component
PET	Positron Emission Tomography
PTSD	Post-traumatic Stress Disorder
SAT	Scholastic Aptitude Test/ SAT Reasoning Test
SEFFM	Standard Engineering Feedback/Feed-forward Model
SNS	Sympathetic Nervous System

ABSTRACT

Music Listening as Therapy

by

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Dr. Paul Haerich, Chairperson

Music is a universal phenomenon and is a real, physical thing. It is processed in neural circuits that overlap with language circuits, and it exerts cognitive, emotional, and physiological effects on humans. Many of those effects are therapeutic, such as reduced symptoms of physical and mental ailments. Music is the result of the elements rhythm, melody, harmony, timbre, dynamics, and form. Rhythm is the focus of pop music, and melody is the focus of classical music. The mind perceives and organizes music in learned, consistent ways in order to generate predictions and extract meaning. There are perceptual laws and information processing limitations to this process. Predictions are based in schematic and veridical approaches, which give rise to expectations. Frustrated expectations result in an effective response. Music only has meaning unto itself and the music listener ascribes any extra-musical meaning. This includes any emotional meaning. The unfolding of a song is much like how Gestalt Therapy theory conceptualizes human experience. Mindfulness offers a clear definition of how one can frame and approach experience to support health and well-being. MinMuList (said “min-mew-list”) is an evidenced-based workshop that offers a concise discussion and straightforward methods for implementation of these aspects of music and psychology. For further information, or to provide feedback, please send email to MusicListeningasTherapy@gmail.com.

CHAPTER 1

INTRODUCTION

Since the 4th century BCE, many great thinkers have discussed the universal phenomenon of music and still there is no consensus regarding its cognitive basis or evolutionary purpose. From the longstanding discussion have emerged two main questions in regards to the origins of music. The first is whether the cognitive mechanisms that allow for music are unique to music, developed in parallel to language abilities, or if they are shared with language circuits and musical ability is an evolutionary byproduct. The second is whether music has an adaptive purpose, such as to emote or to communicate, or if it is purely a hedonistic endeavor, an auditory cheesecake, so to speak (Levitin & Tirovalas, 2009). While interesting, this discussion is beyond the scope of the current manuscript. Additionally, this is neither a discussion about, nor is this intended to supplant, Music Therapy. While a unique discipline with a distinct domain of training, research, and application, Music Therapy has significant overlap with psychology, musicology, and sociology. The stated purpose of this manuscript is to explore music as an aural stimulus and how mindful listening can be used in a psychotherapeutic manner. With due deference, *Music Listening as Therapy* will put in place a solid scientific foundation and build upon that a mindful music listening workshop that can be adapted to a variety of settings and patient populations. The workshop will henceforth be referred to as MinMuList.

The first step will be a demonstration for the need for an integrated approach to mindful music listening that takes a primarily psychological approach. The justification for such an undertaking will take the form of a general literature review on music as a broad therapeutic intervention, as well as a literature review on music performance. The research presented in the second chapter will come from many perspectives, including, but not limited to: (a) psychological; (b) sociological; (c) ethnological; (d) musicological; (e) nursing; (f) medical. Each domain brings a unique perspective to bear on the value of music in support of health, and concepts from each will be interwoven throughout the rest of this manuscript. Information on music performance will be incorporated into MinMuList because a performer is required if there is to be music. However, the workshop will not include a music performance activity because the use of performance is more aligned with Music Therapy. Instead, this information is included because it may shed light on the purpose of music as, at minimum, a communicative device. Furthermore, sharing this information may inspire workshop participants to seek out opportunities to participate in music performance, which will be shown to have psychophysiological benefit. Ultimately, incorporation of diverse views of music listening and performance will help to make MinMuList as informed and effective as possible.

In the third chapter, music as such must be explored. This will be no simple task, as the word music conjures up many ideas, images, memories, beliefs, and so on. The goal being to create form from the formless, the discussion will begin with music as a physical phenomenon and move towards more abstract concepts. As a means to such an end, this chapter will discuss music in the following ways: (a) physics; (b) audition; (c) psychoacoustics; (d) theory. The theory section is very much like an expansion of the psychoacoustic section and will include physical and theoretical descriptors of music. Within the theory section, there will be brief, but necessary, descriptions of the elements of music and Western Classical musical concepts. The elements include: (a) rhythm; (b) melody; (c) harmony; (d) timbre; (e) dynamics, (f) form. Concepts include ideas such as melodic contour and chord progression. These physical dimensions and theoretical concepts are wed through music listening to create what is known as music (Iakovides, 2004). If MinMuList is to be well grounded and effective, then the space between and joining the objective and the subjective dimensions of music is precisely where this conceptual exploration must venture. Therefore, a longer exploration of the phenomenology of music listening will be required.

The fourth chapter then will focus on Leonard B. Meyer's seminal work *Emotion and Meaning in Music* (1954), the importance of which is still seen in the zeitgeist of psychophysiological music research. It examined the relationship between patterns and meaning in order to provide guidance for research in the domain of music theory and aesthetics (Krumhansl, 2000). Meyer included the most up-to-date theory and research as he blended philosophy, psychology, and musicology to explore how music listeners experience, organize, and react to music. Essentially, Meyer's theory took a cognitive approach to music listening, with strong influence from Gestalt laws of perception. He determined that, regardless of music type consumed, each music listening experience is subject to the three interrelated factors: (a) attention; (b) imagination; (c) affective awareness. His take home message is simply that if explicit attention is paid to aesthetic music, then the music listening experience can be a powerful cognitive and affective one. Just how music goes from a psychological to a physiological experience must then be understood to create the strongest mindful music listening workshop.

The fifth chapter will then explore the mechanism by which music achieves change in a music listener's physiology. This is best accomplished through presentation of the Engineering Model of Music Audition (EMMA), which itself is based on the book by Daniel J. Schneck and Dorita S. Berger entitled *The Music Effect* (2006). The EMMA holds that exploration of the human body as a mechanistic entity is the best approach to understanding how the psychoacoustic properties of music lead to specific and noticeable effects on human psychophysiology. The EMMA postulates that the human body collects information about itself and its environment, though it is subject to physical limitations, such as limited auditory range. The human body then processes sensory information through subconscious and emotion areas then associative areas. While following Gestalt laws of perception when processing sensory and cognitive information, such as grouping, the body attempts to minimize wasteful output and maximize space and energy. Ultimately, the human body has survival as its primary goal. The EMMA chapter will weave together the psychophysiological and cognitive imaging research that accumulated in recent decades since the providence offered in *Emotion and Meaning in Music* (1956). Additionally, consideration of the components of the EMMA will help to strengthen MinMuList.

The sixth chapter will be a deeper exploration of the psychophysiological research on two musical elements, rhythm and melody. These elements are the two most basic musical elements, and each represents the principal musical element for pop and classical musical styles. As will be explored in the Music Cognition chapter, the importance of rhythm and melody in determining the focus of the music listening experience cannot be understated. This chapter will also help set the stage for the mind-body connection will be then be explored in the Gestalt Therapy theory and mindfulness literature review chapter. Although six core musical elements have been identified, it is beyond the scope of the current manuscript to offer such an in-depth discussion of such breadth. Therefore, comprehensive exploration of rhythm and melody will suffice for the purposes of establishing a strong scientific foundation for MinMuList.

Given the harmonic parallel to Meyer's theory, the seventh chapter will be an introduction to Gestalt Therapy theory and mindfulness. One focus will be on Hanne Hostrup's conceptualization of Gestalt Therapy theory, especially the concept of zones of awareness: (a) environment; (b) mind; (c) body. The introduction to mindfulness will focus on the best approach to remain present in the current moment in support of the most important factors of the music listening experience: (a) attention; (b) imagination; (c) affective awareness. The introduction to the tenets, practices, and psychophysiological effects of Gestalt Therapy theory and mindfulness will provide evidence-based guidance for designing a therapeutic approach to music listening.

The eighth and final chapter will be the conclusion. It will bring together the major theoretical concepts presented in the next six chapters that will act as the scientific foundation for MinMuList. This will be both a summary of the information presented, as well as a template for the workshop itself. MinMuList will be included in the appendix as a workbook. This workbook will provide information, handouts, and activities to present the key concepts, skills, and experiences that will lead to modification of patients' cognitive and behavioral schemata. Included will be information for how to tailor the structure of MinMuList to meet the needs of the situation, such as varying time constraints or patient demographics. The goal is to provide scientifically informed guidance for what, and how, to teach mindful music listening as a therapeutic intervention. Without further ado, what follows next is an exploration of *Music Listening as Therapy*.

CHAPTER 2

JUSTIFICATION

General Therapeutic Effects of Music

The literature review of the broad psychophysiological effects of music provided here will provide a solid justification and foundation for the therapeutic implementation of mindful music listening as the MinMuList workshop. One study about music as an intervention presented clear clinical utility. Patients were more likely to share when they perceived the environment as supportive due to the background music's slow tempo and major key. Conversely, patients were less likely to share when they felt hastened and heightened negative emotional states due to the background music's rapid tempo and was atonic (Jensen, 2001). Either effect can be achieved quickly, where subjective report indicated that music is affectively potent enough to move listeners in as little as one second (Bigand, Filipic, & Lalitte, 2005).

Another inherent benefit of using music listening as one means to teach psychological skills and mindfulness is that music enhances communication and underscores critical information (Alten, 2005; Baumgartner, Lutz, Schmidt, & Jäncke, 2006; Carpentier & Potter, 2007). In the few years that this information has been collected, electroencephalogram, physiological, and psychometrical findings have unanimously found that music markedly enhanced the emotional reactivity to visual stimuli (Baumgartner, Esslen, & Jäncke, 2005). Attention and memory are also improved when music is paired with the target stimulus. When tested for content in a variety of radio commercials, it was found that structured background music in the advertisement improved subjects' recall of verbal content presented (Potter, Lang, & Bolls, 2008).

EEG evidence suggested that music enhances cognitive processing for patients with disorders of consciousness. That is, a subject in a coma was more likely to react to his name if music was playing than if no music was playing (Castro, Tillman, Luauté, Corneyllie, Dailler, André-Obadia, & Perrin, 2015). Music listening has also been found to reduce symptoms of a variety of neurological disorders, such as epilepsy, Parkinson's Disease, senile dementia, and attention-deficit/hyperactivity disorder (ADHD). Data from an fMRI study demonstrated that music listening and performance both helped to slow cognitive decline, as well as enhanced health and well-being (Gutman & Schindler, 2007). Performance on an arithmetic task was improved for students with ADHD when music was playing in the background (Abikoff, Courtney, Szeibel, & Koplewicz, 1996).

Cognitive Research on Music

Carol Krumhansl, the well-known researcher of human perception and cognition, noted that while music has long been a topic of study, computer-imaging technologies have offered tremendous insight in the last few decades. For example, fMRI data found that previous musical training predicted the amount of concurrent activation of auditory cortex and motor cortex (Krumhansl, 2000). Similarly, the overlap between language and music functions is a longstanding issue in the field of psychology. Thanks again to computer technology, evidence for shared neuronal circuits is now well documented. ERP research found that chord progressions that were syntactically irregular elicited an early right anterior negativity (ERAN), while words that were syntactically irregular elicited a left anterior negativity (LAN). The LAN was much weaker when paired with music that evoked an ERAN, but not other signs of error detection. These data suggest overlap in neuronal mechanisms that process language and music (Koelsch, Gunter, Wittfoth, & Sammler, 2005). Categorical perception of musical phrases also suggests similarity between how language and music are cognitively processed (Howard, Rosen, & Broad, 1992; Siegel & Siegel, 1977; Zatorre & Halpern, 1979). However, ERP data suggested that separate neural networks process semantic and melodic congruency, based on patterns of brain activity in reaction to semantically odd words that were sung in or out of key in an a capella format (Besson, Faita, Peretz, Bonnel, & Requin, 1998).

Neurophysiological Research on Music Induced Emotion

Additionally, music has well documented effects on neurophysiological processing. As measured physiologically, emotional reactivity to music is strongest when a voice first enters, at the start of a new section, the pre-chorus, the chorus, and during a change in tonality (Grewe, Nagel, Kopiez, & Altenmüller, 2007; Tsai, Chen & Tsai, 2014). The few fMRI studies that do exist show clear activation of Limbic and Paralimbic structures during music listening for a range of emotions, including joy and fear (Baumgartner, Lutz, Schmidt, & Jäncke, 2006; Koelsch, Skouras, Fritz, Herrera, Bonhage, Küssner, & Jacobs, 2013). In a series of lesion studies that used fMRI and self-report measures, subjects that had had portions of their limbic system resected were found to have less reactivity to emotional music and lost the ability to identify the emotional content of music (Gosselin, Peretz, Noulhiane, Hasboun, Beckett, Baulac, & Samson, 2005; Gosselin, Peretz, Johnsen, Adolphs, 2007; Gosselin, Peretz, Hasboun, Baulac, & Samson, 2011). Continuous self-report and subsequent fMRI data for four piano pieces were time-locked to determine where musical tension was processed in the brain. Data revealed that as tension builds in a musical piece there is increased activation in the left lateral orbitofrontal cortex and the right superficial amygdala, both of which are important emotion processing centers (Lehne, Rohrmeier, & Koelsch, 2013). Electroencephalogram (EEG) data suggested a relationship between the emotional valence of music heard and lateralization of the cognitive processing of the music. Regardless of genre, positive emotional attributions of a musical piece elicited left temporal activity, while negative emotional attributions elicited bilateral activity with most occurring in the right fronto-temoral cortex (Altenmüller, Schürmann, Lim, & Parlitz, 2002). This bilaterality may be due to activity of interlobular system attempting to modulate the negative affective state (Heller, 1993). A PET scan study found increased blood flow to brain regions associated with reward/motivation, emotion, and arousal during subjective report of thrills and chills response to pleasurable passages of music (Blood & Zatorre, 2001).

The positive emotional effects of music are well documented. Sidorenko (2000) found a clear sympatholytic effect after three weeks of two daily 30-minute sessions of listening to Medical Resonance Therapy (MRT)-Music children with high blood pressure. Neuroimaging has also found powerful effects on neuroaffective mechanisms. Results from one study indicate that music-evoked emotions modulate activity in every limbic and paralimbic brain structure involved in the initiation, generation, detection, maintenance, regulation, and termination of emotions (Koelsch, 2010). A physiological study that utilized an animal model found that, upon exposure to classical music (Mozart, K. 205), neostriatal dopamine levels and serum calcium levels were increased compared to controls and resulted in a decrease in blood pressure, which pointed to a well-established dopamine synthesis pathway in the brain (Sutoo & Akiyama, 2004).

Summary of General Effects

Integration of the latest information will support tailoring MinMuList to the specific needs of most patients. This is important because research has demonstrated that subjects report different cognitive assessment of the same musical piece depending on their respective psychological pathology. Specifically, persons diagnosed with schizophrenia reported music as more attractive than persons diagnosed with a depressive disorder or an anxiety disorder, who reported music as less attractive. In the same study, subjects diagnosed with mania reported music with a fast tempo as more attractive and more strongly associated with positive emotions than did normal subjects (Iakovides, 2004). Overall, myriad meta-analytic articles assessed the efficacy of music as therapy for a variety of patients, including those with serious mental disorders like schizophrenia (Gold, 2005, 2009). Additionally, numerous review articles explore the psychophysiology of music listening. Some foci include the perceptual and cognitive aspects of music, as well as the subjective emotional or objective physiological effects of music. While many articles offered sound theoretical explanations for music's notable effects on the human experience, it is frequently noted that there was still a gap in the understanding of the mechanisms by which music exerted psychophysiological effects on listeners (for comprehensive reviews, see Sloboda, 2000; Krumhansl, 2000; and Kreutz, Murcia, & Bongard, 2012; Koelsch, 2013).

General Effects of Music Performance

First, a caveat before more is said about music performance. This section is not a prescription for how to incorporate performance into MinMuList, it is simply to acknowledge the benefits of music performance offered to the performer. Therapeutic music performance falls in the realm of Music Therapy. However, when one considers the variety of aspects of music performance, the complexity of the phenomenon becomes readily apparent, which allows room for analysis form multiple perspectives. One goal of this manuscript is to establish a clear psychological perspective on the broad therapeutic value of music. Multiple academic perspectives are incorporated in order to demonstrate collegiality and to support integrated medicine.

Music exists because it is performed. While the abstract nature of music is important to fully understand it, in the end, without generation of sound by a performer or a computer simulation, there is no music. With that simple fact acknowledged, this section will briefly explore research on music performance, focusing primarily on the performer side of the activity. A more in-depth analysis of listener effects will take place in subsequent sections of this manuscript. The positive effects of music performance for an individual are many. Creative and re-creative performance of music calls upon and improves neuropsychological processes, such as learning, organization, planning, memory, interpretation, expression, and motor skills.

Skills

Music performance, much like any activity, requires familiarity and expertise to achieve maximal quality and gains. Literature makes note of the shift in approach to music education that occurred after the dissemination of high-speed printing in the early 1800s, which made scores of scores readily available. Former teaching practices reflected an oral tradition of interpretation trained though playing by ear and improvisation, while latter practices focused more on reproduction trained though reading of music notation and emphasis on technique (Schleuter, 1984). Regardless of educational approach, more recent research has found there are five important skills related to musical performance: (a) perform rehearsed music; (b) sight-read; (c) play from memory; (d) play by ear; (e) improvise (McPhersen, 1995; Nuki 1984). Later, McPhersen (1997) performed a path analysis on these five skills and found that early exposure, enriching activities, length of study, and quality of study supported skills development, though to varying degrees for both creative and re-creative performance. Enriching activities, essentially engaging music in a variety of ways, will result in the most robust skill enhancement, and a handful of frequently noted activities are private lessons, performing with others, learning multiple instruments, and singing (Grunow & Gordon, 1989; Kohut, 1985; Pratt, Henson, & Cargill, 1990). While some differences in skill enhancement based on performance type were noted (Lehmann & Ericsson, 1993), longitudinal research supports the claim that any form of quality practice makes perfect (Ericsson, 2004; Sloboda, Davidson, Howe, & Moore, 1996). Likewise, despite concerns, emphasis on listening skills was strongly advised as foundational to music education and appreciation (Priest, 1993). One point to emphasize is that rich and multifaceted ongoing experience with music will provide the best education and understanding of the intricacies of music.

Academic Benefit

Furthermore, research has found that students that participate in music education tended to report higher grades in English, math, history, and science than those who did not participate. Likewise, music students achieved higher scores on standardized tests, like the SAT and ACT, compared to students not enrolled in music education (Hodges & O'Connel, 2005). However, it was noted that students interested in music education had higher academic achievement before enrolling in music education (Cox, 2001; Holmes, 1997). Similarly, physical fitness is demonstrated and improved through the performance of music, as well as accompanying dance, which is likely to attract the attention of potential mates (Miller, 2000). Though there exists different opinions on the best way to go about training producers and consumers of music, the secondary benefits of learning and performing music seem clear, such as enhanced organizational skills.

Organization and Execution

Architectonics refers to the organization of a musical piece across multiple structural levels. Generally agreed upon architectonics of Western music were found to influence mental organization and resultant music, both of which reflect executive functioning. A potential explanation for this was that meter, the recurring alternation of emphasized and deemphasized beats, affected the salience and performance of music events (Clarke, 1985). The meter acts as the foundation for the periodicity and describes the regularly occurring events that increase in complexity across the organizational levels of a piece. The salience of musical events that imply periodicity will automatically engage deeper cognitive processing, thereby resulting in a more well developed mental representation of the specific event and its accompanying structure. The more well developed a representation, the more likely it is to be related to other representations. A musical phrase is typically the most salient feature of a piece, the boundary of which is experienced as the tactus: when one is most likely to tap a foot during listening (Fraisse, 1982). A phrase is the structural element most precisely and consistently produced and perceived. Furthermore, a phrase acts as the foreground structural phenomenon that is perceived in relation to the increasingly complex architectonic structure of a piece whose other musical elements provide the background and meaning to the current phrase and overall piece (Meyer, 1956; Schenker, 1969). One reductionist musical theory postulate held that structurally important elements of a music piece will be represented more accurately in a neural network due to a recursive association mechanism (Krumhansl & Kessler, 1982; Lerdahl & Jackendoff, 1983). Performers understood this, and therefore knowingly emphasized the most salience structural features of a piece to aid in their communication of their interpretation of a piece (Todd, 1985). Another study found that performers' improvisational continuations of musical fragments included phrase and abstract structural elements (Schmuckler, 1990). In another study, when improvising on a musical theme, pianists tended to retain only the important structural elements of higher architectonic levels (Large, Palmer, & Pollack, 1995). Listeners explicitly understood the predictive power of architectonics as well, as they reportedly held accurate expectations of subsequent musical events based on previous musical events (Schmuckler, 1989).

Planning and Errors

Planning is a component of executive functions and involves the organization of information in a coherent and logical manner that fits the situation. Memory, another component of execution functions, is linked to planning through organization. Both are important to the complex relationships of the architectonics and elements of a piece. Research suggested that performers have a plan for what they will play when it found that the organizational level of performance errors varied based on the structure of the piece (Drake & Palmer, 2000). Analysis of piano playing found that note errors occurred in pieces with emphasis on melody and tended to occur in the same key signature of the piece. Chord errors occurred in pieces with emphasis on the harmony and tended to be similar in structure to the chord was supposed to be played (Palmer & van de Sande, 1995). One study found that singers' errors were harmonically related to the intended note (Moore, 1994). Another study found that performers' note errors indicated unintentional modulation an intentionally erroneously written note to fit within the key signature of a piece during a sight-reading performance (Sloboda, 1976). Organization of the elements within a piece influence planning as well, where reproduction of a heard phrase was more disrupted as intentional grouping accents were further shifted (Drake, Dowling, & Palmer, 1991). Spontaneous errors in music performance, similar to those in speech, were found to occur within phrases, and rarely across phrase boundaries (Garcia-Albea, del Viso, & Igoa, 1989). Decreases in tempo and dynamics at phrase boundaries have been well documented to imply the structure of a musical piece (Henderson, 1936). This compositional tool has been oft utilized to communicate the relative importance of phrases within a musical piece (Todd, 1985; Shaffer & Todd, 1987). Lerdahl and Jackendoff (1983) noted that the more important the segment, the longer the length of the final phrase. These clear aspects of intermediate level phrases act as anchors for the rest of the interpretation of a piece, as analysis has revealed they are performed consistently across performers while lower architectonic levels of performance vary widely (Todd, 1992; Palmer, 1989). Similarly, pianists played accents that aligned with the meter with great dynamics, longer duration, and smoother articulation (Sloboda, 1983). In the same study, listeners' judgment of meter was more accurate when metrical events were aligned with articulation cues; likewise, listeners correctly utilized dynamic cues to determine meter.

Memory as a Limiting Factor

Cognitive limitations of memory also influence performance planning in the context of musical structure. In one experiment that featured an eye-hand span task, pianists reproduced seven to eight notes beyond the end of musical notation of a piece they had just heard (Sloboda, 1974). In another experiment, and similar to language production, the number of notes pianists accurately reproduced from a memorized piece correlated to the distance to the phrase boundary (Garcia-Albea et al., 1989). Taken together, the importance of planning and memory for music performance cannot be understated. It is the skilled creation of a structured musical space that will allow listeners to best understand the musical piece through efficient consolidation of music thus performed and yet to come.

Communicating with the Listener

Emphasis on structural content has been identified as central to a performer's interpretation (Clark, 1987), and research has identified that this approach is readily possible in parallel during performance for both the performer and listener (Nakamura, 1987; Palmer, 1989). Emphasis on this aspect of interpretation was communicated during performance through early onset of the lead melody compared to other melodies featured in a piece, as well as slowed tempo at phrase boundaries. These two communicative devices were found to vary with expertise, familiarity with a piece, and intentional variations on interpretation of a piece (Palmer, 1996). Previously, Palmer (1992) found that performance most varied from the written score at phrase boundaries, a technique that apparently aided in correct retrieval and performance of melodic events (Palmer & van de Sande, 1993).

Emotional expression was also found to be central to the process of interpretation of a musical piece and communication with the listener. Aggressive or tender interpretations of a Beethoven piece led to notable differences in multiple elements of music (Askenfelt, 1986). Happy and angry emotional content was played with faster tempo and wider dynamic range, with abrupt tone onset in angry interpretations. Sad emotional content was played with slower tempo and a narrower dynamic range, with slower tone onset in a sad interpretation (Gabrielsson, 1995, 1999). Replication of these specific variations in performance, as well as accurate identification of intended emotion by listeners, was later found (Gabreilsson & Juslin, 1996). Research suggested that the interpretive tools employed by performers were effective enough that identification of the intended emotion was equivocal for musicians and non-musicians alike (Geringer & Madsen, 1987; Johnson, 1996; Palmer, 1989; Sloboda 1985). Additionally, there are many characteristic rhythms that feature systematic performance of notes based on the song type. For example, a Viennese waltz features a repeating three-note pattern with a short, metrically emphasized first beat and a long second beat (Bengtsson & Gabrielsson, 1983). Analysis of listener's ratings of similarity of expressive timing patterns of characteristic rhythms revealed three factors important for performance: structure; motion; and emotion. Structure included meter, accent pattern, and simple note duration ratios. Motion included rapidity, tempo, and forward movement. Emotion included vitality, excitement, and playfulness (Gabrielsson, 1982). However, performance expression varied across contexts, as one study revealed, by finding that piano performances dictated by rhythmic groupings were not influenced by the addition of other accents, while performances dictated by melodic accents were influenced by the addition of other accents (Drake & Palmer, 1993). Similarly, despite notation indicating concurrence, instruments that played the melodic lead tended to sound notes before their accompaniment, with instruments that had a longer attack time sounding earlier (Rasch, 1979). This may serve a perceptual purpose, as it will tend to set the melodic voice apart from the harmonic voices, as research shows that temporally offset tones are perceived as parts of separates wholes (Bregman & Pinker, 1978).

Performers also use creative license to compensate for psychophysiological phenomena that change the perception of a musical piece. Skilled application of psychoacoustic mechanisms, such as playing a phrase with more intensity, supports accurate detection of an event, which would be perceived as too quiet to have salience given the scored musical context (Drake, 1993). However, it appears that listener expectations play a role in the phenomenon of salience washout. One study found that listeners accurately identified the one lengthened phrase of a simulated piece, while in another phase in the experiment had more difficulty identifying lengthened phrases the more frequently a performer utilized them (Repp, 1992). These examples illustrate some of the limitations of assuming a psychoacoustic driven or an expectation driven theory of music performance and perception (Repp, 1995). Two theoretical models that have combined both approaches have found supporting evidence through performance and perception analysis. Narmour's (1996) melodic expectancy model predicted the next likely event given the musical context. Lerdahl's (1996) model predicted tonal tension and relaxation based on harmonic relationships through large chunks of a musical piece. Krumhansl (1995; 1996) found evidence that informed listeners could utilize both approaches to make accurate predictions from minimal structural information. Palmer

(1996) found that expressive cues are communicative mechanisms in both theoretical approaches.

Motor Control Models

Palmer (1997) noted: “seminal theories of motor control (Bernstein, 1967; Lashley, 1951) often use music performance as the ultimate example of human motor skill” (p. 117). The speed with which performers could carry out preplanned and precisely timed movement sequences, often without kinesthetic feedback, was the foundation for such a claim (Keele, 1969). The temporal pattern of a musical phrase, that is, the rhythm, preserves the meaning of a movement sequence, without which the sequence would be but noise (Verberg & Hambuch, 1984). However, a theoretical challenge is the determination of the primacy of a bottom-up or top-down source of the relationship between rhythm and movement. Simply put, it is unclear if movement creates rhythm and timing, or if rhythm and timing create movement (Clarke, 1997). There are three competing models that explore the relationship between rhythm, timing, and movement. Each has been designed and studied from theoretical, mathematical, and perceptual perspectives, with varying degrees of support. The main models are: (a) timekeeper models; (b) motor program models; (c) kinematic models.

Timekeeper Model

Timekeeper models hold that an internal clock generates expectations for when musical events will take place, with the abstract temporal reference points acting as the basis for plans of subsequent motor events (Schaffer, 1981). Support for this model comes from reproduction tasks, where subjects were most accurate at reproducing musical rhythms with 1:1 or 2:1 internals (Essens & Povell, 1985). Subsequent similar research revealed that subjects were more accurate at reproducing patterns with rhythms that had integer ratio relationships, regardless of prior musical training or performance (Essens, 1986). Both studies acknowledged the methodological confound that the task included both perceptual and behavioral components. Experimental observations of spontaneous tapping and walking found that subjects had an internal clock with an interbeat interval of 540 – 600 ms (Fraisse, 1982). During musical performance, however, musical structure, such as solo or duet, set an apparent hierarchical clock timed to the subbeat, the beat, or the bar (Schaffer, 1984). Familiarity with a piece appeared to shift time keeping to a higher architectonic level, where the durations of a string quartet performed multiple times by the same performers was highly consistent. The standard deviation of the total piece was almost identical to that of the movements, and when one movement was lengthened, almost always another was shortened (Clynes & Walker, 1986).

Motor Program Models

Motor program models hold that a person will generate representations of a motor plan and processes to execute that plan in coordinated fashion independent of external cues (Keele & Summers, 1976). Flexible schemas account for the fluency, expressiveness, and adaptableness of the motor program theory (Rosenbaum, Weber, Hazelett, & Hindorff, 1986). While research in support of this theoretical approach to music performance was mixed, methodological issues were cited. It was suggested that the structural changes the musical piece were significant enough across experiment phases that the resultant motor plan for each was too different to actually test this theory (Clarke, 1982).

Kinematic Models

Kinematic models operate from the assumption that rhythm generates movement, given the regularity of motor movements, especially those related to music performance. Rhythm is indeed transmitted through sound, which is how a performer provides the listener with a satisfying structural framework for a musical piece (Shove & Repp, 1995). Kinematic models are often mathematical models of rhythm and timing that can be used to stimulate performance. One study found that the music generated by the kinematic model of focus created within listeners the experience of movement (Kronman & Sunberg, 1987). Repp (1992) later modeled accelerations and decelerations using a cubic equation. Subjects preferred simulations based on integer values where the timing profile modeled by the equation was similar to that which best modeled the live performance. Concurrently, Todd (1992) developed a model that held tempo constant and instead varied dynamics, which he explained as having a base in a kinetic energy model. He further developed this model to account for small and large body movements. While parsimonious compared to timekeeper models because it is based purely on performance, the model may overfit the data given the at-times poor accuracy of the graphic representation of a performance (Todd, 1995). Further criticism of kinematic models of timing and performance holds that the physical energy of motion is not the same as a their psychological representations (Desain & Honing, 1994). Likewise, the linear and curvilinear changes in rhythm modeled reflect neither observed changes in rhythm during performance, nor are they in agreement with perceptual laws that govern categorical separation of segments based on abrupt tempo changes (Clarke, 1985).

Limitations of the Research on Music Performance

Despite extensive exploration, musical performance remains a difficult phenomenon to explore due to a lack of an experimental control because of the limitations of musical notation, which can call for specific tone pitch and duration, but less specific tone intensity and quality (Palmer, 1997). Though providing for a rich and enduring element of culture, the uniqueness of each performer's interpretation creates the quagmire of selecting an ideal performance for analysis (Cone, 1968; Levy, 1965; Meyer, 1973). The challenge is to determine which performance by which performer of which musical piece to consider as representative (Kendall & Carterette, 1990). One solution is to look at differences of performance within a piece, rather than from the written score (Desain & Honing, 1991). Another popular solution is to consider the meaning making process of interpretation, which tends to be based on Meyer's theory (1956) that links structure, emotion, and physical movement. There are well-studied two popular theories about the musical structure-performance relationship. One theory focused on differentiation and grouping rules (Sundberg, Fryberg, & Fryden, 1991), while the other focused on composers' consistency within structural level across their catalogs (Clynes, 1986). Both simulated performances and live performances supported both theories based on perceptual data, indicating that both architectonic and personal factors contribute to performance, further complicating research efforts (Repp, 1989; Repp, 1990). Clarke (1993) found similar confounding results in regards to this concept, where while pianists were able to accurately recreate scores with distorted structure-expression relationships, listeners' ratings of the quality of the performances correlated negatively with the amount of aforementioned distortion. One possible explanation for how listeners can extract information from the performance without clear auditory cues could be that they learn the performer's vocabulary of expressive gestures. Davidson (1993, 1994, 2001) reliably found that observers of point-light displays of performers accurately rated the meaning of the performer's gestures in the absence of the audio of the music performed.

Summary

Music has numerous well-documented effects on listeners, including those found specifically in the therapeutic environment. Memory, mood, and physical health were shown to improve by listening to music. Furthermore, subjects were able to identify specific aspects of music that contributed to their experience while listening to music. Performance of music is the mechanism by which the abstract rules of music theory and the physical properties described by psychoacoustics come to be. Performers enhance their understanding of and abilities to create music through a variety of activities that support cognitive and physical fitness. Music performers that consistently practiced experienced improved learning, organization, planning, memory, interpretation, expression, and motor skills. For MinMuList considerations, acknowledgement of these benefits will support attendee to buy-in to the value of the workshop. Then attendees will be more likely engage the material and actively participate, which will improve outcomes. The next chapter will focus on psychoacoustics, where the physics, physiology, and theory of music will be explored.

CHAPTER 3

MUSIC AS SUCH

The phenomenon of music having just been discussed, this section will now explore this thing called music from a physical and musicological perspective. This information is important to include in MinMuList because it corresponds lines up with important psychological theory, which will be discussed in Chapter 7, "Gestalt Therapy Theory and Mindfulness." Suffice it to say for now that understanding the real, physical thing that is music and basic music theory will support insight into one's environment and mind. Generally speaking, music begins as organized sound waves that are detected by someone, the listener. The listener then organizes the detected sound waves and assesses them across a set of dimensions called elements. The elements have to do with the timing, relationship, and feel of the sound. Music compositions tend to follow rules, such as what pitches fit well together and how to organize the pitches over time. The information presented in this chapter is based on general conceptual knowledge found in many texts and other informal teaching materials. However, the following information is primarily based on the following texts: (a) Wright (2014); (b) Gazzaniga, Ivry, and Mangun (2009); (c) Meyer (1956); (d) Schneck and Berger (2006). Now, a brief exploration of music as such.

Physics of Music

The real, physical object of music is sound waves. A voice, an instrument, or a digital source generates sound waves, which are air molecules that vibrate at a consistent rate. Sound waves can be plotted on a graph over time to communicate information about their objective properties, such as the frequency of waves per second and volume of the sound, known as pitch and dynamics, respectively. A pure sound wave, one that is a consistent and smooth oscillation on a graph, is called a tone. However, sounds are almost never pure, and their sound waves are almost never smooth, perfect oscillations when plotted. Most sound waves are the result of imperfect noise generators that feature overtones, which are tones that are mathematically related to the intended tone, and pass through inconsistent media, which is usually transmitting other sounds. However, there are reliable properties about noise generators and media that allow for one to learn how to readily identify different voices, instruments, and environments. For example, one can typically identify a good friend by hearing them speak one word, even cough. Similarly, one usually expects to hear an echo when one is having a conversation in a gymnasium.

Musical Instruments as Noise Generators

For music, the properties that are relevant for noise generators have led people to create a musical instrument classification system, where instruments with similar sound generating properties are grouped. The most common classification system in Western music includes string, woodwind, brass, and percussion instrument groups. String instruments include the violin, viola, cello, bass, piano, guitar, citar, banjo, and ukelele. Woodwind instruments include the piccolo, flute, oboe, clarinet, saxophone, and bagpipes. Brass instruments include the cornet, trumpet, flugelhorn, trombone, and tuba. Percussion instruments include the bock-a-da-bock, cowbell, triangle, djembe, and timpani. This classification system is based on how the air molecules are put into motion, such by a vibrating string or by breath, and how the frequency of the air molecules is controlled, such as by changing the length of the string or tube. For example, a piano and an oboe can both play a tone with the same frequency, like center C, but one listening can identify which instrument is playing because of the unique resonant properties of the piano and the oboe. A piano uses a vibrating string attached to a large box to move air molecules, while an oboe has a vibrating reed that vibrates air molecules in a brass tube. There are many other ways to classify instruments, such as by how the noise generator is activated or the range of the frequencies the instrument can generate. Often, each culture will have its own way of classifying instruments. The point is that there are myriad culturally bound theoretical and practical systems one can employ to understand and describe instruments and the sound waves they create.

Audition

As the sound waves propagate outward from their source, they bump into whatever physical entity is in their path. If the sound waves reach a human's ear, then they are transduced to a chemical/electric signal that can be analyzed in and by the brain. Transduction occurs when the sound waves are funneled by the outer ear into the ear canal, which then bump up against and vibrate the tympanic membrane at the end of the ear canal, which then vibrates a series of small bones called ossicles within the middle ear that are connected to the tympanic membrane, which then vibrate the oval window which is the beginning of the cochlea. The cochlea is a fluid filled chamber that tapers and is wrapped up like a snail shell and is divided into three smaller chambers by Reissner's membrane and the basilar membrane. Hair cells, which are connected to the organ of corti and run along the basilar membrane inside the cochlear duct, vibrate at different frequencies depending on their relative position within the cochlea, with higher frequencies detected nearer the oval window. When a hair cell vibrates, it transmits the raw spatial and temporal information about the detected sound wave via a chemical/electric signal through the organ of corti. In this case, the spatial information represents the frequency of the sound. The organ of corti then projects to the brain via the auditory nerve, which is also called to cochlear nerve. The auditory nerve also transmits information about balance from the nearby semicircular canals. The average human auditory nerve contains around 30,000 nerve fibers that transmit raw information about the relative durations and frequencies of the sounds waves detected. Fibers exit the auditory nerve and project onto the cochlear nucleus and the inferior colliculus in the midbrain. Projections then lead to the medial geniculate nucleus in the thalamus, and then to the limbic system for threat vetting and primary auditory cortex for identification. Further exploration of the cognitive processing of sound will take place in the Engineering Model of Music Audition chapter below.

Psychoacoustics

Psychoacoustics is the psychology of sound audition. In addition to the physics and psychical detection of sound, psychoacoustics takes into account the meaning making and emotional processes that occur within humans during audition. The process by which a music listener is able to perceive and deconstruct music into its component parts is similar to a Fourier Analysis, where a complex function is understood through the summation of its simpler constituent parts. Fourier Analysis has been used throughout the longstanding history of psychophysiological music research to design experiments that ensure construct validity and support valid conclusions about music audition (Iakovides, Iliadou, Bizeli, Kaprinis, Fountoulakis, & Kaprinis, 2004). In recent years, mostly due to advances in technology, research on psychoacoustics has become increasingly complex.

A later chapter will explore some of the research as it relates to the elements of music that are critical for this manuscript.

Music Theory

The rules that music generally follows vary across cultures, and one must understand those rules in order to fully appreciate the aesthetic value of music (Meyer, 1956). Certainly, one can learn about a style of music simply by listening to it and picking up trends and nuances; however, a brief theoretical introduction to a style of music, combined with actual listening to music of that style, provides the best approach to learning and the best avenue to appreciation (Wright, 2013). In this spirit, this manuscript will now provide a brief introduction to Western Music that includes information about the elements of music and how they combine to create music.

The Elements of Music

Music is a complex phenomenon that exists in four dimensions and is described across a variety of metrics to help composers and performers track and generate it. Those metrics are called elements of music, and there are many. Each textbook presents a different set of core elements. *The Music Effect* (Schneck & Berger, 2006), the basis for the Engineering Model of Music Audition discussed in chapter 5 of this manuscript, listed the core elements of music as: (a) rhythm; (b) melody; (c) harmony; (d) timbre; (e) dynamics; (f) form. An in-depth look at the psychophysiological research on rhythm and pitch/melody will take place in Chapter 6, "The Critical Elements of Music." A cursory explanation of these six core elements of music will now take place.

Rhythm

Rhythm is the regularly recurring pattern of sound events that alternate with silence. The basic thump of a sound event is called the beat, and it is the detection of the beat that is the essence of rhythm. Rhythm is found throughout a person's day, such as when one tracks her respiration rate or hears the seatbelt alarm in her car. It is indeed the many rhythmic physiological processes, such as a pregnant woman's heart beat that is audibly detected by the developing fetus, that make so many consider it the fundamental element of music. Rhythm is the underlying structure to which sound events align, giving rise to the phenomenon of music. It is the driving force that keeps a song going.

Beats tend to be grouped into twos or threes, both by composers and by brains, with the emphasis on first beat. This means that most Western music is in duple meter or triple meter, where meter refers to the grouping of beats; that is, music that can be tracked by repeatedly saying, "ONE-two," or, "ONE-two-three, respectively (Krumhansl, 2000). A score, which is music is that is written down in a traditional matter, clearly indicates the meter. The score also has clear visual demarcation of each group of beats called a measure or bar. There is typically an Italian word written near the beginning of the score to indicate the pace of the rhythm, such as lento for slow or allegro for fast. The easiest way for a music listener to determine the rhythm is to perform some type of physical action that is naturally timed with the music, such as clapping along to a song. The mind and body will naturally respond to the rhythm of the music. It is indeed this natural psychophysiological response that makes pop music successful, and why people listen to music during physical activities, such as dancing or running.

Syncopation

At times, emphasized offbeat sound events will themselves exhibit periodicity. An expressive tool that is characteristic of some styles of music, such as jazz and electronic dance, the syncopation can be single sound or an important note in series. To demonstrate, if one were to clap on the following capitalized words, one would experience a regular beat versus a syncopated beat: “ONE-and-TWO-and-ONE-and-TWO” versus “one-AND-two-AND-one-AND-two-AND.” The qualitative experiences between the regular and syncopated beats are indeed remarkable.

Melody

Melody is the tune of the song; the catchy part that listener’s hum long after hearing the song. Scientifically speaking, melody is the sounding of related pitches over time. A pitch is the quality of the frequency of the note. The higher the frequency, the higher the pitch; the lower the frequency, to lower the pitch. The pitches that relate to each other are readily identified as a key signature, which is identified at the beginning of a song. There are many subtle variations of key signatures called scales. A major scale is the most common scale in Western music and it is typically associated with a light and happy feeling. The minor scale is also common in Western music and it is typically associated with a heavy and sad feeling. Since the melody is the lead, it usually communicates the mood of the musical piece. The composer uses melody to communicate emotion through careful selection of notes, or pitches. When three or more notes from the same scale are sounded at the same time by the same instrument, it is called a chord. Melody will be explored in depth in “Chapter 6: The Critical Elements of Music.”

Consonance

Consonance occurs when two or more notes that fit well together are played at the same time, creating a subjectively pleasant experience for the listener. There is a sense of agreement, of cooperation, among the notes. This is mostly due to the harmonics of the sounded pitches. That is, the wave patterns of the pitches line up in such a way as there are no clashes among their peaks and valleys. Notes that are consonant are considered related and are therefore included in a key signature and a scale. The three notes with the greatest consonance within an octave are sounded together in a major chord; those are the first, third, and fifth notes of a scale. A major chord has a sense of completeness because of the consonance and harmony that results. Typically, musical pieces will start with a consonant melody, then shift to an unstable or dissonant melody, and then resolve through return to consonance.

Dissonance

Dissonance occurs when two notes that do not fit well together are played at the same time, creating a subjectively unpleasant experience for the listener. There is a noticeable wobble in the sound that results when two notes are played at the same time. The strongest wobble occurs when two notes that are one half-step apart are sounded at the same time. Usually, composers try to avoid dissonance; however, dissonance is often used as an expressive technique in music, such as to evoke physical discomfort that is to be interpreted as a foreboding. One classic example of intentional dissonance comes from the movie “Jaws”; the accelerating duh-nuh, duh-nuh, duh-nuh elicited physiological discomfort prior to pairing with the approach of the titular shark.

Harmony

Harmony is the sounding of two, related melodic lines at the same time. Building upon the aforementioned preferred notes and chords of a key signature, two voices or instruments that play notes that pair well together are said to be in harmony. Often, one instrument will play a chord while another will play a melody. For some instruments, like a piano, one hand will play a chord while the other hand will play a melody. Usually the chord is the lower, deeper sound, while the melody is the higher, lighter sound. This arrangement is often called bass and treble.

Timbre

Timbre is the color, quality, or texture of the sound. It varies as a result of the media that makes up the noise generator, so each instrument and voice has its own timbre. The unique properties of noise generators create subtle variations in the sound waves that propagate out as notes, which are rarely pure, as discussed above. For example, the timbre of a note varies if it is generated by a plucked string that vibrates a guitar body compared to a bowed string that vibrates a violin body. Furthermore, the timbre of a note varies if the guitar body is made of hard wood compared to soft wood. Additionally, the timbre of a note varies if the guitar has steel strings or nylon strings. Even the air through which the sound waves of the music travel will change the timbre of the notes. There is no shortage of factors that contribute to timbre. However, timbre is fairly reliable across environments and instruments. That is, a flute will sound like a flute. One is usually able to identify an instrument when it is playing, given that one is already familiar with the instrument. Timbre can described overall sound as well. For example, the “Star Spangled Banner” as played on kazoos by children or on electric guitar by Axl

Rose. While the preponderance of musical elements may be the same, such as the rhythm and melody, the overall experience is likely to be quite different as a result of the timbre.

Dynamics

Dynamics is volume. More specifically, dynamics is the volume of a note, as well as the pace and style in which the volume changes through the piece. There are a variety of ways that dynamics change through a musical piece. For example, one instrument may begin quietly, and then gradually increase in volume, perhaps to imply a building romance. Once loud, the volume may suddenly drop, perhaps to imply the loss of the new love. In another instance, dynamics may vary regularly to create a beat, with alternating loud and soft notes played by the same instrument. In a duet, each instrument may take turns being louder then quieter than the other in order to imply a musical conversation. The importance of dynamics in music becomes clear when one considers that music notation includes extensive dynamics directions throughout a piece, such as when and how to increase or decrease in volume. In a more informal sense, low background music can set the appropriate mood for a social gathering, whereas blaring music can ruin an intimate conversation.

Form

Form is the overall Gestalt of a musical piece. It is the combination of the objective parameters and subjective experience of the elements of music. The composer must consider the musical piece at many levels to ensure the form is correct. That is, a well-written piece takes into account that the developments of the tonal and temporal relationships of the instruments over time contribute to the listener's experience. The song is always heading somewhere, and each element of music is an evolving facet of that journey. Therefore, the journey in sum is the form.

Instrumentation of Western Classical Music

The main instrument classes in Western Classical Music are: (a) strings; (b) woodwinds; (c) brass; (d) percussion; (e) keyboard. Examples for each instrument class will now be given, with each list descending in overall pitch region. Strings include the violin, viola, cello, and upright bass. Woodwinds include the piccolo, flute, oboe, clarinet, and saxophone. Brasses include cornet, trumpet, trombone, and tuba. Percussions include claves, xylophones, snare, and timpani. Keyboards include the harpsichord, piano, and organ. Many instruments can fit into multiple categories, such as the piano, which can be thought of as a stringed instrument that is activated through a percussive process. The idea is to organize the multitude of instruments in order to better understand, compose, create, and enjoy music.

Structural Rules of Western Classical Music Pieces

Now there will be a short discussion about some of the rules of Western music, specifically classical music. In general, Western music is about probabilities. Given the relationships within music mentioned above, such as key signatures, scales, and chords, one could say that clear music theory structures exist within a style, so composition and performance are simply matters of transforming those theories into realities. Whereas myriad cultures and styles abound, and what is considered acceptable within them changes with time, there remains a core of steadfast probabilities of note, chord, and structural progressions. What is always true for classical music, and most Western pop music, is that a song progression should go usually expected, possibly as unexpected, and never as surprising. Listeners come to expect music to be a certain way. While stretching the rules can be enjoyable for composers and serious music listeners, most listeners will tend to become aggravated if the music is not predictable and cannot be readily understood. There will be more on the cognitive and affective processes of the music listener in later chapters.

Diatonic Function

The root note of a key signature and its associated major chord are called the tonic. For convenience, the Roman numeral I refers to the tonic. All the notes and their associated major chords in the diatonic scale then have labels based on their relative position to the tonic. In ascending order, the Roman numerals, and their associated names, are: I, tonic; II, supertonic; III, mediant; IV, subdominant; V, dominant; VI, submediant; and VII leading tone. That is, in the key signature C, the note C chord is the tonic note, I, which makes G the dominant note, V; furthermore, that makes the C chord the tonic and the G chord the dominant. The names of the relative positions of the notes have to do with the subjective tension associated with the sounding of the note or the chord relative to the root. The idea is that the melody and chord progression always seek resolve through return to the root.

Melodic Contour

As mentioned above, notes within a musical piece tend to be related to one another based on the key signature of the piece. The Diatonic Function accounts for some of the reasoning for the specific notes selected in the melody, though there are many other reasons that composers choose specific notes. A common practice is that a melody will have adjacent notes that flow up or down the key signature. For example, the oft-heard pastoral melody is notes I-II-III-V-III-II-I-II-III-V-III-II (IV is typically not played). When in the melody there is a sudden jump up the key by some notes, the flow tends to reverse; for example, I-V-III-I-VII-V-III-I.

Chord Progressions

So too are the chords featured in the song related to one another based on the key signature of the piece. The progression of roots is probabilistic, which means a composition that stays within the rules will have more and less predictable chords played as the song progresses. Meyer (1956) reprinted a clear table of usual root progressions:

- I is followed by IV or V, sometimes by VI, less often II or III
- II is followed by V, sometimes VI, less often I, III, IV
- III is followed by VI, sometimes IV, less often II or V
- IV is followed by V, sometimes I or II, less often III or II
- V is followed by I, sometimes VI or IV, less often III or II

Chord Inversions

A chord inversion is an example of an expressive technique. In this modified chord form, the root note is not the bass note of the chord. Instead another note in the chord acts as the bass. For example, in a C major chord, the notes C-E-G are played, with C being the bass, while in the first inversion of the C major chord, the notes are G-C-E and G is the bass. This can create a tension in the listener, where the chord fits in to the progression, but it seems to be off. Intervals, melodies, and other aspects of musical structure can be inverted. Within an interval, a common inversion results in modulation of the song's current major key to a minor key, which is explained by the Circle of Fifths.

Circle of Fifths

There are clear relationships between major and minor keys, where the sixth note of the major key, the submediant, becomes the root of minor key. Interestingly, the notes that make up a minor key are the same as the notes that make up its corresponding major key. This leads to an important concept for classical music, and all Western music, referred to as the Circle of Fifths, which is often represented visually as a circle. Placing C at the top of the circle and proceeding clockwise by a fifth of the diatonic scale, one next arrives as G, then D, and so on. From the top, the order of roots around the circle is: C, G, D, A, E, B, F#/Gb, Db, Ab, Eb, Bb, and F, then it returns to C. Each key has as many sharped notes as it is notches away from C, though the most a key can have is seven sharps. Being one notch away from C, G has one sharped note. Being two notches away from C, D has two sharped notes. If one were to go counterclockwise, each step is down a fourth and each key has as many flatted notes as it is steps from C, again with a limit of seven flats. The circle of fourths is less common in classical music, and more common in jazz analysis.

Common Forms of Musical Pieces

The aforementioned theoretical aspects of music are presented in a variety of overall forms. While there exist numerous forms of musical pieces in classical music, the overall structure for each type of form is fairly consistent. A song may have one or many instruments, and it will tend to have an introduction, verse, chorus, bridge, and conclusion. A sonata will feature one or two instruments that play opening, middle, and end movements, with each exploring a tonal center through restatement of the musical phrase in the key of each movement. A fugue is similar to a sonata in that it has one or two instruments playing opening, middle, and end movements. However, a fugue is characterized by a running melodic theme that is explored through repetition and subtle variation. A suite is a collection of short pieces that are played in succession; often, each piece was a type of dance. A concerto features a solo instrument that is accompanied by an orchestra, where an orchestra features multiple instruments from each instrument class mentioned above. Typically, the lead instrument is a piano, flute, violin, or cello, and the piece almost always has three movements. A symphony is a large-scale piece that features a full orchestra that plays four movements, the first of which is typically a sonata in order to establish the tonal center. A tone poem is a continuous symphony that has only one movement. It is so named because its structure is meant to elicit the sense of a poem or visual art piece, rather than the traditionally segmented symphony. An opera is a combination of music and theater, where a symphonic musical score and lyrics for classical singers are theatrically presented. These represent but a sample of musical forms features in Western Classical music. Furthermore, the particulars of each form changed from era to era. For example, a suite included one set of dances in one time period, and in another time period it included a prelude followed by a different set of dances.

Summary

The purpose of this section was to provide an introduction to physical and theoretical structure of music as a stimulus and as an art form. As a stimulus, music is but sound. Sound is air that vibrates in a consistent pattern and is detected by a listener. Through a series of steps explored above, the detected sound waves are transduced into electrical signals in the nervous system. Those sound waves are classified and compared against what the listener has learned to consider art, or, at the least, music. Music then is perceived as a precise blend of elements. The elements include rhythm, melody, harmony, timbre, dynamics, and form. Each element has its own features and emergent properties. For example, timbre is a result of the unique aspects of a sound generator in a particular environment. So a rhythm may put someone to sleep when played by an upright bass in a candlelight club, though that same rhythm may cause someone to dance vigorously when played by a drum kit in an arena concert. Furthermore, there are general rules that Western music follows, such as what notes sound good together, both sounded at the same time and in succession. Additionally, there are common structures in which the organized stimulus of sound presented as music. This information will be included in MinMuList because it will likely support insight and awareness into one's environment and mind. Next, this manuscript will explore the psychological processes of music listening, commonly referred to as music cognition.

CHAPTER 4

MUSIC COGNITION

General Music Cognition

Now that we have explored music theory and music performance, we will investigate music cognition, the psychological processes of music listening. The long and distinguished history of music cognition has been examined in a variety of theoretical frameworks and through a multitude of methodologies. For many decades, Gestalt psychology, psychoacoustics, psychophysics, information processing and cognition, psychology of emotions, and neuroscience, to name a few, each acted as a basis for the conceptualization of music. More recently, computer science and biology, as well as the humanities, including philosophy, sociology, musicology, and ethnomusicology, have demonstrated increased interest in the psychology of music perception (Krumhansl, 2000). Indeed, the field of music cognition stretches back to Pythagoras' time, when Arixtoneus, an Aristotelian philosopher, argued that the mathematical approach to music analysis ignored the important aspect of the experience of the music listener (Griffiths, 2004; Levitin, 1999). Ehrenfels, whose importance for the development of Gestalt psychology cannot be overstated, was particularly interested in the perception of music and was himself trained in music (Smith, 1994). However, before we begin discussion about what happens in our minds during music cognition, we must touch upon the cognitive origin of music, as well as its purpose, a controversial topic that has received much attention in the literature.

Biomusicology

Biomusicology deals with the origins and applications of music (Wallin, 1991). The theoretical structure has three main branches, each with a unique focus: (a) Evolutionary Musicology; (b) Neuromusicology; (c) Comparative Musicology. Evolutionary Musicology deals with how music evolved in humans and animals alike, focusing on areas such as bird song. Neuromusicology deals with the neural and cognitive mechanisms involved in music production and perception, as well as contributing ontogenetic factors. Comparative Musicology deals with the cultural aspects of music, such as general practices, rituals, and aesthetics. The development of this field reflects a reemergence of Darwinian anthropology, evolutionary psychology, and gene-culture co-evolutionary theory (Brown, Merker, & Wallin, 2000). However, some authors have raised concerns that the "overly glib discussion" about the legitimacy of biomusicology appears to be less than scientific (Fitch, 2006, p. 85). The primary concerns are the lack of hard evidence from the distant past and the apparent emotionality of those involved in the discussions. For the purposes of this discussion, Comparative Musicology will not be addressed.

Therefore, the two main camps concerning the origins of music cognition in humans are as follows: (a) music is simply a consequent of cognitive abilities that serves only hedonistic goals; (b) music supported human evolution through the development of cognitive abilities (Levitin & Tirovolas, 2009). Steven Pinker, a cognitive scientist speaking at the Society of Music Perception and Cognition, declared that music cognition is "not worth studying [because…music] is auditory cheesecake" (Carroll, 1998). He implied that music serves no evolutionary purpose, because its existence, emotional effects, and physiological effects are simply byproducts of the language and emotion circuits of the brain, much like all of the aesthetic arts (Pinker, 1997). Many still see no evolutionary advantage offered by music, again emphasizing that it is pleasure without gain (Craton, 2008).

However, Michael Gazzaniga held that artistic thinking does indeed afford an evolutionary advantage and the emergence of music supported human development. The founder of cognitive psychology argued that enjoying fictional thinking would afford us the ability to consider the outcomes of a variety of reactions to potential situations without taking the risks involved in enacting our reactions (Gazzaniga, 2008). Furthermore, Gazzaniga found that executive functions, specifically memory and mental and emotional flexibility, are enhanced through music composition and improvisation, as explored above. Neuroimaging research by Levitin and Menon (2003) found that music listening activated neural areas responsible for processing spoken and signed linguistic structure. They argued that Brodmann Area 47, the pars orbitalis region of the left inferior frontal cortex, and its right hemisphere homologue may actually be involved in processing myriad of fine-structured stimuli that evolve over time. Soon thereafter, an fMRI study by Menon and Levitin (2005) found that music perception and cognition utilized distributed neural circuitry that enhanced functional and effective connectivity among brain regions related to reward, autonomic, and cognitive processing. This information provides support to the positive impact that music listening has on cognitive ability.

Numerous well-respected theorists and experimentalists disagree about the purpose of music cognition, aligning with one camp or the other, but a full exploration of this topic would require an entire manuscript. Justus and Bharucha (2002) referred readers to various chapters appearing in the edited volumes of Deutsch (1982, 1999b), McAdams and Bigand (1993), and Deliege and Sloboda (1997). Additional broad reviews include those by Dowling and Harwood (1986), Krumhansl (1991, 2000a), and Sloboda (1985). Suffice it to say, that, as will be demonstrated, music cognition does indeed occur and it has numerous well-documented effects on human psychophysiology.

Meyer's Perspective

The most often cited name in regards to the psychology of music cognition is Leonard B. Meyer. His foundational *Emotion and Meaning in Music* (1956) will act as the basis for this paper's thesis about the psychological processes of music listening, and for MinMuList. One of the reasons for the popularity and durability of *Emotion and Meaning in Music* is that Meyer incorporated a breadth of perspectives throughout his examination of numerous dimensions of music. Likewise, he did so as he would compose a score, wherein the tempo, rhythm, and themes emerged early which give the reader a sense of predictability and familiarity. He masterfully crafted a thought provoking work that explored the philosophy, musicology, and psychology of the history, emotion, cognitive processes, aesthetics, and stylistic rules of diverse types of music. Of note, this particular work did focus on Western art music (e.g., baroque, classical, romantic, etc.), the emphasis of most of his career. This chapter will also focus on aesthetic music in order to apply Meyer's theory most appropriately. However, the information still applies to pop music and the content offered in MinMuList. A summary of the important aspects of *Emotion and Meaning in Music* (Meyer, 1956) as they relate to this transcript will now follow.

Pop Music Versus Aesthetic Music

The main differences between pop and aesthetic music Meyer identified were, respectively: (a) electronic or acoustic generation of music; (b) the presence or absence of lyrics; (c) a focus on rhythm or on melody; (d) whether performance is from memory or from written score. Broadly, pop music uses electronic enhancements to amplify and change vocal and instrumental sounds. Furthermore, pop music is primarily vocal, which overtly informs the listener how to feel, and it has a strong beat that prompts movement in the listener. Pop music also tends to be short and involve exact repetition, so it can be performed from memory, not from a written score. These aspects afford performers greater freedom during performance than compared to aesthetic music performers. Aesthetic music, on the other hand, is created with only acoustic instruments and it is primarily instrumental. The lack of lyrics means the stimulus of music has no inherent meaning. Instrumentation is such that there is a focus on melody where variations on musical phrases throughout the piece allow the listener to extract the beat. Furthermore, the music is written with precise prompts that address the aforementioned musical elements, so the performer knows how to create the musical event that the composer intended. The distinction of exactness of musical performance then influences how music listeners experience and interact with the music. These differences lead to ultimately different goals for any given musical performance, where that of pop music is focus exclusively on the affective dimension and that of aesthetic music is focus on the imaginative dimension. In other words, pop music rallies around rhythm and lyrics to achieve maximum affective effect in the music listener, whereas aesthetic music blends melodies and harmonies that support the unfolding and swelling of the attentive music listener's imagination (Miller, 1961).

Absolutist Perspective

Meyer started the work with theory, leading with clarification of the absolutist perspective that the book held; that is, musical meaning lies exclusively within the context of the work itself. While he disagreed with, though saw value in, the opposing referentialist perspective (i.e., music points to extramusical concepts), he pointed to the lack of multi-cultural concurrence of referential meaning as a primary argument against it. Furthermore, psychological research and neurological research seem to support the absolutist stance. Sperry's two brain hypothesis that resulted from discussion of the peculiar effects on perception and behavior of patients that had undergone severance of the corpus collosum may have acted as the jumping off point for this realization (1966, 1968). What is invoked by the notion of two-brains is the concept of lateralization: specialization of each hemisphere of the brain for a specific type of task. The most basic example of lateralization is as follows: the left hemisphere is primarily verbal, and the right hemisphere is primarily spatial (Cook, 2002). This fundamental difference in hemispheric function has lead to an essential distinction between music with and music without lyrics based on the following conclusion: lyrics communicate extramusical meaning, while music puts to the listener the task of determining meaning (Wright, 2014). Taken with the body of evidence in music theory and cognitive research amassed since its publication, this conclusion can arguably be used to support the absolutist perspective (Austerlitz, 1983; Durbin, 1971; Krumhansl, 2000; Lerdahl & Jackendoff, 1983; Meyer, 1973; Rosner & Meyer, 1986; Sloboda, 1985, 2005).

Illustration of the Absolutist Perspective

Exploration of cognitive research supports the two-brain and absolutist perspectives as well. Utilization of electroencephalography (EEG), magnetic resonance imaging (MRI), and positron emission tomography (PET) have generated consistent data that reveal differences between cognition of music with and without lyrics. Music with lyrics led to greater activation of the left hemisphere, compared to music without lyrics (Gardener, Silverman, Denes, Semenza, & Rosenstiel, 1977; Besson, Fai'ta, Peretz, Bonnel, & Requin,1998; Marin & Perry, 1999; Krumhansl, 2000; Ohnishi, Matsuda, Asada, Aruga, Hirakata, Nishikawa, Katoh, & Imabayashi, 2001; Yasui, Kaga, & Sakai, 2008; Levitin & Tirovolas, 2009). One PET experiment found bilateral supplementary motor area (SMA) activation during mental rehearsal of lyrics (Halpern, Zatorre, Bouffard, & Johnson, 2004). In another imaging experiment that required subjects to perform overlearned lyrics, activation of the right hemisphere was detected; however, the context of these results seem to indicate the reason for this notable difference in typical brain activity is due to effortful control of the pitch and timbre of the lyrics produced (Cook, 2002). One EEG experiment found a clear distinction between how lyrics and music are processed, where congruent words sung out of key produced one pattern of activity (increase in the negativity of the EEG signal, or, N400), while incongruent words sung in key produced a second pattern of activity (increase in the positivity of the EEG signal, or, P300; Besson, Faïta, Peretz, Bonnel, & Requin, 1998). Self-report data found a similar subjective experience of the independence of music and lyrics (Rentfrow & Gosling, 2003).

There also exist notable differences of patterns of brain activation during music cognition between musicians and non-musicians. For example, musicians and non-musicians appeared to process emotional content of music differently. EEG data found that musicians had a late positive component event related potential (ERP) in response to the onset of a note in a minor scale, a difference that is likely due to the musicians' familiarity with Western music style (Halpern, Martin, & Reed, 2008).

Subjective Versus Objective Evidence

Extending the referentialist and absolutist themes, Meyer then drew distinctions between subjective evidence and objective evidence. His main point was that there was not a known mechanism for how music listening induced an emotional response. Subjective evidence, therefore, was not reliable in his opinion because there was not a reliable source of the reported emotional experience during music listening. Indeed, incongruences between subjective report on mood and objective physiological proxies for autonomic nervous system activity have been noted in research over the years (Dainow, 1977; Ellis & Brighouse, 1952; Iwanaga, Kobayashi, & Kawasaki, 2005). From an absolutist perspective, emotions from music are misleading because the music itself does not refer to an external object, as most emotions do (Raffman, 1990; Rice 1987; Zatorre & Halpern, 2005). Furthermore, the emotional reaction to music gets garbled during the crude verbalization process, when the fluid experience is translated into symbols. Research has provided evidence that demonstrates the inability of subjects to verbalize their affective response to music (Herz, 1998). Objective evidence was divided into two categories, behavioral response and physiological response. Behavior is not a reliable source of data because of the cultural norms associated with response to aesthetic objects and events, known as preparatory set, a concept that will be explored further. Therefore, people tend to respond behaviorally to the situation, not the stimulus. Additionally, observable behavior can be misinterpreted, such as assuming a person is crying because of sadness, when in fact one may be shedding tears of joy (Iwanaga, 1995a, 1995b). Physiological responses were also problematic because, at the time *Emotion and Meaning in Music* was written, neither the physiological effects of the elements of music, nor their mechanisms of effect, were clearly understood. Meyer's main point is that a music listener has a set of explicit and implicit expectations and schemata that affects how one approaches, interacts with, and experiences music. Suffice it to say that Meyer advised researchers to use caution when interpreting experimental evidence of the emotional response to music. In the decades since Meyer's work, however, myriad of research has shed some light on this area and has been organized into what is called the Engineering Model of Music Audition. It will be explored in the next chapter of this manuscript.

Theory on Emotion

What Meyer did state confidently was his position on the psychological theory of emotions, which was based on John Dewey's Conflict Theory of Emotion (1894). This commonly held theory in 1956 postulated that emotion or affect is aroused when a tendency to respond is arrested of inhibited. Basically, a stimulus will lead to a learned response and emotion results that learned response cannot be successfully executed. The selling point for Meyer was that this process was essentially described in the competing psychology theories at the time. This process was believed to have three phases: (a) arousal of instinct or tendency creates nervous energy; (b) nervous energy is blocked and becomes behavior or thought; (c) behavior or thought is blocked and nervous energy is manifested as affect or emotion. Instinct or tendency can create nervous energy when one has two competing plans in mind, though is unclear which to enact. Also, nervous energy can result from a situation that is structurally confused and ambiguous. In both cases, resolution is delayed and emotion is felt (Dewey, 1894; Angier, 1927). While this theory of emotion does not how an emotion is felt, Meyer argued that physicists discuss magnetic and electrical fields with similar uncertainty.

Emotion Versus Affect

The distinction between affect and emotion warrants attention. Affect is diffuse and undifferentiated, much like the nervous energy described above. Emotion is affect within an understood context, that is, understanding the event and the underlying beliefs that led to the affective response gives that affective response meaning. Given one's propensity to resolve affect, one's behavior becomes increasingly automatic with increasing levels of nervous energy (Angier, 1927). The trouble is that the automatic behavior may not resolve the affective state because it may not address the precursor to the affective state (Hostrup, 2010). This introduces the notion of pleasant and unpleasant emotional states. A pleasant emotional state is one that will indeed resolve. An unpleasant emotional state is one that may not resolve. It is the apparent sense of efficacy, or helplessness, of the experiencer that makes a situation bearable, or unbearable, respectively (Hebb, 1949). Meyer proposed that one way a person copes with emotion is through communication. Designative behavior refers to the attempt of one experiencing emotion to communicate their affective state. It typically reflects cultural practices, intends to elicit an empathic response, and becomes more coded over time as it is rehearsed. Meyer argued that the absolute nature of music means that musical emotions do not exists, but musical emotional experience do exists. This is because the affective response to music is strictly due to the music itself.

Thus, Meyer built his theory of emotion and meaning in music on the assumption that music listeners experience emotion when their expectations of the heard music are frustrated and met. Held is the assumption that a musical piece will act as the stimulus that activates tendencies, inhibit those tendencies, and then provide meaningful and relevant resolution. Unlike day-to-day life where one may cope through means wholly unrelated to the emotional stimulus, such as exercising to deal with an insulting co-worker, music is unique in that acts as the mechanism by which all three steps are accomplished. Tendencies, in this case, are both temporal and structural. Furthermore, they are learned, which means they can be behavioral, such as a habit, and cognitive, such as a concept or meaning. The automaticity of a tendency means that one may a tendency with little awareness. Every tendency has an expected outcome; one enacts a tendency with an implied consequent. Music therefore can evoke tendencies because it activates expectations in the listener. Composers and performers understand that music evokes tendencies. The joy of the creative process then comes from creating culturally and aesthetically acceptable ways by which tendencies and expectations are aroused and satisfied.

Role of the Rules of Music

As explored in the previous chapter, music has rules. These rules vary from culture to culture, surely, though when one listens to a song, one has a sense of the rules of that particular piece (Bigand, & Pineau, 1997; Schmuckler & Boltz, 1994). The affective response of music listening then comes from the listener's understanding of how the current piece follows, bends, or breaks the rules. At times, the forthcoming phrase will be absolutely certain, such as a chord progression finishing on the dominant chord. At other times, however, the next phrase will be less certain, such as what notes will sound within a melody. The ability of a listener to predict what is to come depends on the structural certainty of a piece up to that point. True across the certainty spectrum, however, is that the listener will indeed experience tension during and expect resolution by the end of the musical piece. The longer a listener must wait for an outcome, the greater the amount of nervous energy to be released. It is this expectation-induced tension that can be utilized by the composer and performer to build suspense within the listener (Steinbeis, Koelsch, & Sloboda, 2006). The moments before resolution create an affective response to the uncertainty because they allow the listener's mind to consider the possible outcomes: (a) the expected; (b) the unexpected; (c) the surprising. The expected is what one has determined to be the most likely outcome. The unexpected is within the realm of possibilities, but does not seem likely given what is known about the piece thus far. The surprising was not considered as an outcome and tends not to be satisfactory to the listener. Upon arrival of the outcome, the listener releases the tension and nervous energy held and then begins to understand the musical piece thus far (Koelsch, Kilches, Steinbeis, & Schelinski, 2008). The less likely the outcome appeared to be prior to its arrival, the more processing required to reach resolve (Koelsch, Fritz, & Schlaug, 2008). In the case of an unexpected or surprising outcome, a listener may suspend judgment and wait for further clarification. The listener may, however, become frustrated and reject the stimulus. At times, the listener will forgive the blunder committed by the composer or performer. Ultimately, musical events: (a) meet expectations with little affective response; (b) are intellectualized with little affective response; (c) frustrate expectations with a strong affective response. The main hypothesis of Meyer's work is that musical emotion experience is an important part of music because listeners hold learned expectations that are informed by cultural norms, aesthetic preferences, rules, and behaviors that are activated by a situation and engaged by music to generate affective responses.

Meaning

The meaning of music in this framework comes from the music itself. It is the aesthetics and rules of the listened-to music that activates expectations and subsequent affect. True enough, however, that a one will add non-musical meaning to music when one experiences an additional stimulus, such as a memory of the last time a song was heard. In both cases it is the processing of stimuli that gives the music meaning. The triadic relationship of meaning is relevant in this analysis. Meaning exists somewhere in the context of: (a) the stimulus; (b) that to which the stimulus points; (c) the observer. Change any of the three, the meaning changes (Mead & Mind, 1934). Therefore, the meaning of a particular musical piece varies from listener to listener because the observer has had different distant and recent experiences. There is one way to argue for objective meaning in music, however. There exist three types of meaning: (a) hypothetical; (b) evident; (c) determinate. Hypothetical meaning arises during expectation and can be more or less ambiguous. Taken alone, this eliminates the possibility of objective meaning of music because each listener has different expectations at the outset of a musical piece. Evident meaning comes from the process of identifying the relationship between an antecedent and a consequent. Once understood, the consequent becomes a subsequent antecedent and hypothetical meanings again emerge. Determinate meaning results from the relationship among the many hypothetical meanings and evident meanings (Budd, 2002). It is essentially the four-dimensional gestalt of a musical piece that can only fully be realized once the entire musical piece is timeless is memory. The argument for objective meaning of music is therefore derived from the potential that each listener can comprehend the determinate meaning of a musical piece. Meyer argued that the objective meaning of a musical piece can only be understood if the listener objectifies the affective experience during and after listening, choosing instead to consider the experience through an intellectual lens. This self-reflective process requires focus and skill.

Expectation and Learning

Emotion and Meaning in Music (1956) then featured a deeper exploration of expectation and learning. Two types of expectations were presented: (a) those that emerge out of the nature of human mental processes, such as laws governing perceptual, grouping, and organizing; (b) those based in learning in the broadest sense of the term. Long before the Cognitive Primary Effect was empirically validated, Meyer postulated that learned cognitive structures, such as language and expectations, occur prior to natural forms of thought, such as affective content (Nummenmaa, Hyönä, & Calvo, 2010). However, context tends to govern these activated heuristics and expectations, such as how we perceive and think in terms of language (Lai, Hagoort, & Casasanto, 2012). This led Meyer to a discussion of style, which is an understood set of rules that governs the probabilities of consequents. When considered in a stylistic context, a sound stimulus becomes a sound term. For example, a series of tones becomes a melody when one understands it occurs in a musical piece. A sound term takes on different meanings at different architectonic levels, such as a theme being a unique phrase and an anchoring point for the rest of the piece. One is constantly revising meaning of previous phrases and expectations of future phrases in light of what has already occurred. This is why determinate meaning comes only after reflection upon the entire piece.

Repetition

With repetition of a sound term comes more accurate prediction of subsequent sound terms. The more repeated a specific sound term, the better learned the structure of the musical piece, the clearer expectations for the rest of the musical piece. Deviations from predictions based on clear expectations are more effective at eliciting affect in the listener. Another mechanisms for eliciting affect is through the use of ambiguity.

Ambiguity

Ambiguity in a musical piece results when forms and structures are unclear, unexpected, irregular, or inconsistent (Cross, 2001, 2005). It also results when, at any point in a musical piece, there exist many equipotential consequents to the current antecedent. Affect is elicited because one abhors doubtful and confused states, preferring instead certainty and control. Ambiguity can be used effectively when its presence is considered objectively and related to various architectonic levels; that is, the ambiguous part may contribute to the meaning of the unambiguous whole (Meyer, 1956). This flexible approach to meaning making parallels the assumed structure of music, which is dynamic, has ebb and flow, and more and less clarity. Hence, for a listener to appreciate the full meaning of a song, affect must be considered objectively, as data that informs the ordering system of beliefs, in order to bring unity to the experience.

Probabilities

Probabilities of consequents are flexible and learned over time. The probably of a consequent form is a result of numerous considerations during music listening. Developing probabilities through music listening of a particular piece comes from knowing the style, the composer, the performer, the piece type, the instrumentation, etc. (Wilson, 1986). Probabilities reflect activated expectations, where there are ideal types and class concepts activated. An ideal type is the best form. A class concept is the general form. One selects the ideal type and class concept depending on the musical piece, where a sonata has a best form, though Bach and Brahms will each have a best sonata form. Responses are also learned and over time become automatic. Responses are also activated in the same way that probabilities are activated. This reflects the idea that, while music is a universal construct, music is not a universal language because it has many styles, or, dialects. What is true for all styles is that probabilities are activated throughout music listening. Similarly, from a mathematical perspective, certain tone combinations and progressions are considered more stable and pleasing in numerous cultures, such as the octave and the fifth. This means that one can appreciate an unfamiliar style, and eventually learn the subtleties of that style (Cross, 2009). This point is reflected in the dynamic nature of style, where acceptable probabilities shift over time as composers take creative license, and cultural, social, and political climates change.

Illustration of Expectation and Learning

Anecdotal evidence of the dynamic nature of probabilities for style can be found in the story of the premier of Igor Stravinsky's ballet, "The Rite of Spring." First performed in 1913 for a full house in Paris, France, the avant-garde style of the production caused uproar in the audience. Normally somber and respectful, the onlookers booed, screamed, fought, and threw objects at the orchestra. The choreographer had to shout at the performers to help them keep time when the orchestra was drowned out by the din. By the end of the program, however, there were numerous curtain calls. Subsequent performances were greeted with a less cacophonous audience. The strong affective response was seated in the unfamiliar forms and structures of the composition, which were presented the same evening with familiar ballets. Over time, though, deviants with low probabilities became more commonplace and pleasing to listeners (Abumrad & Krulwich, 2006).

Deviants

What is deviant at one time can become the normal. This tends to occur in four ways. The first is that the degree of deviation is exaggerated, so a more modest deviation is normal. Second, a more deviant form makes the initial deviant seems less outrageous. Third, new deviants replace old deviants, making the old deviants seem more commonplace. Finally, old norms can be revisited, making them now seem deviant, in a cyclical manner. While a deviant can become a norm, therefore no longer inhibiting tendencies, it can still be expressive when paired with new deviants. Composers take pleasure in finding ways to create deviants and shifting the style, though they are often under the same constraints of any creator, such as the personality of one’s employer. Shifting a new style takes a predictable path where deviants are adopted and elicit affective response, even cultural push-back; then the deviants become norms, even cliché. The response to any shift in style often has to do with how critics and listeners approach the composition, as demonstrated in EEG studies (Koelsch, et al, 2008a, 2008b; Koelsch & Mulder, 2002; Verleger, 1990).

Use of Patterns: Weakening of Shape

Weakening of shape is another affective tool often used by composers that Meyer discussed. A recognizable sound term will take on certain meaning in the context of the musical piece. Throughout the composition, however, this sound term can begin to shift, which then requires the listener to engage in a meaning making process where the similar sound terms are compared and contrasted (Feeney, 2012). As the shape weakens, it becomes more difficult to understand the relationship with the original form, requiring more processing to understand the meaning. This takes advantage of the minds innate tendency to group stimuli, though sound terms that are too dissimilar may be seen as unrelated. The goal of the composer, then, is to articulate a sound term in such a way as to achieve grouping with like sound terms through cognitive processing on the part of the listener (Adorno, 1993).

Use of Patterns: Saturation

Saturation is the opposite process as the use of weakening of shape, and it achieves the same affective activation (Meyer, 1956). It is the continued repetition of a sound term that leads to a stronger and strong expectation that the sound term will change and resolution will be achieved. The strength of the form of the sound term correlates with the amount of change in the sound term that is necessary to satisfy the need for affective release generated by the frustrated tendency for change or completion. That is, a term that is presented numerous times and easily recognizable, such as a theme, must feature greater change to be considered different than a term that was presented once.

Repetition of a sound term, however, can be used purposefully, such as to build up the introduction of a musical piece, or as a background to a melody or harmony (Wilson, 1986). Whether repetition is experienced as saturation or as an effective affective tool often depends on the style of the composer and the structure of the musical piece. The context of the music listening experience is important.

Preparatory Set

Preparatory set refers to the numerous mental and physical adjustments a listener makes when preparing to hear music. It has to do with the listener frames the music listening experience. The first part of a preparatory set includes the listener's beliefs about the aesthetic experience; that is, the purpose of listening to this piece of music. For example, attending an orchestral performance at a concert hall has a different purpose than listening to rock music at the gym. The second part of a preparatory set includes the listener's experienced and knowledge about music, which may include formal training and informal consumption of music. The third part of the preparatory set includes the information gathered during the particular music listening occasion, such as what is acceptable behavior in the environment, or what forms are present within the musical piece. When the preparatory set frames music listening as an aesthetic experience, the music listener will engage see the music as unique and valuable, therefore engaging it as such. Focus will be on the experience of music; overt behavior will be inhibited; mental and emotional experiences will be seen as playful illusions; and faith will be placed in the assumption that the musical piece will be an "honest signal," that is, serious, purposeful, and logical (Cross, 2009). During performance, there are numerous clues as to the intended experience and behavior for the music listener, as explored in the previous chapter. However, Meyer's main assumption is that the ultimate foundation of rhythm is to be found in mental activity, where rhythm comes from the mind and not the body. Again framed in the absolutist perspective, this leads to the conclusion that music listening is best explored in terms of mental behavior.

Pattern Perception: Gestalt Laws and Learning

Meyer then explores how the mind organizes stimuli, especially in regards to music. While he acknowledges the value of Gestalt Laws of perception, he emphasizes the role of learning, which frames and eases organization and consolidation of new information. For example, one can learn the following series of letters with some difficulty: "R S E T E L T." When one takes the same letters and groups them by similarity, learning is easier: "T T R L S E E." The most satisfactory way to learn, however, is when stimuli is grouped by cultural established norms: "L E T T E R S." The roles of good continuation, good fit, and completion are emphasized in Meyer's discussion, especially the enduring affective response to a sound term that does not feature these lawful characteristics. Further exploration of Gestalt Laws and their role in the experience of music listening will take place in the next chapter, when the Engineering Model of Music Audition is discussed.

Summary

Music cognition has been an area of theoretical discussion and vigorous research for as long as music has been in existence. It has at its core a debate about whether music refers to extramusical concepts, or if music is a means to an end in and of itself. While valid opinion varies, this paper will align with the absolutist perspective. Regardless, the affective and emotional experience of music cannot be denied. However, with the right approach, it is possible to objectify the music listening experience such that the intended meaning of any musical piece can be understood. *Emotion and Meaning in Music* (Meyer, 1956) presented a comprehensive analysis of music listening to allow listeners to do just that. Now, this paper will take a more mechanical look at how music achieves such effects on listeners through exploration of the Engineering Model of Music Audition.

CHAPTER 5

ENGINEERING MODEL OF MUSIC AUDITION

The theoretical and methodological paradigm that explores how music listening achieves physiological and psychological effect will be discussed as a research program. It will henceforth be referred to as the Engineering Model of Music Audition (EMMA). The engineering perspective is based on a mechanical-physiological understanding of the human body and mind. This perspective is primarily based on the conceptualization presented in *The Music Effect* (Schneck & Berger, 2006). The fundamental basis of the EMMA is a hard core that is composed of axioms that are not tested, but simply given as true. Sitting outside of and surrounding the hard core are critical processes, which serve to support the hard care during attempted falsification by integration of and adaptation to new data produced by research. The critical processes also allow for functional predictions to be made regarding the contents of the research program. For example, the critical processes would postulate the efficacy of MinMuList. Additionally, the EMMA contains important content to include in MinMuList. The EMMA has parallels to biomusicology, which was discussed in the previous section. The parallels are the consideration of the adaptive psychophysiological aspects of the creation and perception of music. Therefore, information from the previous chapter, "Psychology of Music Cognition," will be interwoven throughout this exploration of the EMMA.

Hard Core

The hard core of the EMMA is composed of three tenets. The first tenet holds the basic assumption that the human body is a controlled system and it is most interested in survival. The second tenet holds that the human body monitors and processes information about its internal and external environments. The final tenet holds that the human body will react to information in a purposeful and adaptive way (Milsum, 1966; Schneck & Berger, 2006). The EMMA will examine the underlying psychophysiological processes of the tenets through development of the Critical Processes. Further exploration of these tenets is useful in order to clarify the utility of the subsequent critical processes.

Tenet One: Controlled System of the Human Body

The controlled system of the human body is composed of six levels of organization, increasing in size and function. Those levels are: (a) atoms; (b) molecules; (c) cells; (d) tissues; (e) organs; (f) systems (Schneck & Berger, 2006, pp. 32). This particular controlled system is subject to control by the Standard Engineering Feedback/Feed-forward Model (SEFFM), which is composed of seven basic levels, adapted to generate a conveniently charming heuristic. Those levels, when integrated and applied to music listening as therapy are that there are seven basic responsive attributes that respond to the six fundamental elements of music. Music as a stimulus is subject to five Gestalt laws of perception under four primary constraints as processed through three levels of the central nervous system's (CNS) information processing pathway. All the while, the music listener's physiological and cognitive systems are under two governing principles and always working to satisfy the one primary goal of survival (Damasio, 2003; LeDoux, 2002). Each of these levels will be expounded upon below as they relate to the critical processes.

Tenet Two: Ambiensomatic Perception

The body perceives, interprets, and reacts to ambiensomatic information (Ornstein & Thompson, 1984; Schneck & Berger, 2006, pp. 76). Ambiensomatic perception is the continuous monitoring of the internal and external environment, each referred to as interoception and exteroception, respectively (Nicholls et al, 2001). Proprioception is a specific type of self-monitoring of the muscles, tendons and joints; this monitoring system is important to note because it utilizes the same cognitive circuits as, and is processed in parallel to, auditory information.

Tenet Three: Purposeful and Adaptive Response

The body engages in ambiensomatic perception with the same ultimate goal as described above, that is, survival (Schneck & Berger, 2006). Subject to one of the governing principles alluded to in the SEFFM above, the body will output energy only through the path of least resistance (Schneck, 1990, 2003). This output is referred to as accommodation and will be explored at length below. Suffice it to say, the three simple statements of the EMMA hard-core call for much explanation and allow for a great deal of discussion in the form of critical processes.

Illustration of Hard Core

For example, when the EMMA is applied to post-traumatic stress disorder (PTSD), it becomes clear that the emotional dysregulation and maladaptive behavior exhibited by a person results from an overemphasis of the client's survival instinct. One with PTSD employs a threat schema, which can be thought of as an overactive survival instinct. In the threat schema, information processing emphasizes the identification of and reaction to threatening stimuli. The schematic focus on threat leads to frequent misinterpretation during information processing where all stimuli is generally seen as more threatening than it actually is (Dalgleish, 2001). Therefore, one with PTSD experiences common stimuli as a threat and then he has an elevated stress response. He then focuses cognitive and behavioral energy on attempting to distance himself from the stimuli in order to survive the perceived threat. This distancing process is known as avoidance, and it is very common among all people, especially those with PTSD. Avoidance can have some advantage, such as if one needs to focus on a business meeting instead of think about a leaky faucet at home; however, persistent avoidance can lead to increased morbidity. One could unlearn avoidance, and subsequently unlearn a threat schema, through focused awareness, such as savoring an aesthetic experience like listening to music (Cukor et al, 2009). The hypervigilance associated with PTSD also results from an over-activation of the sympathetic nervous system (SNS), which is associated with the survival instinct, can be influenced by music listening, and will be discussed in greater depth below.

Music Cognition Perspective of Illustration of Hard Core

Meyer may explain the phenomenon of PTSD as a constant expectation of threat that continuously activates a preparatory set geared toward avoidance. The automatic nature of the expectation of threat and tendency to avoid prevents subsequent learning to occur through inhibition of avoidant behavior. Objective examination of ambiensomatic information, and therefore change, cannot occur in this context.

Critical Processes

With the hard core now established, it is now possible to begin discussion of the critical processes. Critical processes are general, allowing for a great deal of discussion and exploration, both in research and therapeutic application. Each will now be stated and examined more closely.

Critical Process 1: Detection of Stimuli

Referring directly to the first tenet of the hard core, the human body collects ambiensomatic information via the sensory systems; information detected is called “stimuli” (Nicholls et al, 2001, pp. 333). These stimuli are transduced, relayed, processed, and integrated at various levels of awareness. If stimuli are deemed significant, they will elicit a response; stimuli are disposed of if deemed insignificant. The process of stimuli detection and response will be explored in depth below, in Critical Process 5. For now, we will focus on the basics of this process. During processing, stimuli are first checked against homeostatic set-points and processed to the point of identification at the sub-cognitive level (Coren & Ward, 1989; Schneck, 1992). The thalamus is the initial cognitive structure in the information-processing pathway within the CNS and houses these set-points, which refer to the operating parameters of specific systems of the human body. Some examples of set-points are: (a) core-temperature; (b) heart rate; (c) respiration rate; (d) metabolic rate (Berger & Schneck, 2003; Schneck, 1990; Schneck & Berger, 2006). Any difference between the interoceptive stimuli with their associated set-points results in an error signal. Error signals are defined by three parameters: (a) proportional control, how far from the set-point the system is; (b) differential control, rate of change of discrepancy; (c) integral control, persistence of discrepancy.

Illustration of Critical Process 1

Like musical expectations, set-points can be modified to a certain extent. For example, one diagnosed with PTSD has altered set-points, where physiological activity is geared more towards a fight or flight response. This altered set-point leads to the hypervigilance mentioned above, causing increased focus on and reaction to unimportant stimuli that are perceived as threatening. As a result, these persons exhibit emotional dysregulation and maladaptive behavior because they are reacting to stimuli in the environment to which persons with normal set-points would not typically react. For a more in depth exploration of the fight or flight response, please see Critical Process 5 below.

Music Cognition Perspective of Illustration of Critical Process 1

Meyer's take on this process would likely hold that set-points are much like expectations and one's body learns set-points. Collected information is incorporated and used to generate expectations about appropriate physiological operating parameters given the situation, much like how a music listener's expectations change with familiarity with a musical style and the venue in which the musical piece is heard. The physiological process of error signals is similar to the cognitive process of suspense in music listening, where an expectation for a musical piece is like the set point. There is a positive correlation between the affective response to an actual sound term with the amount of difference in timing, melody, and progression from the expected sound term.

Critical Process 2: Physiological Control and Entrainment

The set-points of the human body are enforced by finely tuned physiological control mechanisms. Forcing functions are outside influences acting on controlled systems trying to push the system off of its set-point and can result in error signals (Schneck & Berger, 2006). In accordance with tenet three of the hard core, the body reacts to these error signals through adaptive processes that can result in short, medium, or long-term changes, relatively speaking (Schenck & Berger, 1999). These changes range from momentary reflexive or behavioral responses, to temporary changes in set-points, to permanent changes in set-points. The most basic reflexive homeostatic responses occur in the Autonomic Nervous System (ANS), which communicates with the body through neurotransmitters; these communications are short lived, but powerful, with primary changes occurring in heart rate, blood flow, and attention (Tortora & Gerbowski, 1993). The Endocrine System exerts more long-term, though still quite transient, control over the body, primarily in the form of hormones, which mainly alter cellular metabolism. The Immune System is also involved in error signal response, and responses include increased production of antigens and antibody components, which identify and destroy pathogens within the body.

When applied to the controlled system of the human body for long enough forcing functions can induce changes in physiology, known as accommodation. Entrainment refers to the precise application of forcing functions on a human body, with a specific accommodating goal. Entrainment can result in accommodations in four distinct ways. The first is modification of neuronal connections through neural excitation, inhibition, and neogenesis, process that refer to the architecture, plasticity, and pruning of the CNS (Bear, Connors, & Paradiso, 2007). The second form of entrainment can come through the control of gene expression, suppression, and recruitment, which changes the proteins expressed in the body (Russell, 2005). Protein structures and functions are diverse and include such neurotransmitters, neurotransmitter receptors, substrate carriers, and hormones. The third form of entrainment modifies enzyme kinetics through mobilization or deactivation of these specific types of proteins (Campbell & Farnell, 2006). Primarily, second messenger systems within cells are affected, resulting in modulation of long-term cellular signaling effects (Ornstein & Thompson, 1984). The fourth form of entrainment is a biasing of CNS information-processing networks by changing the threshold potential of its constituent cells, a conceptual example of which is the threat schemata. “Threshold potential” refers to the level of input to a neuron necessary to result in an “action potential,” which is the electronic form of communication within a neuron that induces a “release event.” A “release event” is how neurons communicate and is characterized by the spilling of neurotransmitter into the synapse (space) between sequential neurons within a network (Nicholls et al, 2001 pp. 14 - 17). The basic idea behind threshold potential biasing is to make neural networks, or schemata, which represent ideas and information, more or less likely to be active. This will make the schemata more or less available to the conscious mind. It is important to note the interplay of each method of accommodation, where specific effects exerted on neurons, as well as altered protein levels, will bias the network or schemata with which they are associated. Likewise, specific behaviors emerging from modified neural networks or schemata can induce the expression of particular proteins at the cellular and systemic level (Hartman, 2008).

Illustration of Critical Process 2

Per diagnostic criteria, persons diagnosed with PTSD will be triggered and re-experience their initial traumatic event in the form of nightmares, flashbacks, dissociative episodes, intense distress, prolonged distress, and/or marked physiologic reactivity after being reminded of the trauma. Therefore, when triggered, one diagnosed with PTSD is subjected to the same forcing function regularly, which in this case is strong psychological and physiological activity. The short-term response to the re-experienced event is extreme ANS activity, which often induces panicked and/or erratic behavior.

Given the inability to objectively analyze the experience, one learns and comes to expect that a trigger will automatically result in significant ANS activation. Over time, the ANS activity induces changes in medium-term set-points, which are changes in the hormonal balance. The short- and medium-term changes act as a source of constant force on the long-term set-points, such as modified transfer-functions in the form of hypervigilance and emotional dysregulation. Likewise, entrainment will reinforce within one with PTSD behaviors that appear to reduce the misperceived forcing function. While the now-maladaptive behavior might have been an appropriate response to the original traumatic experience, it is no longer viable in the non-threatening environment. For example, if a person is held up at gunpoint, increased ANS activity was likely necessary so that the victim could prepare to fight the gunman or flee the scene; however, now, when the victim re-experiences being held up at gunpoint and the ANS becomes activated, there is no gunman with whom to fight or from whom to flee. Therefore, the victim is physically prepared for extreme activity and therefore must find a way to cope with or an outlet for the excess energy, such as substance use or unprovoked altercations.

Music Cognition Perspective of Illustration of Critical Process 2

A music listener will develop and activate expectations through repeated exposure to music form a particular style, composer, and/or performer, which are known as cues. When one is told that a musical piece is in the Baroque style, one would expect certain instrumentation and chord progressions. Similarly, when one is listening to a composition by Mozart, one would expect relatively length phrases that will repeat numerous times in the piece. When one seems a live performance by an expressive pianist, one would expect large arm movements during dramatic portions of the composition. In consideration of mental health concerns, an inexperienced music listener is much like one diagnosed with PTSD, where cues and triggers are equivocal. Confusion and frustration set in due to an inability to accurately predict the outcome of a situation based on cues, or, triggers. Unsure of what ambiensomatic information to consider, the affective response to triggers of one with PTSD will manifest as automatic behaviors, such as substance use. Knowledge about the learning and affective processes that occur during music listening can generalize to skills that can be useful in psychological treatment.

Critical Process 3: Biofeedback and Modifying Set-points

Biofeedback refers to the conscious monitoring and integration of information about physiological functions to inform thoughts, emotions, and behaviors. It is essentially the functional application of detected ambiensomatic information (Libet, 2002; Shevrin et al, 2002). Biofeedback can modify inappropriate information-processing and maladaptive behavior, leading to clinically relevant modification of set-points and cognitive constructs. An objective biofeedback process during this application can result in modified cognitive constructs, or ways of thinking about particular stimuli and events. When one learns how to objectively use biofeedback, one can detect physiological effects through ambiensomatic monitoring and then use the information to execute appropriate responses. Modification of the physiological activity of a person is possible through utilization of a dose-response relationship of the forcing function of the physiological effects of the elements of music. Over time, controlled and consistent application of the forcing function of music can lead to entrainment of a one's physiological system. In the context of the SEFFM, entrainment of physiological systems will support objective analysis of one's experience (Schneck & Berger, 2006). Critical Process 3 is an integration of the three tenets of the hard core, where the controlled system can be forced towards a clinically relevant point, while interoceptive processes provide feedback on the physiological goal of the intervention, which will eventually be integrated in a purposeful and adaptive way.

Illustration of Critical Process 3

An example of the application of Critical Process 3 is therapy for one diagnosed with PTSD, where set-points support hypervigilance due to the marked activity of the ANS during re-experiencing. The forcing function of music may allow one with PTSD to feel calmer during re-experiencing of the traumatic event. With guidance from the clinician, one may then objectively analyze the traumatic event. Over time, paired with objective analysis in therapy, music may be able to shift set-points to more appropriate parameters as one re-experiences the traumatic event. This can result in improved reality testing and a calmer emotional baseline in therapy and, eventually, in daily life.

Music Cognition Perspective of Illustration of Critical Process 3

One meta-analysis demonstrated that persons diagnosed with psychotic and non-psychotic disorders benefit significantly from music therapy. Statistical analysis provided support for the dose-response relationship, where the number of sessions accounted for 73 – 78% of the variance of therapeutic outcomes (Gold, Solli, Kruger, & Lie, 2009). One explanation for these results, as well as Critical Process 3, is that learning comes from practice, repeated exposure, and continuous evaluation, much like skill development and determinate meaning. Ultimately, a trained music listener can use music listening to have a more informed and controlled cognitive and emotional state.

Critical Process 4: Information-processing Principles and Constraints

The operation of information processing is complex, with direct implications relating to the clinical application of music listening as therapy. Once stimuli are "transduced," or, converted from their original energy form by a sensor to a chemical/electrical form that is understood by the CNS, they are then subject to control by the levels of the SEFFM (Schneck & Berger, 2006, pp. 70). The most relevant levels are: (a) influence of the Gestalt laws of perception; (b) constraints on the system; (c) the hierarchical processing pathway.

Gestalt Laws

There are five critical Gestalt laws that describe the heuristics of human perception in regards to music listening. They are, briefly: (a) proximity, where close objects are grouped; (b) directionality, where objects moving in the same direction are grouped; (c) similarity, where like objects are grouped; (d) closure, where breaks are filled in" and dots are connected; (e) Prägnanz, where perceived objects are as simple as possible (Meyer, 1956; Berger & Schenck, 2006). An example of Prägnanz is when one views the Olympic rings as overlapping rings, as opposed to a complex series of oblong shapes and incomplete circles (Haerich, April 13, 2010). The effect of each of these laws is immediate, implicit, and difficult to avoid, though easy to detect. These laws allow for rapid and effective pattern detection within stimuli, thereby reducing the cognitive load of processing every detail of a perceived environment (Coren and Ward, 1989; Haerich, 2010).

Sensory Constraints

There are four primary constraints on the information-processing system, including: (a) the sensory window; (b) tempering of auditory input; (c) rate of transduction; (d) the hierarchical pathway of information-processing. The first three constraints limit the amount of information that even gains access to the CNS; the fourth constraint limits the amount of information that gains access to consciousness. Further exploration of these constraints will now occur.

Sensory Window

The "sensory window" refers to the limited number of forms and ranges of energy that can be detected by human senses (Schneck & Berger, 2006, pp. 82). For example, the visual spectrum is a narrow band of electromagnetic radiation. With regards to music, the audible range of frequencies (pitches) we can detect is 20 – 20,000 Hertz (Hz), where a Hertz refers to the number of times the sound wave completes a full cycle each second. As one grows older, the auditory window shuts, and it becomes more difficult for one to detect frequencies at the extremes. With respect to the auditory system, the structure of the sensory apparatus employed is critical to the explanation of the limited size of the window (Békésy, 1960; Békésy and Rosenblith, 1951; Nicholls et al, 2001). Sound is detected by hair cells within the cochlea that vibrate at the same rate as the auditory stimulus; every dimension of the hair cell is important, with slight deviations from blueprints resulting in serious detection issues (Buser & Imbart, 1992).

Tempering of Auditory Input

The tempering of auditory input refers to the broad bandwidth of auditory input that is detected as one stimulus. That is, two sounds with frequencies that vary by a few

Hertz may likely be heard as the same sound. This is, again, due to the structure of the auditory sensory apparatus, which is not able to accommodate every possible frequency due to structural and special limitations. This is usually not a critical issue, however, since most sounds are not a pure frequency, but rather are a result of the superposition of numerous frequencies. Another reason for tempering is “beat frequencies,” which emerge when there are two distinct auditory stimuli that are very close in frequency. The superposition of the sound waves of mismatching frequencies produces a detectable “wobble” of amplitude that are perceived as painful or bothersome, with unpleasantness peaking at a “wobble” frequency of 24 Hz, which is about one-half of a step of a musical scale (D’Attelis, 2001; Schneck & Berger, 2006, pp. 82). Therefore, when two musical notes that are one half-step apart are sounded at the same time, a wobble can be heard on top of the two sounded tones.

Rate of Transduction

The rate of transduction and integration refers to the speed with which: (a) sensory transducers can detect and signal a detection of stimuli; (b) sensory systems can transmit information; (c) sensory filters can filter information; (d) neural networks signal detection of associated meaning; (e) higher order cognitive structures can detect and integrate neural network activities (Schneck, 1990). Needless to say, the numerous steps of the process inherently imply a delay between stimuli production and detection at a conscious level, as well as significant degradation of stimulus signal. The clinical relevance of the constraints is related to the “drop-out rate” of information, which relates to the amount of information from the environment that is never sensed, processed, or integrated (Schneck & Berger, 2006, pp. 85). Drop-outs can result in inappropriate error signals, overload, confusion, frustration, and fear, each of which can induce maladaptive behavior (Woody, 1982).

Hierarchical Pathway of Information-processing

The hierarchical information-processing pathway refers to the order of CNS structures that receive, process, and transmit stimuli information. An extensive review of this pathway will be completed in our discussion of Critical process 5, but a word of discussion is warranted. There are three levels that are most pertinent to this constraint with the SEFFM: (a) the Reticular Formation; (b) the Spinothalamic tract; (c) the Limbic System.

Reticular Formation

The Reticular Formation is an important early point in sensory processing where neural networks begin to assemble and integrate incoming information. This is the first point in the pathway where stimuli are processed for importance, where insignificant information is stopped and significant information is allowed through. The Reticular Formation is not itself a functional unit, but, rather, it is a pinky-sized area within the brainstem that is made up of numerous nuclei that act as information exchange points for their respective neuronal tracts.

Spinothalamic Tract

The Spinothalamic tract refers to the pathway of spinal nerves that project onto, i.e., send information to, the thalamus. The thalamus is where stimulus information is checked against the set-points, as discussed above. Sensory information from the visual, auditory, tactile, and gustation systems are processed through specific regions of thalamus, where each area is dedicated to a specific sense (Ornstein and Thompson, 1984).

Limbic System

Upon completion of evaluation and classification of stimuli, the thalamus then sends projections to the primary sensory regions of cortex and the Limbic System (Libet, 2002, 2003). Processing of stimulation in these two regions occurs in parallel (Haerich, 2010). The primary sensory regions identify the stimulus information, though this identification does not necessarily make it to consciousness unless it requires attention because it is interesting or important, as alluded to in Critical Process 1. Concurrently, information from the thalamus is processed in the Limbic System, where there is a specific order of structures, which has significant influence on the results of processing (Shevrin, Ghannan, & Libet, 2002).

Illustration of Critical Process 4

Despite the significantly altered psychophysiological state of a person with PTSD, the information processing-principles in play are themselves not significantly altered. One with PTSD still employs heuristics that are subject to the Gestalt principles, though the heuristics themselves can be modified. The primary constraints do not disappear, though they might tighten as a result of ANS hyperactivity or damage to the sensory systems themselves. For example, an explosion created by an IED (improvised explosive device; a common weapon used by militias) could damage the auditory system, resulting in slight deafening, as well as inducing a traumatic experience, such as serious bodily injury. Likewise, the rate of transduction may be modified (explored below), but the concept remains the same. The hierarchy of information-processing is not modified either, though there may be more emphasis placed on the emotional or threat aspect of stimulus detection within the PTSD patient.

Music Cognition Perspective of Illustration of Critical Process 4

Meyer was quite clear in *Emotion and Meaning in Music* (1956) that the Gestalt laws of perception have a strong influence on a music listener's: (a) learning; (b) expectations during music listening; (c) overall experience during music listening. He spent nearly a third of the work describing the influence of the principles of pattern perception on how one organizes sound stimuli into coherent sound terms. Furthermore, the manner in which sound stimuli is organized will strongly influence the expectations a music listener will have a style, composer, and composition. However, he held that it was the principles of good continuation, completion and closure, and the weakening of sound shape that were principally relevant during music listening. A satisfactory dismissal of potential theoretical disagreement of which Gestalt laws are truly relevant can be found in Meyer's own manuscript. He asserted that the heuristics of pattern perception are continuous and any label is simply a matter of convenient discussion.

Critical Process 5: Information-processing

Extending the discussion of the hierarchy of the information-processing network, Critical Process 5 describes the way in which the Limbic System processes information. The Limbic System is charged primarily with identifying the emotional content of perceived stimuli. There is an important give-and-take going on between the physiological activity of the body and the activity of the Limbic System, primarily the amygdala, which is the next structure in the information pathway after the thalamus (Schneck & Berger, 1999). The amygdala checks stimuli for emotional value and for threat level, flagging any stimulus that might require further attention. The Limbic System, primarily due to the influence of the threat-detecting activity of the amygdala, exerts partial control over the body's physiology through the ANS. The ANS is composed of antagonistic subsystems known as the parasympathetic system and sympathetic system, each responsible for "rest and digest" response or the more commonly known "fight or flight (or freeze)" response, respectively (Nicholls et al, 2001, pp. 315 – 317). The significance of amygdalic control of the ANS will be explored below.

Once stimulus information has been processed by the amygdala and determined to have a low level of threat, it is then processed by the hippocampus, which tags the stimulus for temporality in preparation for commitment of the experience to memory (Berger, 2002; Berger & Schneck, 2003; Schneck, 1997). The importance of the parallel processing of information in the Limbic System and primary sensory cortex has to do with the value of memory, which includes: (a) sensation from the primary sensory cortex; (b) temporality from the hippocampus; (c) emotional value from the amygdala. This means if a stimulus, such as a violent event, elicits a strong emotional reaction, it will be preserved more thoroughly, since it would be flagged by the amygdala, and have a physiological response associated with it; this results in a more-well preserved memory that is associated with a strong, negative physiological response and sensation produced by the sympathethic nervous system (Schneck & Schneck, 1996).

An important feature of the Limbic System has to do with the truncating of cognitive processing when the amygdala is highly activated (Damasio & Moss, 2001). If the amygdala has scanned and flagged a stimulus as threatening, it will halt any further processing and focus the mind on the perceived threat. This is accomplished by initiation of the fight-or-flight response, activation of the sympathetic activity of the ANS, that supports “scanning” abilities as the threatened person attempts to locate the stimulus that is the source of the threat (Nicholls et al, 2001, pp. 315 – 317)

The fight-or-flight response is a functionally adaptive response to threatening stimuli in a hostile environment, despite the truncation of objective cognitive processing. However, if an amygdala were to become hypersensitive, it would detect threat where is none, inducing a fear response when it is not appropriate and preventing higher order thinking from occurring in an everyday situation (Berger & Schneck, 2003; LeDoux, 2002; Schneck, 1997; Schneck & Berger, 1999). Likewise, a hyperactive amygdala could easily lead to maladaptive behavior as a result of perceived threat and increased sympathetic activity, as alluded to above (Andreasen, 1997; Couley, 2003; Goldman, 1996). If one were to view sympathetic activity as a forcing function, a system in constant fear response mode would eventually reset its set-point, holding that hypervigilance is normal. This is one possible source of maladaptive behavior where a human with a set-point that indicates high sympathetic activity will feel uncomfortable in a calm state and will seek out hostile environments, possibly creating them (Dolan, 2002; Holden, 2003; Javitt & Coyle, 2004). Another possibility is one of a human that develops an “attitude towards fear,” where a person will feel uncomfortable if they are calm and will therefore always be on alert, never “letting their guard down” and over-reacting to even the slightest detection of the “conditioned stimulus,” the stimulus that induces the fear response (Berger, 2002; Schneck 1990; Schneck & Berger, 2006, pp. 110).

This line of reasoning leads to the idea of the fear spiral: hypervigilant physiological set-points, combined with a schema towards fear, can lead to a self-sustaining and ever-increasing loop where a human will be on alert, detect the conditioned stimulus, over-react, continue to be on alert, detect the conditioned stimulus, over-react, and so on ad infinitum (LeDoux, 1998, 2002). The fear spiral is just what a PTSD patient experiences, where, as mentioned, the re-experiencing of the traumatic event acts as the forcing function that modifies the set-points, as well as creates conditioned stimuli. The idea of a schema towards fear is embodied by the PTSD patient's avoidance of the situation that is known to induce the fear spiral. There is hope, however, for victims of the fear spiral.

If the inappropriate set-point that induced the schema towards fear could be reset by a precisely controlled forcing function, then the fear spiral could be stopped before it even got started. Not only would the person not physiologically be on alert due to sympathetic activity to begin with, but they would not be expecting to be on alert. Preventing the fear spiral has both psychological and physical benefits. The human will be able to more accurately experience the environment, more easily engage in appropriate behavior, and prevent the toxic effects of persistent stress hormones (Schneck, 2002). The clinical ramifications of this positive result cannot be underestimated. Once the precise forcing function has been developed, it could be possible to set the patient up with an at home forcing function generator, such as a personal music player like an iPod.

Illustration of Critical Process 5

Information processing in the Limbic System that results in persistent hypervigilance and a fear spiral has serious ramifications for a person with PTSD. A fear spiral is created when a traumatic event that has high emotional value, is committed to memory with that emotional value attached, but with little higher-order cognitive processing. When one diagnosed with PTSD recalls the traumatic event, the memory will induce the physiological change associated with the memory through the integrated memory and physiological functions of the Limbic System. This is the source of maladaptive behavior, since one recalling the traumatic memory is now in a fight or flight state, focused on and reacting to stimuli that would normally be perceived as non-threatening. The more often the patient re-experiences the traumatic event, the more normal the hypervigilant state becomes to the body. Furthermore, if one is typically in a hypervigilant state, then one will learn more implicit triggers.

Music Cognition Perspective of Illustration of Critical Process 5

Meyer thoroughly discussed the effects of learning on expectations (1956). In regards to one diagnosed with PTSD, as the fear spiral develops and more triggers are created, one would begin to assume a threatening outcome is more likely, in more situations. Essentially, the more frequently one detects threat and feels afraid, the stronger the expectation one has that danger is present and great bodily harm is imminent. Even if a truly threatening event does not occur, frustration from the suspense for the threat to manifest will set in. This frustration then mixes with the hypervigilance originally generated by the trigger. The heightened affective and emotional state will then cue automatic behaviors that are likely to not deal with the original source of the physiological response, the trigger, and are more likely going to deal with the current affective state. The continuous negative experience of the automatic initial affective response to triggers, and the secondary frustration with the inability to resolve the affective response, will impede objective analysis of the process. This will prevent attenuation of the deleterious effects of the symptoms of the diagnosed PTSD through effective therapeutic examination of the original traumatic event or any associated triggers.

Critical Process 6: Music Listening as Therapy

Music sans lyrics has unique therapeutic potential since it has no explicit, semantic meaning and most likely extends from visceral "human calls," the first oral expression of emotions emoted by humans (Deacon, 1997, pp. 15). Likewise, music can be processed "in the background" because it does not require explicit attention and focus in order to be processed by the mind. Therefore, even passive music listening can lead to sub-cognitive alteration in set-points and behaviors that will subsequently be considered "normal" by the patient (Schneck & Berger, 2006, pp. 119).

The idea that emotion is a visceral, basic part of the human experience stems from the hierarchical influence of the CNS, where the Limbic System, the emotional center, is part of the paleocortex, the older portion of the brain, which developed over a quarter of a billion years ago (Berger, 2002; Damasio, 1999, 2001, 2003; LeDoux, 1998, 2002). Compare that to the neocortex, the portion of the brain responsible for symbolic language and verbalization of emotion, which has been around for a mere 5 million years (MacLean, 1990). This significant difference in age, along with the Limbic System's emphasis on appropriate physiological reaction towards threat, lends credence to the notion that we must express our emotions.

Expanding on the idea that music extends from human calls, each element of music, specific modes/tonal scales, and even specific instruments, can therefore be associated with, and exert control over, specific physiological functions and systems (Darwin, 1998; Friedman & Rosenman, 1974). From this, we can deduce that music can be a holistic therapy, working with the body, not against it, in a non-invasive and naturalistic way.

Illustration of Critical Process 6

Music therapy has been found to be effective with a variety of mental health disorders, including PTSD (Cukor, 2009; Dalgleish, Moradi, Taghavi, Neshat-Doost, & Yule, 2001), in large part due to the expression of emotional content that is found in music (Gold, et al, 2009). Furthermore, music therapy has been found to be effective in pain management through its effects on sympathetic nervous system activity (Hughes, 2001, 2002; Krumhansl, 2000; Levitin, & Tirovolas, 2009; Pitman & Kridli, 2011). The growing body of evidence that suggests the broad clinical utility of music therapy lends itself to the notion that music has an important place in the therapeutic context.

Music Cognition Perspective of Illustration of Critical Process 6

The positive health effects of music can be accounted for by the mind's ability to detect and process information. The absolutist perspective holds that music itself does not account for any affective, emotional, or physiological changes within the listener. Rather, it is the automatic pattern analysis that occurs during music listening that will result in physiological changes due to, and cognitive understanding of, the stimuli. The greater the understanding of music one has, both from experiential and academic learning, the better the mind is at understanding the listened-to music. When applied in a therapeutic paradigm, the more knowledgeable one is about music, the more effective music listening is as therapy. Therefore, the music listener would gain the most benefit from music listening after formal training on the elements, rules, and performance of music as they relate to cognitive and affective experience.

CHAPTER 6

THE PRINCIPAL ELEMENTS OF MUSIC

In "Chapter 3: Music as Such," the elements of music were introduced and basic music theory was discussed. While each element is important and integral to the phenomenon of music, extensive exploration of each element is not needed for the purpose this manuscript. However, this chapter will offer a much more in depth discussion about the principal elements of music, rhythm and melody, which are the focus of pop and classical music, respectively. At the conclusion of this chapter, the reader may wish to refer back to the Chapter 3 section entitled "Structural Rules of Western Classical Music Pieces."

Rhythm

Rhythm refers to the regular, repeating flow of tones through a musical piece (Krumhansl, 2000). It is the detectable and predictable undercurrent that provides the forward movement to the musical piece. It can be found is many aspects of life, including respiration, heart rate, walking, and the changing of the seasons (Chanda & Levitin, 2013). When multiple instruments are playing, each featuring its own rhythm, the resultant effect is referred to as polyrhythm. The rhythm of a musical piece makes one want to tap, clap, or nod at the same pace as the musical piece. While a straightforward phenomenon to detect, rhythm is a result of the relationship of three attributes: (a) pulse; (b) pace; (c) pattern.

Pulse

The pulse of a musical piece is derived from the alternation of beats and silence, like the regular tick of the second hand of an analog clock. One will cognitively and physically sense the pulse of a musical piece. The drive to jump with a rock song or dance to a samba is the manifestation of the body's alignment of psychophysiological processes to the pulse (Schneck & Berger, 2006). Research has shown that heart rate will conform to the pulse of a musical piece (Standley, 2000).

Pace

The pace of a musical piece refers to the rate of beats per minute. Conversely, it is the amount of time that passes between the onset of one beat to the next, called the inter-beat interval. For example, the pace of a clock ticking is 60 beats per minute, with a 1,000 millisecond inter-beat interval. Research has found that subjects asked to tap at a steady pace will average a 500 – 600 millisecond inter-beat interval, and that one's preferred tap-pace will be evidenced in other rhythmic activities, such as walking (Friberg & Sundberg, 1995; Fraisse, 1982).

Pattern

The pattern refers to the repeating set of strong and weak beats in relation to the pulse. Take, for instance, a clock's pendulum: when it swings, there is often an audible tick-tock-tick-tock. This is an alternation of short-long-short-long. A musical piece will often feature multiple patterns in order to communicate structural information and meaning at the time. For example, a regular beat pattern of short-long-short-long may switch to beat pattern of short-short-short-short to indicate the end of a musical phrase. Changing pattern is almost necessary because the brain will tend to tune-out repetitious stimuli, which can result in a loss of interest in the musical piece.

Psychophysiological Research on Rhythm

What will follow now is a focused look at various domains of psychophysiological research on rhythm. This is to demonstrate the utility of rhythm as a clinical focus within a mindful music listening therapy protocol. The areas that will be discussed in this section are (a) grouping; (b) attention; (c) neuronal entrainment; (d) selected physiological research; (e) selected cognitive rehabilitation research.

Grouping

Research seems to indicate that what is primary is the relative relationship of events to each other, rather that the absolute timing of the events (Krumhansl, 2000). For grouping auditory events, human subjects reported that tones that sounded within 100 millisecond (ms) of each other were one event, while tones sounded more than 1,500 ms apart were not related (Fraisse, 1978). Fraisse (1982) later noted that people tend to synchronize movements with rhythmic sound events, so much so that they find it difficult to tap off-time. In the same article, subjects were found to group auditory events into twos and fours based on subjective timing, where they generated a requested number of tones into the same amount of time despite no timing prompt, or objective quality of tones, where they grouped listened-to tones based on differences in length, volume, or pitch. Further research on mental representations of rhythm found that subjects relied on familiarity with the style of the listened-to musical piece, goodness-of-fit judgments, and memory of earlier sections of the piece. Each of the three criteria for generation of a mental representation of rhythm used aspects of the pulse, pace, and pattern to determine the actual rhythm (Palmer & Krumhansl, 1990). Additionally, performers appeared to emphasize the various aspects of rhythm as cues for how the listener ought to segment musical structures, with a direct relationship between skill and subtlety of cues (Drake & Palmer, 1993, 2010). For example, in quadruple rhythm, the first beat has the most stress, then the third, second, and fourth, which means a music listener will mentally group a section starting with a high stress beat, then start another group with a high stress beat, then another, then another, and so on. A written example of quadruple meter with this arrangement of stressed beats is as follows: ONE – two – Three – four – ONE – two – Three – four – ONE – two – Three – four. Evidence for this way of grouping musical phrases was found in numerous experiments, regardless of age, music knowledge, and sample music style (Krumhansl, 2000).

Attention

Decades of research support the notion that periodicity, and the subjective experience of rhythm, supports selective attention (Krumhansl, 2000). Cherry (1953) pioneered the idea of selective attention. Commonly known as the cocktail party effect, selection attention was an explanation for how humans are able to sift through vast amounts of sensory stimuli and extract vital information without becoming overwhelmed. Broadbent (1968) then suggested the idea of filtering of auditory stimuli. Later research found that subjects appeared to exploit probabilities and rules of grammar to determine salience and value of auditory stimuli in order to free up attentional resources for other co-occurring cognitive processes (Treisman, 1960, 1964). Extension of research on selective attention found that rhythm improved judgment as well. Subjects have consistently been more accurate at judging the pitch and temporal duration of tones that were sounded in rhythm, as opposed to when tones were sounded offbeat (Jones & Boltz, 1989; Jones, Moynihan, MacKenzie, & Puente, 2002). Furthermore, when target stimuli were on beat, subjects were more accurate at detecting violations higher order melodic rules (Jones, Boltz, & Kidd, 1982). The concept that familiarity with stimuli and premorbid knowledge shapes perception, subjective experience, and judgment of stimuli will be explored further in the chapter on Music Cognition.

Neuronal Entrainment

More recent theory on rhythm has boldly purported that rhythm as such did not actually exist, but was in fact a psychological phenomenon that is referred to as entrainment. That is, the subtle variances in pulse, pace, and pattern utilized by performers to provide richness to a musical performance prevent a rigid rhythmic structure that was objectively periodic. However, the perception of rhythm did have survival benefit in that it allowed multiple persons to synchronize, therefore psychophysiological mechanisms evolved to support the subjective experience of periodicity and therefore rhythm (Large & Snyder, 2009). In support of this claim, electroencephalogram (EEG) studies found that subjects' brains generated steady state-evoked potentials that enhanced the electrical reactivity of the brain in response to the listened-to rhythms. That is, neuronal entrainment exaggerated electrical activity when the rhythm of the stimulus synchronized with the rhythm of the brain (Nozaradan, Peretz, & Mouraux, 2012). Other recent research on the effects of rhythm on temporal judgment has utilized the oddball paradigm, where the target stimulus is qualitatively different from surrounding stimuli. In one experiment where the oddball varied both in duration and placement with respect to a rhythmic beat, results indicated that judgments about length of an auditory event were most accurate when the oddball was sounded on beat. Subjects were significantly less accurate when the oddball was sounded offbeat; estimations were too short or too long if the oddball occurred before or after the beat, respectively (McAuley & Fromboluti, 2014).

Selected Physiological Research

Sympathetic nervous system activity is the focus of most physiological research in the realm of music. Typically, the data used to measure physiological reactivity to music is heart rate, skin conductance response, and blood pressure. Research consistently found that each of these measures was greater during music listening compared to silence (Koelsch, Gunter, Wittfoth, & Sammler, 2005; Koelsch, 2013). When a musical event occurred later than was rhythmically expected, a state of tension was reported by and measured in listeners, as indicated by increased heart rate and skin conductance response (Huron, 2006). One study found a positive correlation between music pace and physiological reactivity, although the strength of the correlation varied with genre, where rock music had a weaker correlation than did classical music (Carpentier & Potter, 2007).

Selected Cognitive Rehabilitation Research

Speech has a rhythm as well, though it is typically referred to as prosody in mental status exams. Utilization of rhythm as a timing mechanism to emphasize enunciation has been helpful in speech rehabilitation (Adamek, Gervin, & Shiraishi, 2002). On a larger time-scale, Mozart's predictable, 24-minute, three-movement "Sonata for two pianos in D," K. 448, was found to decrease the frequency of epileptiform events both during and after music listening in most subjects. This "Mozart Effect" was believed to due to long-term periodicity, or, rhythm, in the form of numerous repetitions of the melodic line (Hughes, 2001). Similar research strengthened the claim that long-term periodicity and melodic repetition reduced epileptiform events, again demonstrating that

Mozart's work was the most effective, followed by compositions by Haydn (Hughes, 2002). Hughes also provided suggestions for the best method to use when selecting music intended to help control seizure activity. A publication by different researchers confirmed the positive effects of Mozart's music on refractory epilepsy, reporting that subjects had less frequent and shorter epileptiform events and improved motor control after listening to Mozart for three months. Of note, the aforementioned effects of listening to Mozart were found even when the subjects listened while asleep (Lahiri & Duncan, 2007).

A comprehensive study of the effects of Medical Resonance Therapy Music (MRT-Music; whose rhythmic structure is based on the so-called rhythmical harmony laws of nature) found that subjects who listened to MRT-Music for one hour a day for six to 16 days had many positive results. Those results included: less frequent and less severe epileptic events; less amnesia; better quality of life; better regulated mood; reduced unrest, wrath, and irritation; and reduction in Minnesota Multiphasic Personality Inventory detected levels of sickness, psychasthenia, paranoia, hypochondria, aggression, and depressive states (Sidorenko, 2000).

Clinical Utility of Rhythm

As discussed and defined here, rhythm is present in many daily activities and detection of rhythm in music occurs naturally and with little effort (Krumhansl, 2000). The breadth and value of the innate ability to assess for and predict the recurrence of temporal events has been explored extensively in research on human capacity for processing temporal information. Rhythm has been found to be foundational in numerous human phenomena, such as perception, attention, memory, time management, speech, and even consciousness (Krumhansl, 2000; Grondin, 2010; Farbood, Rowland, Marcus,

& Ghitza, 2015). It also supports social synchronization, such as participation in rituals, organizations, care giving, and group cohesion (Trehub, Becker, & Morley, 2015). This means that heightened awareness around rhythm detection may support social bonding, communication, and executive functions, such as attention, planning, and memory. Attention would be improved though music listening skills training because one would learn how to utilize predictable information to support selective attention. Memory could be improved by augmented segmentation and grouping skills. Planning might be augmented through the ability to identify structures and generate predictions. This in turn could support the ability to carry out activities of daily living and instrumental activities of daily living, such as eating and paying rent, respectively. Furthermore, subjective quality of life, such as mood and health, could be improved by listening to musical pieces selected for specific rhythmic properties.

Melody

Melody is a subjectively satisfying rhythmic flow of pitches. It is considered by some musicologists to be the ultimate goal of music. The melody is the lead of Western Classical music, and often establishes the theme or motif of the musical piece. This means the melody is repeated with more and less noticeable changes in rhythm and pitches; a sort of plaything for the composer or performer. Ostinato is when the melody is repeated without change; it must be used carefully because irritation often sets in quickly. Given that melody is the ultimate goal of Western Classical music, the theoretical component parts and emergent applications of melody must now be explored further. This discussion will now examine more closely: (a) pitch; (b) key signature; (c) scale; (d) chord. Immediately following this, the psychophysiological research on melody will be presented.

Pitch

The pitch is determined by the frequency of the sound. The higher the frequency, the higher the pitch; the lower the frequency, the lower the sound. There are limits to how high or low a pitch can be and still be detected; recall that a human ear can, at best, detect pitches that are 20 to 20,000 Hz. Furthermore, there must be a large enough difference in pitch so that a person can hear the difference. A semitone, or half-step, is the minimum difference of pitch that can be detected by an average human. The half-step was used as the basis for developing the structure of key signature. Each note has a fundamental frequency, and it is periodic, so every twelfth semi-tone the same note is heard, though at a different integer value of the fundamental frequency. For example, the aural qualities of 880 Hz, 1,320 Hz, and 1,760 are almost identical to 440 Hz, the fundamental frequency of A; it is also known as A440. The similarities of these integer values to the fundamental frequency are due to the harmonics of the periodic waves.

Key Signature

The key signature is what determines what pitches in the octave are related to the starting pitch, or, key; the related pitches are called notes. The octave refers to the twelve unique pitches that exist, separated by a half-step each. The thirteenth pitch is harmonically similar to, and given the same name as, the first. That is, the thirteenth pitch will seem to feel the same as the first, but it will be higher or lower frequency. While there are twelve half-steps in an octave, there are seven notes in the octave, which are labeled with the first seven letters of the alphabet, A through G. However, C is considered home, or, middle. The half-steps between the whole notes (A through G) are represented by the letter with a # of a b, meaning sharp or flat, respectively. For example, C# (C-sharp), or Gb (G-flat). A scale refers to all the related notes in a key signature and lists what notes are acceptable to be played in a melody, that is, the notes that when sounded will be considered melodic.

Scale

A diatonic scale is the most basic scale, and includes all seven notes of an octave (it then repeats). The diatonic C scale includes the notes: C-D-E-F-G-A-B (which then restarts at C). The diatonic G scale includes the notes: G-A-B-C-D-E-F#. There are other scales that call for different pitch relationships, which change the feel of the scale. For example, the heptonic scale (also called a minor scale): C-D-Eb-F-G-A-B. The ratio of the key note to each other note is related to how pleasantly they fit together, and therefore how preferred, each note is within a scale. The simpler the ratio, the more pleasant the experience of the two notes sounded at the same time. For example, the perfect fifth in the C major scale, C:G, is 3:2; the minor second for the C major scale, C:C#, is 16:15. The name says it all for the perfect fifth, where the integer ratio, a relatively simple 1.5, suggests pleasant harmonic agreement. Indeed, it is found very frequently in Western music, especially in the chord structure. The minor second, on the other hand, has the integer ratio of 1.066, and the experience is rather unpleasant due to the dissonance of the harmonic wave patterns that result during their concomitant sounding. The preferred notes within each key signature that have been described with probability ratios for each style and composer. During music listening, these probabilities lead the trained music listener to make predictions about subsequent notes in a melodic line, and to be able to identify when errors are made during music performance. Furthermore, there are related key signatures, so a song can shift from one key signature to another key signature that is related through overlap of pitches.

Chord

A chord is like a vertical melody, where notes from the same key signature are played at the same time. The root determines the key signature for the chord and is typically the lowest note featured in the chord. There are many chords, though most have well-established note compositions, avant-garde styles have developed more complicated chord structures. A major chord is the first, third, and fifth note of a key; for example, C-major is C-E-G. A minor chord is the first, minor-third, and fifth note of a key; for example, A-minor is C-Eb-G. A-minor is the relative minor to C-major, so named because the subjective instability of A-minor pulls for the C-major chord. Much like as with melodic rules, the acceptable order of chords during a musical piece is based on the spatial relationship of the tonic chord to the other chords. This means that most chord progressions are predictable once the tonic is identified. For example, if one knows the key of a musical piece and then hears a relative minor chord, then one can most likely assume that it will be followed by the relative major chord. Common chord patterns were explored in the "Chord Progressions" section in Chapter 3, "Music as Such."

Psychophysiological Research on Melody

The separation of cognitive-affective and physiological-emotional experiences has been widely accepted for over a century. This is most clear in theory and research on melody, the flow of which is often compared to the prosody of language. Held as an immutable fact by many leading scholars in the field, the primacy of cognitive appraisal through top-down and bottom-up expectation systems acts as the background for the music listening experience (Frijida, 1986). The blend of prior knowledge about a music style and immediate knowledge of the musical piece provide the mechanisms and forcing functions that lead to affective and emotional experiences (Narmour, 1991). The strongest affective response to a tone that occurs in the context of a melody has been noted to occur when that tone occurs on a strong beat, is not preferred in a key signature, or when it is dissonant (Bharucha, 1996). Top-down, schematic approach to music perception was further support by recent event-related brain potential research. Data revealed that tonal expectations exert influence on pitch perception early in cognitive processing, as demonstrated by out-of-tune tones eliciting tell tale early right-anterior negativity signals (Marmel, Perrin, & Tillman, 2011). Now, there will be a brief exploration of leading theories about how melody is experienced and predicted.

Melodic Predictions

Schematic expectation models that resemble neural networks appear to explain the parallel cognitive processes of learning consolidation and prediction generation during music listening (Krumhansl, 2000). These schemas have nodes that represent different architectonic levels of music, including tone, chord, and key relationships. The schemas could be primed and were also demonstrated to be modifiable, which explained expertise and within-musical piece learning. The schema model accounted for subjects' relatedness judgments, memory judgments, and expectancies demonstrated (Tillman, Bharucha, & Bigand, 2000; Bharucha, 1987, 1991; Bharucha & Olney, 1989). Bharucha & Todd (1989) differentiated between two forms of tonal expectancy, schematic and veridical. Schematic is based on cultural learning, whereas veridical is based on instance-based learning. There are times when predictions made by the two forms conflict, and the tension due to the difference elicits affect in the music listener, as described by Meyer (1956).

Further research in support of a schematic expectation pointed toward utilization of Gestalt principles of proximity and continuation, again, as described by Meyer (1956). Some studies implied that familiarity with a style accounted for predictive accuracy (Cuddy & Lunney, 1995; Krumhansl, 1995a). However, compelling research demonstrated that subjects could hear an unfamiliar style of music and in a brief amount of time begin to make accurate melodic predictions (Krumhansl, 1991a, 1995). Similarly, perceptual and performance research supported the idea of melodic archetypes (Rosner & Meyer, 1982, 1986; Schmuckler, 1990). Event-related brain potential research appeared to confirm the schematic explanation of melodic prediction as well. Sounded notes or chords that did not fit the apparent contour of a melody elicited late positive potentials (Besson, Faïta,, & Requin, 1994; Besson & Faïta, 1995; Janata, 1995). Similar brain activity was observed when subjects heard incongruent spoken language (Patel, 1998, 2003; Patel, Gibson, Ratner, Besson, & Holcomb, 1998). However, other research appeared to indicate separate melodic and language processing areas (Besson, Faita, Peretz, Bonnel, & Requin, 1998; Patel, Gibson, Ratner, Besson, & Holcomb, 1998).

Tonal-Harmonic Hierarchy

A plethora of research indicated the importance of Tonal-Harmonic Hierarchy, which is a top-down approach that generates tone and chord predictions that affects the music listening experience. Once a music listener identifies the key of the musical piece, automatic beliefs based on learning then establish a sense of note and chord stability, which in turn affects tension and release for the listener (Krumhansl, 1990). Of course, the matter of context is found to be of paramount importance. For example, a C-chord may be considered stable in one key signature, but not another (Bharucha & Krumhansl, 1983). One study demonstrated the effects of tonal-harmonic hierarchy on listeners' cognitive and affective experiences. Subjects reported that a progression felt less complete when it ended on an unexpected chord compared to an expected chord. Subjects also took longer to determine if the unexpected chord belonged to, and was consonant with, the chord progression (Bigand & Pineau, 1997). These results were later replicated (Bigand, Madurell, Tillman, & Pineau, 1999).

Implication-Realization Model

Narmour originally proposed the Implication-Realization (I-R) Model of tonal prediction in 1990. It was able to predict music listener's judgments of how well a target note fit in with a melody. It also demonstrated that familiarity and expertise did not contribute to accuracy of subjects' judgments. However, it was repeatedly criticized for being too complicated (see Cuddy & Lunney, 1995; and Schellenberg, 1996). Eventually, Schellenberg (1997) proposed a more parsimonious, though still predictively powerful I-R model. This simplified I-R Model consists of the two factors pitch proximity and pitch reversal. Pitch proximity predicts that a music listener will expect the next note in the sequence to be proximal to the current note and continue in the same ascending or descending direction within the key. For example, if a one hears the notes "C-D-E," then one would expect "G" (remembering that "F" is not included in the C-major scale). Pitch reversal then applies when there is a disjunct motion in a melody; that is, when there a note sounds and the next note is many semitones away, the next note will be closer in pitch to the first note than the second note. For example, if one hears the notes “C-D-G,” then one would expect “E.” A later study on the I-R Model found that children as young as 5 years of age implicitly understood the pitch proximity principle, as demonstrated by their judgments of how well a target note ends a melody and by the note they sung to end a melody. Adult subjects in the same experiment demonstrated implicit understanding of pitch reversal principle, as they demonstrated by their expectations following melodic disruption (Schellenberg, Adachi, Purdy, & McKinnon, 2002). The I-R Model is a statistically derived mathematical description of common composing practices described in the “Melodic Contour” section of Chapter 3, “Music as Such.” The I-R Model also demonstrates Meyer’s (1956) assertion of the importance of the good continuation and completion, as discussed in this manuscript in the “Pattern Perception: Gestalt Laws and Learning” section in Chapter 4, “Psychology of Music Cognition,” and in the “Gestalt Laws” section in Chapter 5, “Engineering Model of Music Audition.”

Melodic Anchoring

Another description of the cognitive processes of melodic expectation formation is referred to as Melodic Anchoring. Anchors are described as a cognitive reference point and this process is thought to demonstrate a more general cognitive process. This conceptualization is again based on the self-organizing neural net notion in which each note is a representational unit. This model incorporated previous work on representational units, which are influenced by co-occurring bottom-up and top-down priming systems (Krumhansl, 1990). The models also incorporated research that found that tones will be perceived as more related when a less stable tone is followed by a more stable tone compared to the reverse order (Krumhansl, 1979). In addition, this model acknowledged the limited resources of the attentional system, which was found to result in greater processing of tones near salient leading tones (Deutsch, 1978). The goal of the Melodic Anchoring Model is to predict expectations of what stable tones will sound to resolve unstable tones as a melody unfolds. The idea is that a melody repeatedly will feature an unstable tone that brings tension, followed by a stable tone will bring resolution. The stable tone is called the melodic anchor and it is under two constraints. The proximity constraint holds that anchor must be no more than two semitones away from the unstable tone. That means there are four anchor options, plus-minus one semitone and plus-minus two semitones. The asymmetry constraint holds that the anchor tone must be closer in pitch to the unstable tone than the tone that preceded the unstable tone; this may limit the anchor options. A tonal force vector for the four potential anchor tones is calculated based on how far it is from the unstable tone and its likelihood of occurrence given the key signature. The sum of the tonal force vector gives the yearning vector, which is the prediction of the music listener's expectation (Bharucha, 1996).

Chord Prediction

Much like a melody, during music listening listeners tend to predict the odds of what chords will be sounded. This is a reflection of learned frequencies of musical structures, which has been demonstrated experimentally (Deliege, 1989). Further research found that listeners tend to use surface clues, rather than underlying structural information, to guess chord progression during music listening (Deliege, Melen, Stammers, & Cross, 1996). One study on detection of and preference for uncommon progressions found that all subjects, novice and expert alike, were sensitive to unusual musical progressions. However, the study did find an interaction effect between subject expertise level and atypicality of progression, where music novices preferred common progressions and music students preferred uncommon progressions (Smith & Melara, 1990).

Categorical Perception

Intervals are of paramount importance to melody. As described in the above section, "Melodic Predictions," judgments of the interval guide expectations of subsequent notes. Research established over three decades ago that experienced musicians almost always judged common intervals accurately regardless of context, much like how judgments of speech sounds are absolute despite context. Furthermore, musicians demonstrated abrupt shifts in judgments of intervals (Siegel & Siegel, 1977). In one study, when subjects were told to identify the interval they just heard, they almost always labeled them as a minor third, major third, or perfect fourth (Burns & Ward, 1978). The same sharp categorical boundaries during intervals identification was observed in harmonic intervals; that is, when two notes were sounded at the same time (Zatorre & Halpern, 1979). The final interval of a melody was also judged categorically, and subjects were more accurate when the interval was presented in the context of the melody rather than in isolation (Wapnick, Bourassa, & Sampon, 1982). Categorical judgment of intervals was observed cross-culturally as well. Western and Javanese musicians demonstrated internal interval standards, as demonstrated by the non-categorical judgments of uncommon intervals. Javanese musicians had blurrier interval boundaries, likely due to the dual tuning systems found in their culture (Perlman & Krumhansl, 1996). Non-musicians were noted to lack categorical judgments of intervals, and their judgments were less accurate in ambiguous contexts (Siegel & Siegel, 1977).

However, it was noted that non-musicians' judgments of intervals improved markedly through one experiment, suggesting that categorical perception can be learned in a brief amount of time (Howard, Rosen, & Broad, 1992). Taken as a whole, this data suggests that moment-to-moment perception of melody is indeed categorical and partially subject to context for an experienced music listener.

Chords

Although primarily related to harmony, as described above, chords and chord progressions can be thought of as forms of melody. For this reason, a brief discussion about psychophysiological research on chords will now take place. Many researchers take for granted that a music listener that is familiar with Western will subjectively experience a major chord as positive and a minor chord as negative (Howard, Rosen, & Broad, 1992). Event-related potential (ERP) data supported this idea. One experiment paired auditory and visual stimuli then identified the telltale signs of early processing, a decreased N2 ERP, which would indicate that the stimuli were congruent. Indeed, when subjects viewed a happy face and heard a major chord, the ERPs included a decreased N2 signal. This data suggested that native listeners had implicit understanding of the emotional connotation of these chord structures (Bakker & Martin, 2014). Another experiment found that subjects responded quicker to targets when the auditory and visual stimuli presented during the task had congruent affective content compared to incongruent content. This experiment noted a late positive potential (LPP), but not an N2 or N400 signal (Herring, Taylor, White, Crites, & Stephen, 2011).

Clinical Utility of Melody

The human mind uses adaptive schemas to make predictions about future events. As can be seen above, there are many theories about how this is done for melody. This is in large part due to the numerous components that make up melody, such as pitches, key signatures, and scales (Krumhansl, 2000). Each of these components guides understanding of the melody, and the overall musical piece. The music listener is often unaware the he is analyzing so much about the melody, likely because so much of this analysis happens incredibly early in the processing of the stimuli (Marmel, Perrin, & Tillman, 2011). Because of this, he just has a sense about how the musical piece feels, and makes him feel (Bharucha, 1996). Furthermore, experience is an important factor in a music listener's analytical process (Narmour, 1991). The bottom line is that each music listener compares information about a current musical piece to the rules of the style of the musical piece, known as veridical and schematic information, respectively (Bharucha & Todd, 1989). As the music listener hears more of a given musical piece, he is better able to predict the subsequent musical events within that given piece. Music listeners even appear to derive satisfaction from accurate predictions (Meyer, 1956). The listener enters the music listening experience primed with categorical knowledge, determines important parameters about the musical piece, identifies the melody, and then compares the subsequent variations of the melody to the original. The primary cognitive activities involved in the processing of melody include priming, biases, information collection, prediction generation, memory, and outcome analysis. Each of these skills is employed by the music listener to track a melodic line through a musical piece. These skills are required in most activities of daily living. The therapeutic application of melody would be to teach the skills needed to detect and organize musical information in order to make melodic predictions. Then draw clear parallels between this activity and other activities.

Summary

Rhythm and melody are the principal elements of music. Rhythm is the timing and momentum of a musical piece, while melody is the pleasant flow. Rhythm is the focus of pop music, which tries to gets the listener to move and dance. Melody is the focus of classical music, which tries to get the listener to attend and reflect. Each has value, both musically and therapeutically. For the purpose of MinMuList, each must be described and taught to provide skills that support executive functioning, open-mindedness, and social behaviors. The next chapter will describe the therapy theory and skills that will provide the link between the theoretical information presented thus far and MinMuList.

CHAPTER 7

GESTALT THERAPY THEORY AND MINDFULNESS

So far this manuscript has described music, music theory, music cognition, psychophysiological effects of music, and principal elements of music. In order to justify the creation and implementation MinMuList, a clear link between the information presented so far and therapy theory must be established. This is essential because it is the mindful approach to music listening that is reasoned to account for potential positive change in the workshop participant. Without such a link clearly established here, one could argue that most of the positive outcomes from such a workshop were due to other factors, such as the social engagement inherent in workshops. While social engagement will contribute to the positive outcomes expected from MinMuList participation, a clear and convincing link to theories of mind and change will support the claim that specific psychological mechanisms targeted by material in MinMuList are responsible for the preponderance of positive outcomes. This link will now be drawn through a brief introduction to Gestalt Therapy Theory and a brief literature review on mindfulness.

Gestalt Therapy Theory

Martin Buber's *I and Thou* (1923/1996) establishes the existential framework for Gestalt Therapy theory. Primarily that relating in an authentic, unbounded way is required if one is to achieve true awareness. Fritz Perls is recognized as one of the most important figures in developing and furthering Gestalt Therapy theory. He also emphasized authenticity and insisted that therapy be a place of honest introspection and reflection. He will be remembered for his unapologetic presence. While many of the ideas and concepts presented below are well established, the focus will be on *Gestalt*

Therapy: An Introduction to the Basic Concepts of Gestalt Therapy (Hostrup, 2010). This is done in order to provide a concise and elegant description such a broad and complicated field of knowledge that has theoretical roots stretching back for nigh a century. In addition, there are numerous Gestalt Therapy institutes around the world that serve to enrich the field through their unique perspectives. For further information about each point below, the reader is advised to obtain a copy of Hanne Hostrup's book.

Broad Strokes

The meta-theory of Gestalt Therapy is an existential phenomenological worldview. This emphasizes the individual's meaning-making process, choice, and responsibility. The psychological theory is phenomenological. This means the focus is on the patient's perception and experience of the here-and-now. Authentic dialog between the patient and the therapist is the primary vehicle to support change in the patient. Authentic dialog is achieved when the patient and therapist relate to one another in an I-Thou relationship, with both persons being equal. Change is achieved through insight and awareness. Insight is recognition of the structure of one's overarching worldview and phenomenology of one's moment-to-moment experience. Awareness is recognition of and in-the-moment experience of the dynamic relationship of one's worldview and phenomenology. This is a blend of cognition and emotion, fire and heat, so to speak. Therefore, a Gestalt therapist will tend to ask how questions, rather than why questions. For example, "How do you know that you are feeling sad?" rather than, "Why do you feel sad?" This is done to support greater insight into how the patient perceived and organizes information, and support his focus on the current emotional experience.

Awareness

To begin, the ultimate goal of Gestalt Therapy is increased awareness of what, how, and that one experiences. Awareness is a process of contact between the self and the field. The hope is that with awareness, one is able to meet one's needs, maintain health as one defines health, and live the life one wants and wishes to live. The self is the entirety of one's memories, needs, preferences, behaviors, identities, senses, physical person, etc. The field is everything else, including other people, the immediate environment, and the far reaches of time and space. Both the self and the field are dynamic and interrelated. This means that action in one or the other will change both the one and the other. Scientifically, this is much like Newton's Third Law of Motion, which is commonly known as: for every action there is an equal but opposite reaction. Socially, this is much like culture, which has a tremendous impact on one's attitudes and behaviors because it is a summation of the behaviors and environment within which one exists. Culture is bound to a time and a place, much like what is needed, healthy, and wanted by any one person. Furthermore, culture is a clear example of how the boundary between the self and the field can change, where one cannot differentiate himself from his culture despite being a unique person. With regards to temporal considerations, awareness helps a healthy person to recognize changes in the environment and adapt to these changes. The self has awareness of that which is most salient at the moment. What is most salient is determined by how one perceives and organizes information. The Gestalt Laws of Perception describe the predictable ways in which people tend to perceive information, as described above in Chapters 4 and 5. Awareness is an experiential and a metacognitive process; one is aware of current thoughts, emotions, and sensations, as well as the fact that he is an aware being.

Gestalt Figure Formation and Resolution Process

This stepwise process is carried out by the psychophysiological systems of the body and can therefore be thought of as a form of learning. That means that one's process is shaped by one's experiences, and new processes can be learned. The basic idea is that a person becomes aware of a stimulus and then comes to understand the stimulus in the context of the environment. The stimulus is called a figure, while the context is called the ground. The figure organizes the ground, while the ground gives meaning to the figure. A figure can be anything, such as a thought, an emotion, or a sensation, and that this process is repeated endlessly. Once one perceives and organizes information about the figure and the ground, he will then create and enact a plan. Then he must perceive, process, and consolidate information about his effect on the environment. His focus, behavior, and goal will shift in a predictable way. For example, when an altruist hears a shout, he will orient to the sound to figure out what is happening and what to do about it. When he realizes someone just shouted to catch her friend's attention, he then carries on with his day; if she shouted because she was hurt, he would approach her to see how he could help. Generally speaking, some figures are destroyed rather quickly, as in the shouting example explored above. Some figures remain within one's self for a longer period of time. For example, waiting for an important phone call may elicit anxiety that can last a few hours or days. Worry about the safety of a child can last a lifetime.

Steps of Gestalt Figure Formation and Resolution Process

The dynamic process of organizing figure and ground has been described in the Gestalt Figure Formation and Resolution process, which has the following steps: (a) undifferentiated field; (b) figure formation; (c) figure sharpening; (d) scanning; (e) planning; (f) execution; (g) assimilation; (h) undifferentiated field. The undifferentiated field is when there is no immediate need, want, sensation, etc. that is capturing the interest of the person. Figure formation is when one becomes aware of some need, want, sensation, etc. Figure sharpening is the process when which one becomes clearer about that which is arising. Scanning is the process by which one determines resources available to destroy the figure. Planning is the process of accounting for resources and developing a method to destroy the current figure. Execution is the process of carrying out the plan. Assimilation is the process of determining if the executed plan was effective or ineffective. Undifferentiated field then implies that one is no longer aware of any particular figure, either due to having destroyed the previous figure, or having lost focus on a figure. Now there will be a step-by-step example of the Gestalt figure formation and resolution process.

Stepwise Example of Gestalt Figure Formation and Resolution

As one sits in his chair daydreaming, he has an undifferentiated field. Suddenly, a fuzzy figure forms when he detects energy in his stomach. He sharpens this figure by comparing it to other times he felt this energy. He remembers he felt this energy this morning, just before breakfast, but not just after breakfast, so he may be hungry or thirsty. In this case, he is thirsty. He then scans himself and environment to see if there is water nearby to quench his thirst. There is not. However, the kitchen can meet this need.

He plans his trip to the kitchen for a glass of water, imagining each step more or less vividly. He then executes his plan by actually walking to the kitchen, then noticing and grabbing a glass, then noticing and opening the tap, then filling and drinking from the glass. He then closes the tap and replaces the glass on the counter. Assimilation takes place as he notices the energy in his stomach in gone. He determines the automatic sigh after he drank to mean his thirst has been quenched. He further determines that water is an adequate means by which to quench thirst, the tap has water, a glass transports water from the tap well, and this kitchen has both a glass and a tap. Satisfied, he then returns to the undifferentiated field of daydreaming.

Zones of Awareness

The theoretical construct of zones of awareness holds that each person has three domains of internal and external information to organize: (a) mind; (b) body; (c) environment. The mind is a remarkable zone because it is both the intermediary between the body and the environment, as well as a unique space unto itself. The automaticity of many behaviors, such as breathing and walking, may call into question the existence of the mind. However, given that automatic behaviors can be influenced and changed with the appropriate approach may suggest that the mind does indeed exist. Zones of awareness can help a person to organize information in order to determine the location and importance of each Gestalt figure. However, each person must learn how to relate to the zones in order to organize incoming information, determine the meaning of the information, and determine how to act upon this information. How one relates to each of his zones is essentially embedded in the Gestalt figure formation and resolution process. Again, each person will have characteristic ways of relating to each zone. Cultivation of awareness of zones is then limited by the same factors that limit learning. This includes genetic factors, prior experience, skills training, injury, chemical influences, etc. While the concept of Zones of Awareness is not universal in Gestalt Therapy Theory, it is useful in the context of this manuscript. Consider that in relation to music this manuscript has offered descriptions of: the mind in Chapter 4, "Psychology of Music Cognition;" the body in Chapter 5, "Engineering Model of Music Audition;" and the environment in Chapters 2, 3, and 6, "Justification," "Music as Such," and "The Principal Elements of Music."

Focus and Organization of Zones of Awareness as Related to Health or Illness

Health is balancing each zone. This means maintenance of a broad focus that can shift and narrow to process important information from each zone. For example, as one walks in a meadow, that one daydreams, feels relaxed, and observes the flora and fauna. As that same one walks down a dark alley, there is less focus on thoughts or feelings, and more focus on scanning the environment for signs of threat, such as looking and listening for movement. In both cases, the walker is relating to the zones in a flexible manner as called for by the context. Illness is distorted focus and organization of the zones. For example, one becomes fixated on one zone at the cost of others, such as hyperfocus on the body in image disorders. Perhaps one cannot separate the zones, so information from the mind zone is thought to be from the environment zone, such as auditory hallucinations in a psychotic disorder.

Forms of Contact

As stated, each person has a characteristic way of organizing information about the figure and ground at each stage of the Gestalt Figure Formation and Resolution process for each zone of awareness. In addition, each person has characteristic ways of relating to each figure and the ground at each step for each zone that can support or impede contact. The different ways one can relate to another person or object are called forms of contact. The forms of contact are: (a) confluence; (b) introjection; (c) projection; (d) retroflection; (e) deflection; (f) full contact. Confluence is when one cannot differentiate from other. Introjection is when one understands the self based on feedback from the environment. Projection is when one assigns meaning to other based on one's internal experience. Retroflection is when one holds in some type of energy. Full contact is when one recognizes the boundary between self and other and allows energy to flow freely between the two. These forms of contact are learned in step-wise, developmental fashion. Each serves adaptive behavior when used in the right place at the right time. For example, a mother must be confluent with her infant if she is to understand the meaning of the infant's cries. Another example: retroflection is at times useful as one is typically advised to withhold an aggressive reaction to a boss that assigns overtime at the last minute on a Friday. However, in the context of an intimate relationship in a private setting, full contact is the true goal where it implies open and honest emotional connection.

Contact as a Process of Health or Illness

When one is able to seamlessly go through the Gestalt Figure Formation and Resolution process, one is thought to be healthy. This means one intentionally enacts a form of contact with the focus of each stage, then moves on to the next stage, again intentionally enacting a form of contact. For example, becoming confluent with energy from the body during the figure sharpening stage, or retroflecting urges to act on the first impulse in order to plan. The automaticity of behaviors and Gestalt processes, such as perceptual laws and figure formations and resolution, are believed to be helpful to our ability to master our environment. It is then our ability to check-in with these processes and modify them as our environment changes that supports health and wellness. This fluid approach to perception, organization, and action takes practice and energy; it waxes and wanes. One must learn to support the self in order to maintain the ability to remain aware. Support of the self can come from within, or without. One may be able to reaffirm the self and find the confidence to complete a challenging task. At another time, one may seek reassurance from a loved one during a difficult time. The idea is that one is able to determine what one needs or wants and how to meet that need or want through use of each form of contact. When one is unable to select from all forms of contact at each stage, one may develop illness. For example, when one is scanning the environment for water when thirsty and one cannot deflect the urge to clean the dirty dishes, one will clean the dishes instead of quench one's thirst. This is a rather innocuous example, though the process is important to note as it will likely become characteristic in all times and all places. If one has posttraumatic stress disorder (PTSD), then triggering stimuli act as highly distracting figures that derail the figure formation and resolution process. Re-experiencing a trauma means that one is unable to experience the here and now; it means that one is aware of a memory, the threat associated with that memory, and the physical sensations paired with that memory, which can be in stark contrast to the actual level of safety offered by the current environment. Each diagnosis can be described in terms of an interruption in this normal process. Identification of an interruption as it occurs then becomes a figure that can be addressed and destroyed. This is the justification for therapy. Given that forms of contact are learned, each person can cultivate greater awareness in order to improve and maintain health.

Mindfulness

The emergence of mindfulness as a topic of clinical interest coincided with the third wave of Cognitive Behavioral Therapy (CBT) programs. Since the 1980s, it has been incorporated into a variety of treatment protocols in many different ways; at times as an after thought, at times as a primary component, such as with Dialectical Behavioral Therapy (DBT) and Acceptance and Commitment Therapy (ACT; Brown & Ryan, 2003). Furthermore, clinical studies have assessed the efficacy of mindfulness as a treatment for a variety different disorders in many different ways, including pre-post, waitlist controlled, and treatment-as-usual controlled studies. A recent meta-analysis noted over 2,300 published clinical trial studies that included a mindfulness-based treatment intervention. The final analysis examined 209 studies that included 12,145 subjects with diverse ages, genders, and clinical profiles. Overall, mindfulness based therapy (MBT) had small to moderate effects sizes when compared to psychoeducation, supportive therapy, relaxation, imagery, and art-therapy. However, MBT was found to be equally effective as traditional CBT (Khoury, Lecomte, Fortin, Masse, Therien, Bouchard, Chapleau, Paquin, & Hofmann, 2013). Overall, MBT is safe, effective, and has lasting positive effects. A closer look at mindfulness and its documented clinical effects is warranted.

Defined

Leading researchers met several times to author an operational definition of mindfulness (Bishop, Lau, Shapiro, Carlson, Anderson, Carmody, Segal, Abbey, Speca, Velting, & Devins, 2004). As an approach to experience, mindfulness was defined as a non-elaborative, non-judgmental, present-centered awareness where each figure of awareness is acknowledged and accepted as it is. Clinically, it was described as a form of mental training that supports distress tolerance and helps to mitigate pathological emotional and behavioral reactivity. It is simultaneously focused on the present and meta-cognitive. Rather than tangentially tracking figures that randomly emerge, one's maintains focus on a specific aspect of experience. The model suggested had two components labeled self-regulation of attention and an attitude of curiosity, openness, and acceptance. Discussion of each component will now take place.

Self-Regulation of Attention

This is the veridical, moment-to-moment component of mindfulness. One that is mindful has intentional attention. One remains mindfully focused by consistently choosing to focus on one aspect of experience. To remain mindful, one simply observes the inevitable emergence of thoughts, emotions, and sensations, and then returns attentions back to the original focus. Often, the breath is the anchor. In that instance, one would focus on one's breath. As thoughts about family, chores, work, etc. come up, or sirens down the street sound, one simple notes the presence of such objects, and then returns his focus to his breath. In music, the anchor could be the melody or the rhythm. In that case, one could choose to focus on the melody, tracking the lead instrument over time. As another instrument sounds, one could note its presence, then return to unfolding of the melody. The meta-cognition portion could come later, when one notices how the melody of one instrument relates to the melody of another instrument.

Rather than skipping along the surface of awareness, jumping from one figure to the next, intentional attention will lead to a deepening of awareness by allowing time to become intimate with experience. In other words, self-regulation of attention on the here-and-now leads to a sensation of being fully present by shifting from an about to a direct experience (Teasdale, Segal, & Williams, 1995). An observational approach allows one to switch among stimuli. Attention and switching are therefore improved through mindfulness; furthermore, they are specific and measurable. Given that a mindful practice means acknowledgement of a thought or sensation with return to a decided upon focus, another skill that is improved is inhibition of elaborative cognitive processes (Bishop et al, 2004). Elaborative processes are commonplace in a variety of common mental health disorders, such as rumination in depression, perseveration in PTSD, or distractibility in attention/hyperactive disorders.

Attitude of Curiosity, Openness, and Acceptance

This is the schematic, overarching worldview component of mindfulness. Overall, it means allowing one's self to be, without forcing a state of being. For example, the pressure or anxiety of wanting to relax will prevent relaxation. Curiosity means that one is to simply notice any thoughts, feelings, and sensations that arise. That they arise means they are relevant. Their relevance gives them license to be observed. Observation is simply noting that something has come along the stream of consciousness. Openness results when one simply observes because one allows one's mind to act simply as a receptacle of experience, or a riverbed that holds flowing water. Acceptance is a non-emotional, non-judgmental approach to experience where one remains experientially open to the reality of the present moment. This attitude extends to how one acts toward himself, which means he will be patient and understanding with himself as he learns mindfulness.

If one makes the conscious decision to employ a curious, open, and accepting attitude, then one is less likely to employ cognitive strategies from avoidance or elaboration. Deciding to take a non-elaborative approach to one's experience is an ongoing, active process (Bach, Gaudiano, Pankey, Herbert, & Hayes, 2006). This attitude will lead to an investigative approach to awareness that will foster insight, as it supports an orientation to intensive self-observation. For example, labeling is a common behavior where one is to note if an object in the stream of consciousness is a thought, feeling, or sensation. Labeling, like all mindfulness skills, supports the purpose of maintaining an attitude of curiosity, openness, and acceptance: to maintain meta-cognitive awareness of experience. The insight and awareness that would result from a mindful approach to experience supports distress tolerance, emotional awareness, psychological mindedness, self-awareness, and reality testing (Bishop et al, 2004).

Clinical Research on Mindfulness

Research demonstrated that mindfulness supported overall well-being and effectively treated myriad mental health concerns (Baer, 2003). A meta-analysis found that demographically diverse subjects benefitted from the structured group therapy protocol Mindfulness-Based Stress Reduction (MBSR). Subjects had mood, anxiety, and medical disorders, and came from both sexes, all age ranges, multiple ethnic groups, and multiple socio-economic status ranges (Grossman, Niemann, Schmidt, & Walach, 2004). Research on development of the Mindful Attention Awareness Scale (MAAS) demonstrated that persons with higher levels of mindful attention had higher levels of well-being, enhanced self-awareness, and lower levels of mood disturbance and stress (Brown & Ryan, 2003). Clinical research of the efficacy of mindfulness as a treatment of specific categories of mental illness will now take place.

Mood Disorders

Mindfulness-Based Cognitive Therapy (MBCT) was a significant component in relapse prevention for depression (Teasdale, Segal, & Williams, 1995; Segal, Williams, & Teasdale, 2012). Replication studies clarified that MBCT was most helpful for subjects that had three or more episodes of depression (Ma & Teasdale, 2004; Teasdale, Segal, Williams, Ridgeway, Soulsby, & Lau, 2000). Research shows that MBCT is a helpful adjunct to pharmacological treatment of bipolar disorder. One study found that subjects with bipolar disorder that were in remission and had a history of suicidal ideations had lower levels of anxious and depressive symptoms after completing the MBCT protocol (Williams, Alatiq, Crane, Barnhofer, Fennell, Duggan, Hepburn, & Goodwin, 2008). Further clarification found that, in conjunction to pharmacological treatment of patients with bipolar I and II, an eight-week MBCT program helped reduce inter-episodic depressive symptoms and suicidality. To a lesser extent, the MBCT program helped reduce manic and anxious symptoms (Miklowitz, Alatiq, Goodwin, Geddes, Fennell, Dimidjian, Hauser, & Williams, 2009).

Anxiety Disorders

Mindfulness has also been identified as effective at treating numerous anxiety disorders, most notably Generalized Anxiety Disorder (Evans, Ferrando, Findler, Stowell, Smart, & Haglin, 2008; Vøllestad, Sivertsen, & Nielsen, 2011). One study found that subjects had statistically significant improvement on all measures of anxiety used in the study (Lee, Ahn, Lee, Choi, Yook, & Suh, 2007). A longitudinal study found that subjects reported maintenance of gains three years after completion of an eight-week stress reduction program based on mindfulness meditation (Miller, Fletcher, Kabat-Zinn, 1995). Data was less promising for treatment of social anxiety disorder (Koszycki, Benger, Shlik, & Bradwejn, 2007; Lee, et al., 2007).

Substance Use Disorders

A plethora of research demonstrates the efficacy of mindfulness in the treatment of numerous substance use disorders, including those of alcohol, cannabis, and stimulants. Specifically, data suggested that a Mindfulness-Based Relaxation Program (MBRP) was effective in the treatment of addictive behavior (Witkiewitz, Marlatt, & Walker, 2005). Later research on MBRP clarified that homework compliance, group attendance, and participant satisfaction were associated with higher levels of acceptance and acting with awareness, as well as lower levels of substance use and cravings (Bowen, Chawla, Collins, Witkiewitz, Hsu, Grow, Clifasefi, Garner, Douglass, Larimer, & Marlatt, 2009). A later study determined that the subjective experience of craving was a significant moderator in substance use relapse and the reemergence of depressive symptoms. This study again found that MBRP reduced the level of cravings reported by subjects (Witkiewitz & Bowen, 2010). One study found that incarcerated subjects that completed treatment that focused on mindfulness meditation was associated with lower levels of substance use and better psychosocial outcomes when they were released to the community (Bowen, Witkiewitz, Dillworth, Chawla, Simpson, Ostafin, Larimer, Blume, Parks, & Marlatt, 2006). One limitation of the research presented here is that all of the subjects were stabilized in inpatient or intensive outpatient substance use programs within months prior to participation in the mindfulness-based treatment programs. That is to say, mindfulness may have a different affect for persons in the general population. To that point, one study of college students found a positive relationship between mindfulness and tobacco use, as well as mindfulness and frequent binge drinking. This means that subjects that more mindful were found to be more likely to use tobacco and binge drink (Leigh, Bowen, & Marlatt, 2005). Furthermore, one meta-analysis stated that while safe and associated with positive outcomes, conclusive data for mindfulness meditation as treatment of substance use disorders is lacking. The study noted significant limitations in methodological analysis and a lack of clear mechanisms of action (Zgierska, Rabago, Chawla, Kushner, Koehler, & Marlatt, 2009).

Psychotic Disorders

Mindfulness based therapy (MBT) has typically not been recommended as a treatment of psychotic disorders. However, recent data suggests that there may be certain instances when MBT may be appropriate and a helpful adjunct to pharmacological treatment (Chadwick, Taylor, & Abba, 2005). A meta-analysis noted that, in conjunction to pharmacological treatment, mindfulness was moderately effective at treating the negative symptoms of psychotic disorders (Khoury, Lecomte, Gaudiano, & Paquin, 2013). ACT utilizes mindfulness as a core principle and it had moderate success with severe, persistent mental illness (Bach et al, 2006). One study found that mindfulness training for subjects with active psychosis supported clinical functioning and mindfulness of distressing thoughts and images, but not of distressing voices (Chadwick, Hughes, Russell, Russell, & Dagnan, 2009). A later study using a similar approach found that subjects in an inpatient hospital that had not responded to traditional therapies were able to tolerate mindfulness-based treatment groups and could reflect on the experiences and relate them to their daily lives. However, pre- and post-session measures did not suggest any significant improvement in levels of stress or interference by positive symptoms of psychosis (Jacobsen, Morris, Johns, & Hodkinson, 2011).

Personality Disorders

Mindfulness is noted for its efficacy in treatment of parasuicidal behavior, a distinguishing characteristic of Borderline Personality Disorder (BPD; Linehan, 1993). For this reason, it has been incorporated into DBT, the preferred treatment for BPD (Baer, 2003; Lynch, Trost, Salsman, & Linehan, 2007). While a large body of evidence has amassed that demonstrated how well mindfulness reduced symptomatology associated with BPD, there is a striking lack of research on the effect mindfulness has on other personality disorders.

Other Mental Health Disorders

A systematic review of eight studies found promising evidence for the efficacy of mindfulness in the treatment of disordered eating (Wanden-Berghe, Sanz-Valero, & Wanden-Berghe, 2010). One study found that Mindfulness-Based Stress Reduction (MBSR) supported overall post-traumatic growth; it also supported spirituality and reduced symptoms of anger, anxiety, and depression. Generalizability is limited as the subjects were women recovering from breast cancer (Garland, Carlson, Cook, Landsell, & Speca, 2007). One theoretical review clearly outlined how mindfulness could be utilized in the treatment of trauma related disorders. Specifically, that the patient unlearn avoidance of triggering stimuli and learn to remain mindful when encountering triggers or re-experiencing the trauma (Follette, Palm, & Pearson, 2006). As a treatment for obsessive-compulsive disorders, mindfulness was found to work well as a complement to well-established CBT protocols when it was restricted to supporting a metacognitive level of awareness (Fairfax, 2008).

Select Neurological Studies

An fMRI study found that mindfulness, as well as music listening, supported major neuronal communication pathways in the brain, and preserved cognitive functioning in aging subjects (Gutman & Schindler, 2007). Another fMRI study found that mindfulness, specifically the labeling behavior, was associated greater prefrontal cortex activation and decreased amygdala activation during processing of emotion (Creswell, Way, Eisenberger, & Lieberman, 2007). One fMRI study examined subjects' neural patterns of activation in reaction to sadness provocation. Data showed that all subjects had activation of self-referential brain areas and subjective reports of sadness matched the time frame of this activation. However, compared to control subjects, subjects that had completed a mindfulness-training program had greater activation of somatosensory brain areas on the right side. Furthermore, greater somatosensory activation had a negative relationship with subjective reports of sadness. This suggests that maintenance of balance between abstract and visceral reactions to emotional states could be a cognitive mechanism of mindfulness (Farb, Anderson, Mayberg, Bean, McKeon, & Segal, 2010). Another fMRI study appears to support and clarify this idea. Data showed that mindfulness meditation led to a decreased activity in neural structures responsible for interoception, a pattern of activation that would suggest disidentification with the self (Ives-Deliperi, Solms, Meintjes, 2011). One article found that after an eight-week mindfulness training program subjects demonstrated increased electrical activity in the left anterior portion of their brains, an area that had been associated with positive mood. Furthermore, compared to the control group, subjects that completed the training program had increased immune response as demonstrated by higher levels of antibody titers following flu vaccination (Davidson, Kabat-Zinn, Schumacher, Rosenkranz, Muller, Santorelli, Saki, Urbanowski, Harrington, Bonus, & Sheridan, 2003).

Summary

Gestalt Therapy theory and mindfulness pair well together as both have at their cores a focus on phenomenology and meta-cognition. As they were presented above, there is a clear basis for how mindful music listening practices will lead to true psychological change. To review, Gestalt Therapy theory holds that mental illness can be thought of as an affliction due to lack of awareness and insight caused by untimely and incongruent behaviors that prevent choiceful contact with the other. Those behaviors are characteristic interruptions in contact with figures and at specific steps from the figure formation and resolution process, as well as unbalanced organization and focus on the three zones of awareness. For example, someone with depression with have difficulty sharpening a figure; someone with anxiety will become distracted during the scanning phase and focus on another figure before the first is destroyed. In session, a Gestalt therapist relates to the patient in an egalitarian way while assessing how the patient relates to his here-and-now. While respecting existential considerations of choice and responsibility, the therapist then raises the patient's awareness around his characteristic interruption, allowing natural self-regulation to occur and health to result.

Mindfulness is a peaceful and accepting approach to life and the self. The first component is self-regulation of attention. This is where one intentionally focuses on one specific aspect of experience, and when distracted by other figures, he gently refocuses attention on that specific aspect. The second component is maintenance of an attitude of curiosity, openness, and acceptance. This is where one chooses to allow himself to be as he is, and he chooses to allow each aspect of experience to be as it is.

Woven together, mindfulness is a phenomenological and meta-cognitive approach that can be explained with Gestalt Therapy theory. When one employs a mindful approach, he becomes increasingly aware of from where he collects information, how he organizes information, makes meaning from that information, feels about that information, and acts upon that information. A mindful approach tends to be a calm approach that will support cognitive flexibility during each of these steps through the various psychophysiological systems explored above. This in turn will allow for flexible collection and processing of information from each zone of contact at each step of processing in order to ensure more comprehensive understanding of figures and their contexts as they emerge. Therefore, mindfulness supports choiceful contact that will allow for deeper awareness and greater insight through improved meaning-making ability that will result in healthier and more responsible behavior. The next chapter will weave together all of the information presented so far in this manuscript in order to explain how a mindful music listening workshop will achieve positive psychophysiological change.

CHAPTER 8

CONCLUSION

Music is a universal phenomenon and it has been a topic of rigorous research and debate since the 4^{th} century BCE. The recent heated debate about the origins of music hope to determine if cognitive circuits responsible for music developed in parallel or separate from the cognitive circuits responsible for language. Another hotly debated question is if music serves an evolutionary purpose, or if it is auditory cheesecake (Levotin & Tirovolas, 2009). Regardless of the evolutionary processes or benefits, it is clear that music elicits psychophysiological effects that can be effectively utilized in a therapeutic manner. This manuscript offers research from psychological, sociological, ethnological, musicological, nursing, and medical perspectives in order to provide a comprehensive examination of music, musical concepts, and the psychophysiological effects of music. In order to translate this information into an efficient and effective evidenced-based therapy program, a mindful music listening workshop is proposed. The mindful music listening workshop will henceforth be referred to as MinMuList (said "min-mew-list"). This manuscript walks a fine line by incorporating information from a variety of academic fields, yet remains bound to a psychological perspective. Specifically, it is important to recognize that this manuscript and MinMuList are not Music Therapy. Music therapy is a well-established field of research and intervention. In order to do Music Therapy, one must be registered as a Music Therapist – Board Certified (MT-BC). The goal of this manuscript is to support the treatment offered in any integrated setting to a variety of patients through the dissemination of the scientific knowledge discussed and utilization of the interventions offered. To that end, any person can present this information and run MinMuList in order to support their patients' mindfulness and overall well-being. In fact, readers are encouraged to consider the information and skills offered here for themselves; perhaps even utilize the information to support the well-being of colleagues. Thus, *Music Listening as Therapy* and MinMuList are for everyone.

Broadly

Music exerts an effect on people in as little as one second (Bigand, Filipic, & Lalitte, 2005). When appropriately selected, music has therapeutic effects. Patients rated songs in major keys with a slow tempo as supportive (Jensen, 2001). Music also enhances communication and underscores information in multimodal contexts (Alten, 2005; Baumgartner, Lutz, Schmidt, & Jäncke, 2006; Carpentier & Potter, 2007; Baumgartner, Esslen, & Jäncke, 2005; Potter, Lang, & Bolls, 2008). This could be due to the overlap in neural mechanisms that process music and language (Krumhansl, 2000; Koelsch, Gunter, Wittfoth, & Sammler, 2005). Although categorical perception suggested that musical phrases are processed similarly to linguistic phrases (Howard, Rosen, & Broad, 1992; Siegel & Siegel, 1977; Zatorre & Halpern, 1979), it appears that semantic and melodic congruency are processed in separate neural networks (Besson, Faita, Peretz, Bonnel, & Requin, 1998). Still, emotional reactivity to the entrance of a voice in a song is strong. There is also strong emotional reactivity at the start of a new section, the pre-chorus, the chorus, and during a change in tonality (Grewe, Nagel, Kopiez, & Altenmüller, 2007; Tsai, Chen & Tsai, 2014).

Neurophysiological research can shed light on some of the emotional reactivity to music. Limbic and paralimbic structures were important structures for music listening, as demonstrated in fMRI studies (Baumgartner, Lutz, Schmidt, & Jäncke, 2006; Koelsch, Skouras, Fritz, Herrera, Bonhage, Küssner, & Jacobs, 2013). A series of studies found that subjects with resected limbic systems had less emotional reactivity to music and they could not identify the emotional value of music (Gosselin, Peretz, Noulhiane, Hasboun, Beckett, Baulac, & Samson, 2005; Gosselin, Peretz, Johnsen, Adolphs, 2007; Gosselin, Peretz, Hasboun, Baulac, & Samson, 2011). fMRI data showed the left lateral orbitofrontal cortex and the right superficial amygdala activates while tension built in a song (Lehne, Rohrmeier, & Koelsch, 2013). Additional fMRI research found that positive musical emotional content elicited left temporal activity, while negative musical emotional content elicited bilateral activation with strong right fronto-temporal cortex (Altenmüller, Schürmann, Lim, & Parlitz, 2002). A PET scan study found concurrent activation of brain regions related to reward/motivation, emotion, and arousal while listeners experienced the thrills and chills so common during pleasurable passages of music (Blood & Zatorre, 2001). One imaging study found that music-evoked emotions were processed in every limbic and paralimbic structure involved in the initiation, generation, detection, maintenance, regulation, and termination of emotions (Koelsch, 2010). An animal model study found evidenced that suggested classical music lead to higher levels of dopamine synthesis (Sutoo & Akiyama, 2004).

In addition to mood regulation, music can help with epilepsy, Parkinson's Disease, senile dementia, and attention-deficit/hyperactivity disorder (ADHD), and severe mental disorders like schizophrenia (Gutman & Schindler, 2007; Abikoff, Courtney, Szeibel, & Koplewicz, 1996; Castro, Tillman, Luauté, Corneyllie, Dailler, André-Obadia, & Perrin, 2015; Gold, 2005, 2009). One article found correlations between mental illness type and musical preference (Iakovides, 2004). Despite knowing this, there remains a gap in understanding the mechanisms by which music exerted psychophysiological effects on listeners (for comprehensive reviews, see Sloboda, 2000; Krumhansl, 2000; and Kreutz, Murcia, & Bongard, 2012; Koelsch, 2013).

Music Performance

A literature review of music performance's effects was included in recognition that music only exists because it is performed, as a way to encourage readers to go play their own music, and as a nod to Music Therapy. Research found there are five primary skills associated with musical performance: (a) perform rehearsed music; (b) sight-read; (c) play from memory; (d) play by ear; (e) improvise (McPhersen, 1995; Nuki 1984). These skills were supported by amount and diversity of practice (Grunow & Gordon, 1989; Kohut, 1985; Pratt, Henson, & Cargill, 1990). Listening skills were also found to be important in the development of performance skills (Priest, 1993).

The benefits of music performance are many, and include improvement in the areas of academics, organization, planning, execution, memory, and communication. Music students have historically achieved higher marks in classes and on standardized academic performance tests (Cox, 2001; Holmes, 1997; Hodges & O'Connel, 2005). Mental organization was influenced by the architectonics of Western music, possibly because the salience of the structural elements was emphasized by the rhythm (Clarke, 1985). Recursive elements of well-organized songs affected performance, where performers executed a song as intended (Krumhansl & Kessler, 1982; Lerdahl & Jackendoff, 1983), and were able to improvise on a song while maintaining the overarching structure (Todd, 1985; Schmuckler, 1990). Notably, research found that the structure will influence the types of the errors made (Drake & Palmer, 2000; Palmer & van de Sande, 1995; Moore, 1994; Moore, 1994; Drake, Dowling, & Palmer, 1991). For example, spontaneous errors tend to be made within phrases, but not across phrase boundaries (Garcia-Albea, del Viso, & Igoa, 1989). Composer recognized this, as well as the variability of minute details between phrase boundaries, and so research noted that important segments had longer final phrases (Todd, 1992; Palmer, 1989). Variability was also reduced when composers wrote accent notes that aligned with the meter; those notes were then played louder, longer, and smoother, which helped the listener track the meter (Sloboda, 1983). Song structure influenced memory, where research found that performers tended to accurately recall a song they just heard up to a phrase boundary (Garcia-Albea et al., 1989). Song structure also assisted in communication between the performer and the listener (Clark, 1987; Nakamura, 1987; Palmer, 1989). Slight deviations helped with communication, however, as the lead instrument tended to enter just before the other instruments and tempo was slowed as phrase boundaries (Palmer, 1996). This plays on the perceptual phenomenon that temporally offset tones are perceived as separate wholes (Bregman & Pinker, 1978). Other musical elements will vary will emotional expression as well (Askenfelt, 1986). Happiness and anger emotion was portrayed through faster tempo and more dynamic range; anger also featured abrupt tone onsets. Meanwhile, sadness was portrayed with slower tempo and narrower dynamic range with slower tone onset (Gabrielsson, 1995, 1999; Gabreilsson & Juslin, 1996). Indeed, musicians and non-musicians alike were found to accurately identify the emotional content of music (Geringer & Madsen, 1987; Johnson, 1996; Palmer, 1989; Sloboda 1985). Of course, it is familiarity with a score as-written that gives a performer the awareness to deviate from the in order to communicate the message he intends (Drake, 1993). Deviations must be used carefully, however, as research found that the more one was used, the more difficult it was to detect (Repp, 1992). Expressive cues are communicative mechanisms in both major theoretical models listeners use to predict music (Palmer, 1996). Narmour's (1996) melodic expectancy model predicted the next likely event give the musical context. Lerdahl's (1996) model predicted tonal tension and relaxation based on harmonic relationships across large sections of the song. Evidence was found for both (Krumhansl, 1995, 1996).

Music performance is the gold standard for motor and timekeeping models. Indeed, "seminal theories of motor control (Bernstein, 1967; Lashley, 1951) often use music performance as the ultimate example of human motor skill" (Palmer 1997; p. 117). This is based on the fact that music performers execute preplanned and precisely timed movement sequences without kinesthetic feedback (Keele, 1969). While rhythm makes the noise music (Verberg & Hambuch, 1984), it is unclear if movement creates rhythm and timing or if rhythm and timing create movement (Clarke, 1997). Three classes of theories explore this timing dilemma. Timekeeper models hold that an internal clock generates expectations for future musical events (Schaffer, 1981). This is supported by data that shows reproduction is most accurate when musical rhythms have integer intervals, especially 1:1 or 2:1 (Essens, 1986; Essens & Povell, 1985). Additionally, familiarity with a piece will generalize to the overall structure, so sections will be played at different tempos so that the entire length of a musical piece will be the same from playing to playing (Clynes & Walker, 1986). Motor program models hold that the motor plan is generated independent of external cues (Keele & Summers, 1976). Flexible schemas were proposed to account for differences between performances (Rosenbaum, Weber, Hazelett, & Hindorff, 1986). Overall, however, this model has limited data to support because it is difficult to test (Clarke, 1982). Kinematic models hold that rhythm generates movement (Shove & Repp, 1995). Mathematical models of rhythm are used to simulate performance, which have created a sense of movement in the listener (Kronman & Sunberg, 1987). While parsimonious, the graphic output of these models does not match actual changes of tempo during performance (Clarke, 1985), not does it appear to have construct validity (Desain & Honing, 1994).

A difficult activity to study because of the plethora of unique interpretations of each piece (Cone, 1968; Levy, 1965; Meyer, 1973), music performance could be examined in many ways. Focus may be on deviations within the piece itself, rather than deviations between the performance and the score (Desain & Honing, 1991). Perhaps the focus could be examination of differentiation and grouping rules (Sundberg, Fryberg, & Fryden, 1991), or maybe consistency of structure within composers' catalogs (Clynes, 1986). Focus could also be on the meaning making process of interpretation that links structure, emotion, and physical movement (Meyer, 1956). Whatever mechanism is central in a study on music performance, one can be sure that meaning is indeed communicated though expressive techniques and the physical movement of playing (Davidson, 1993, 1994, 2001).

Music as Such

Music is movement. A noise generator vibrates, sending sound waves out in all directions. Sound waves can be plotted on a graph over time to indicate certain objective properties, such as frequency and volume. When the wave is periodic, it is a tone. Most of the time noise generators are imperfect so tones have harmonics that are mathematically related to the intended tone. Harmonics of tones means a few things, such as that tones that have integer relationships sound the same, just higher or lower. Harmonics also mean that some tones will sound better together (Wright, 2014).

Musical instruments are predictable and reliable noise generators. Predictable in the sense that one could guess what an instrument will sound like based on the method by which the instrument generates sound. Reliable in the sense that the same tone will result each time if one plays the instrument the same way each time. A listener can tell the difference between two instruments because the method by which it generates noise. In fact, instruments tend to be grouped based on their method of noise generation. Western classical music instrumentation is usually divided into strings, woodwinds, brass, percussion, and keyboard. Strings include violins and bass. Woodwinds include flute and saxophone. Brasses include trumpet and tuba. Percussion includes xylophones and timpani. Keyboards include piano and organ. There are many more instruments for each category. Additionally, there are many more instrument classification systems, which are typically derived from theory or culture (Wright, 2014).

As a sound wave propagates out, it bumps into whatever physical object is in its path. If the object is a human ear, the energy of the sound wave is transduced into a chemical/electrical signal that is processed by the brain. Briefly, the processing pathway from sound wave to detection is: tympanic membrane, ossicles, oval window of the fluid filled cochlea, hair cells of the organ of corti, auditory/cochlear nerve, cochlear nucleus, inferior colliculus, medial geniculate nucleus, limbic system, and primary auditory cortex. The auditory system preserves the kinesthetic form of sound energy until the hair cells send information along the auditory/cochlear nerve (Gazzaniga, Ivry, and Mangun, 2009).

Psychoacoustics is the psychology of sound audition. It is the combination of the physics and physical detection of sound with the meaning making and emotional processes. Fourier analysis, the process of understanding a whole by breaking it down to and then understanding its constituent parts, has always guided the theory and research of psychoacoustics. Technology has allowed this field to test increasingly complex ideas, such as how rules and expectations shape music perception (Iakovides, Iliadou, Bizeli, Kaprinis, Fountoulakis, & Kaprinis, 2004).

Musical rules and expectations vary from culture to culture. However, if one is to fully appreciate music, then one must know the rules of the music to which one listens (Meyer, 1956). One can listen to music and determine musical rules, as well as read about the musical rules. A smattering of some of the rules of Western classical music will now take place.

To begin with, each note has a characteristic frequency called a pitch. When the frequency of a note is multiplied or divided by an integer, the result is a note that is subjectively similar to the original note, but it sounds higher or lower. Notes that are related in this way are called an octave. There are twelve discrete notes each octave, separated from each other by a half-step. Notation is based on a seven note system that includes the whole notes A through G. There are five half steps. The half-steps are called flat, represented by a b, or sharp, represented by a #. For example, D-flat is the same as C-sharp, represented as Db or C#, respectively. The twelve notes, with sharps, are: C, C#, D, D#, E, F, F#, G, G#, A, A#, B. The twelve notes, with flats, are: C, Db, D, Eb, E, F, Gb, G, Ab, A, Bb, B. Each musical piece is typically written in a key, where the key refers to the primary note which acts as home. Further discussion of note selection will take place below, in the discussion about scales.

Furthermore, music can be described as having six core elements, specifically rhythm, melody, harmony, timbre, dynamics, and form (Schneck & Berger, 2006). Rhythm is the recurring pattern of sound events that alternate with silence. It is the underlying driving force of music. It can be found in most daily activities, such as breathing or walking. Syncopation is when an emphasized musical event falls between the emphasized rhythmic event. Melody is the tune of a song that gets caught in the listeners' head. It is the subjectively pleasing pattern of mathematically related tones over time. Harmony is when two melodic lines fit well together. Timbre is the color, quality, or texture of the sound. This is dependent upon the noise generator, the media through which the sound travels, and the environment in which the sound is generated. It is what allows one to differentiate among a voice, a guitar, and a trumpet. Dynamics is volume. Form is the overall Gestalt of a musical piece. It is an emergent property, as it is a sense of how the musical elements change and how the structure of the piece takes shape as the piece unfolds. The elements of music are primarily important in ambient music settings. Fast rhythm, melodic repetition, and loud dynamics will support rigorous activity levels, while slow rhythm, long-term periodicity, and low dynamics will support relaxation.

The rules of Western classical music are rather strict. One such rule, diatonic function, refers to the establishment of a hierarchy of tones and chords based on the key signature. The key note is the tonic. For convenience, the Roman numeral I refers to the tonic. Each other note in the scale, and chord based on that note, has its own Roman numeral. The Roman numerals and their names are: I, tonic; II, supertonic; III, mediant; IV, subdominant; V, dominant; VI, submediant; and VII leading tone. The names are related to the subjective tension the listener feels as he hears a note or chord and waits for release by then hearing the tonic. Melodic contour describes the typical flow of notes. That is, successively sounded notes will follow a step-wise progression up or down a scale, and when there is a jump of multiple notes the flow of notes will reverse. For example, the well-known pastoral melody flows I-II-III-V-III-II-I-II-III-V-III-II (IV is typically not played), while this melody jumps I-V-III-I-VII-V-III-I. Chord progressions are highly probabilistic, and therefore predictable, in Western classical music as well. Meyer (1956) reprinted a clear table of usual root progressions:

- I is followed by IV or V, sometimes by VI, less often II or III
- II is followed by V, sometimes VI, less often I, III, IV
- III is followed by VI, sometimes IV, less often II or V
- IV is followed by V, sometimes I or II, less often III or II
- V is followed by I, sometimes VI or IV, less often III or II

At times, a chord is inverted, where the bass of the chord is not the tonic, but another note in the scale. This is an expressive technique, where the chord fits in the progression, but seems off in some way. Inversions can occur at other architectonic levels of music, such as intervals or melodies. One inversion is shifting from a major key to a minor key. This ides brings up the Circle of Fifths.

The Circle of Fifths is a geometric representation of the intimate relationship of a major scale and its relative minor scale, the natural minor scale (there are multiple minor scales, such as a harmonic minor). The two scales include the exact same notes, but they start on different keys. The major scale starts on the tonic, and the relative minor scale starts on the submediant. The visual representation of the Circle of Fifths starts by placing C at the top of a circle. Then, proceeding clockwise by a fifth of the diatonic scale, one next places a G, then D, and so on. From the top, the order of roots around the circle is: C, G, D, A, E, B, F#/Gb, Db, Ab, Eb, Bb, and F, then it returns to C. Each scale has the same number of sharps as it is steps away from C. Counterclockwise, each scale is a fourth apart; the number of steps from C is the number of flats.

Western classical music has many types of musical forms that have standard instrumentation and sections. Common forms include song, sonata, fugue, suite, concerto, symphony, tone poem, and opera. A song will have one or more instruments and have an introduction, verse, chorus, bridge, and conclusion. A sonata has one or two instruments that play three parts that explore a tonal center. A fugue is like a sonata, except a melodic theme is featured throughout the piece. A suite is a collection of short pieces played together; they are typically dances. A concerto is a solo instrument that is accompanied by an orchestra, where an orchestra has multiples of many instruments from each instrument class. A symphony features a full orchestra and typically has four movements, with the first being a sonata to establish the theme. A tone poem is a one-movement symphony, so named to elicit a sense of fluidity more commonly associated with a poem or a painting. An opera is a symphony integrated into a theatrical production, where lyrics pair with the music and the play. There are many other types of musical forms, and the specifics about each form change with each era of classical music.

Psychology of Music Cognition

Music was originally studied from a mathematical perspective by the Aristotlian philosopher Arixitoneus. However, this approach ignored the experience of music listener (Griffiths, 2004; Levitin, 1999). In more modern time, the psychological processing of music has been investigated from a variety of perspectives, including Gestalt psychology, psychoacoustics, psychophysics, information processing, cognitive psychology, and neuroscience. Humanities fields such as philosophy, sociology, musicology, and ethnomusicology also have investigated the psychology of music processes (Krumhansl, 2000). Leonard B. Meyer was a well-known composer and musicologist. He wrote extensively on the emotional and meaning making processes involved in music listening. *Emotion and Meaning in Music* (1956) was his most famous work, and this tremendous book is a cornerstone of this manuscript and the mindful music listening workshop. Discussion of a smattering of perspectives on psychological processes of music and *Emotion and Meaning in Music* will now take place.

Biomusicology explores the cognitive origins and original purpose of music (Wallin, 1991). The three theoretical branches are: (a) Evolutionary Musicology; (b) Neuromusicology; (c) Comparative Musicology. Evolutionary Musicology focuses on the evolution of music in animals. Neuromusicology focuses on the organization of brain structures as they relate to the production and detection of music. Comparative Musicology focuses on cultural aspects of music, such as general practices, rituals, and aesthetics. The development of this field reflects a blend of modern and longer standing fields of study (Brown, Merker, & Wallin, 2000). Some concerns surround this field of study, as some discussions will lack a certain amount of scientific rigor (Fitch, 2006).

Still useful for understanding the origins of the psychological processes of music, discussion will now focus on the branches of Evolutionary Musicology and Neuromusicology.

The opinion on the evolutionary value of music can be described as two polar perspectives: (a) music serves only hedonistic goals as it simply plays on psychological processes; (b) music supported human evolution through the development of cognitive abilities (Levitin & Tirovolas, 2009). In depth analysis of this long-standing debate can be found in other manuscripts (e.g., Dowling and Harwood, 1986; Krumhansl, 1991, 2000a; and Sloboda, 1985). A brief discussion of this polarity will now follow.

Infamously, the cognitive psychologist Steven Pinker declared at the Society of Music Perception and Cognition that that music cognition is "not worth studying [because…music] is auditory cheesecake." He claimed that music, and the emotional and physiological effects of music, were just byproducts of brain functions. Like all aesthetic arts, music seems to provide a pleasurable experience without providing any fitness gains (Pinker, 1997). Indeed later critics of work from the field of Evolutionary Psychology appear to be in agreement with Dr. Pinker, as music's place in adaption does not seem to be proven by this research (Craton, 2008).

On the other hand, Michael Gazzaniga, a founder and leader of cognitive psychology, argued that music affords an evolutionary advantage. The reasoning was that the imaginative processes inherent in the arts also allow people to consider outcomes of various situations without assuming the risks involved in enacting numerous responses. This shared form of mental exercise for imagination and executive functions therefore supported human development (Gazzaniga, 2008). Neuroimaging research demonstrated that music listening recruited neural areas responsible for spoken and signed language, specifically Brodmann Area 47, the pars orbitalis region of the left inferior frontal cortex, and its right hemisphere homologue. Music cognition may indeed enhance the function of these neural structures responsible for tracking evolution of fine-structured stimuli over time (Levitin & Menon, 2003). Later fMRI research found that music perception and cognition enhanced functional connectivity among distributed brain regions implicated in reward, autonomic, and cognitive processing (Menon & Levitin, 2005).

Leonard B. Meyer said little of the evolutionary origins of music. Furthermore, he held that assumption of one view to explain music is “methodologically suspect and intellectually uncongenial” (Meyer, 1983, p. 517). This is obvious when one considers that *Emotion and Meaning in Music* (Meyer, 1956) incorporated philosophical, musicological, and psychological views of the history, emotion, cognitive processes, aesthetics, and stylistic rules of diverse types of music. Specifically, the book examined aesthetic music, and avoided discussion of pop music. The distinction between the two was explicitly stated. Pop music uses electronic manipulation to modify vocal and instrumental sounds, repetition to emphasize rhythm, and lyrics to emphasize emotion. Additionally, the overall structure makes it fairly easy to perform from memory and allows for improvisation. Aesthetic music uses acoustic instrumentation, scores sans singers, and emphasis on melody and harmony to focus the attention of the listener on the music itself. The exactness of compositions affords performers a relatively limited amount of interpretative freedom; however, skill and familiarity provide more room for individuality. In essence, pop music is about rhythm, lyrics, and emotion, while aesthetic music is about melody, structure, and mentation.

Emotion and Meaning in Music (Meyer, 1956) holds an absolutist perspective of music. The absolutist perspective views music as meaningful only whence referred unto itself. The referentialist perspective views music as a pointer to extramusical concepts. That is, music does not refer to extramusical concepts; however, lyrics do refer to extramusical concepts, which can make music appear to be referential. Support for the absolutist perspective is demonstrated is at least two ways. The first is the recognition that there is a lack of agreement on the meaning of a musical technique or structure across cultures. This even happens on multiple levels, such as on the meaning and structural levels. For example, a particular key signature can mean two things to two styles, and that particular key signature does not exist and therefore has no meaning in a third style. The second demonstration of proof of the absolutist perspective comes from psychological theory and research. The brain is lateralized; among many other divisions of function, the left hemisphere is primarily verbal and the right hemisphere is primarily spatial (Cook, 2002). This leads to a clear distinction in where and how referential and absolutist stimuli are processed. In sum, lyrics are processed in language circuits and give explicit directions for what to feel, while music is processed in spatial circuits and supplies simple fodder for feeling (Wright, 2014; Austerlitz, 1983; Durbin, 1971; Krumhansl, 2000; Lerdahl & Jackendoff, 1983; Meyer, 1973; Rosner & Meyer, 1986; Sloboda, 1985, 2005Gardener, Silverman, Denes, Semenza, & Rosenstiel, 1977; Besson, Fai'ta, Peretz, Bonnel, & Requin,1998; Marin & Perry, 1999; Krumhansl, 2000; Ohnishi, Matsuda, Asada, Aruga, Hirakata, Nishikawa, Katoh, & Imabayashi, 2001; Yasui, Kaga, & Sakai, 2008; Levitin & Tirovolas, 2009).

Subjective versus objective evidence was another dichotomy explored by Meyer (1956). Subjective evidence is unreliable because people have difficulty verbalizing affective responses to music (Herz, 1998), as revealed by research that found regular incongruences between mood reports and physiological data (Dainow, 1977; Ellis & Brighouse, 1952; Iwanaga, Kobayashi, & Kawasaki, 2005). Additionally, affective response to music is unique because music has no extramusical meaning, whereas emotions refer to external persons, concepts, and objects (Raffman, 1990; Rice 1987; Zatorre & Halpern, 2005). Objective evidence must also be handled with caution, as observable behavior can be misinterpreted (Iwanaga, 1995a, 1995b). Furthermore, when in public, people tend to employ a cognitive-behavioral schemata that respond more to the situation than internal experience. That is, one's behavior tends to reflect the context, not his emotion. While Meyer did understand that these schemata were learned and implicitly and explicitly activated, rudimentary research techniques limited information available to identify psychophysiological mechanisms of music cognition (1956). Recent research has been considered in the Engineering Model of Music Audition.

Emotion and Meaning in Music (Meyer, 1956) conceptualized emotion from the Conflict Theory of Emotion perspective (Dewey, 1894). This process has three phases: (a) an instinct or tendency is aroused, creating nervous energy; (b) nervous energy is blocked, creating thought or behavior; (c) thought or behavior is blocked, converting nervous energy into affect or emotion. Internal or external ambiguous states can create nervous energy. One inherently wishes to resolve nervous energy and he will therefore enact learned behaviors to do so. The more nervous energy, the more automatic the enacted learned behavior (Angier, 1927). Designative behavior is an automatic response to cope with nervous energy. More commonly called communication, designative behavior is an attempt to elicit empathy in another person through employment of socio-cultural normative means of sharing an affective state. The more a designated behavior is rehearsed, the more coded as a schema it becomes. Hopefully, and in the case of an aware person, the automatic behavior will adequately and safely address the source of the nervous energy (Hostrup, 2010).

Meyer further clarified the difference between affect and emotion in a musical context for the purposes of the manuscript. Affect is diffuse and undifferentiated nervous energy with no clear source, target, or understanding of the cause of the nervous energy. Emotion was affect in context, that is, with a clear source and target, as well as understanding of the event and the underlying beliefs that left to the affective response. Since music does not point to extramusical objects and it is only meaningful within itself, the affective response to music is strictly due to the music itself. Music avoids creating unpleasant emotional states in the music listener, such as hopelessness that affect will be left unresolved, because it pleasantly addresses the affect it creates (Hebb, 1949; Meyer 1956). Therefore, musical emotions do not exist; only musical emotional experiences exist.

The applied theoretical emotional basis for *Emotional and Meaning in Music* (Meyer, 1956) was essentially that music was the cause, block, and resolution of nervous energy. This is unique because in most scenarios in life the cause, block, and resolution are different. For example, the cause is a rude comment, the block is a personal standard of behavior, and the resolution is venting to a friend in a safe context. In daily life or when listening to music, the instincts and tendencies aroused were learned. Instincts and tendencies have structural and temporal plans with assumed results. The structure, timing, and results of plans create expectations. When the results of each step fail to arrive at the right place or time, the instinctual nervous energy already elicited is blocked and compounded. Composers and performers play on listeners' musical expectations to elicit affective responses.

Expectations are informed by cultural norms, aesthetic preferences, rules, and behaviors. Each of these is more or less salient given the composer's style, the structure of the specific musical piece, and context of the music listening experience (Bigand, & Pineau, 1997; Schmuckler & Boltz, 1994). The listener tracks how the musical piece follows, bend, or breaks the rules, and he experiences tension as he waits for each outcome (Steinbeis, Koelsch, & Sloboda, 2006). The tension is the result of the listener becoming aware of different types of outcomes: (a) the expected; (b) the unexpected; (c) the surprising. Once an outcome arrives, the listener releases the tension built up this round and considers how the build up and outcome fit together (Koelsch, Kilches, Steinbeis, & Schelinski, 2008). The more covert the relationship between antecedent and outcome, the more the music listeners cognitively processes the relationship (Koelsch, Fritz, & Schlaug, 2008). Ultimately, musical events: (a) meet expectations with little affective response; (b) are intellectualized with little affective response; (c) frustrate expectations with a strong affective response.

Musical meaning comes from the music itself. It is the tracking of adherence to and deviation from expectations in regards to the unfolding of the formation and interplay of more or less acceptable relationships of notes and chords. The context of the triadic relationship is essential to the uniqueness of the meaning making process and requires:

(a) the stimulus; (b) that to which the stimulus points; (c) the observer (Mead & Mind, 1934). However, there is an argument for objective musical meaning. Hypothetical meaning arises during expectation and evident meaning comes from understanding the relationship between antecedent and consequent. Evident meaning then creates context for hypothetical meaning, which is especially important in music listening. However, once a musical piece becomes timeless in memory, with all realized and frustrated hypothetical meanings understood as evident meanings, then the determinate meaning of the musical piece, the objective meaning, can be obtained. Meyer (1956) held that this process means considering the affective experience throughout the piece as one feels tension build and release in the process of expectation generation, frustration, and satisfaction. It is only through focused and skillful self-reflection that one can understand the relationships among the antecedents with the potential and the actual consequents.

The meaning making process occurs in the context of the linguistic-primed cognitive systems of human psychology, now known as the Cognitive Primary Effect (Nummenmaa, Hyönä, & Calvo, 2010). Furthermore, context activates heuristics and expectations (Lai, Hagoort, & Casasanto, 2012). In the case of music, style is the context, which Meyer framed as an understood set of rules that governs consequents. Composers and performers of music have long understood these facts, as evidenced by the variety of their use of techniques. Repetition leads to more accurate predictions of sound terms because the structure is clearer. This will usually result in the listener feeling a sense of security. Ambiguity is when forms and structures are unclear, irregular, or inconsistent, and when many consequents are possible (Cross, 2001, 2005). People abhor uncertainty and ambiguity is therefore an effective tool for eliciting affect in a music listener. An ambiguous phrases meaning changes across levels, however, as it can be discomforting in the moment and intellectually clever when considered in the frame of the whole piece. This is a clear parallel of the ebb and flow of music. Probabilities are flexible, learned, and vary depending on the listener's knowledge of a style, composer, performer, type of piece, etc. (Wilson, 1986). There are class concepts that provide a ballpark estimate and there are ideal types that identify the best form for each dimension of a piece. For example, a class concept of a symphony will have four movements, and an ideal type is Beethoven's Symphony Number 9 because it is the best (note that this is just an academic exercise). One simply has to observe the myriad musical styles, radio stations, award shows, and memorabilia to tell that there is no agreed upon universal standard for what constitutes the best in any category of music. Thankfully, in addition to music itself being universal, certain tone combinations are universally pleasing, so one can appreciate and eventually lean a new style (Cross, 2009). Overall, the combination of repetition, ambiguity, and probabilities supports dynamic expectations and helps make music listening consistently and reliably enjoyable.

Composers and performers have multiple techniques to generate and frustrate expectations in music listeners. MinMuList will teach the idea and a handful of techniques to train mindful music listening. One technique is through the use of a *deviant*. A deviant does not fit a normal pattern found in a style of music. Over time, however, deviants become norms. EEG studies demonstrate that style shifts affect how one approaches a musical piece (Koelsch, et al, 2008a, 2008b; Koelsch & Mulder, 2002; Verleger, 1990). Another effect eliciting technique is weakening of shape. A sound term is established, and then subtly changed over the course of the piece. Music listeners group similar sound terms through a cognitive process of compare and contrast (Feeney, 2012). The goal of the composer is to offer multiple variations of the original sound term that are still grouped with the original sound term (Adorno, 1993). Saturation is a third technique that can generate and frustrate expectations in music listeners. It achieves affective activation through continued repetition of a sound term that generates expectations of change in the listener. The greater the strength of the sound term, the greater the need of change to release the affect built up (Meyer, 1956). Saturation can be used to build up energy in an introduction, or as background to a melody or harmony (Wilson, 1986).

The Preparatory Set is immensely an important topic in MinMuList. This term refers to the numerous mental and physical adjustments a listener makes when preparing to hear music. This essentially refers to how to frame the music listening experience for each zone of awareness. Take, for example, attendance of a classical music concert. The music listener is aware that the environment is offering auditory stimulation as a primary stimulus; that the body is to remain mostly still to become awash in the auditory stimulation; and that the mind is to remain focused on perception of, and pattern detection in, the auditory stimulation as compared to previous knowledge about this style of music. In this case, the music listener will remain dedicated to listening to the "honest and true" signal of music that will be a fulfilling experience unto itself (Cross, 2009). The preparatory set will shift to accommodate other settings. For instance, when one attends a rock concert, the music is still a main focus, however, one is allowed, even expected, to dance and sing along. When one is at a café with friends, the music serves more as a background to create ambiance. A mindful music listener will be able to shift amount preparatory sets in order to accommodate the style of music and the context in which the music is heard.

The cognitive processes of pattern perception are critically important to understand for a mindful music listener, and are therefore a topic in MinMuList. Meyer (1956) primarily focused on the dynamic relationship of Gestalt Laws of perception and prior learning. He emphasized that overlearned relationships will influence pattern detection and meaning making. For example, grouping is a law of perception, and it is subject to language. Specifically, recall of a group of letters is easier when they are presented as a word. That is, it is difficult to recall the stimulus "E S L R T E T;" easier to recall the stimulus "T T E E L R S;" and easiest to recall the stimulus "L E T T E R S." This concept will be combined with the curious, open, and accepting attitude inherent to mindfulness to support a flexible approach to experience, which in turn cultivates awareness.

Engineering Model of Music Audition

The Engineering Model of Music Audition (EMMA) is the theoretical and methodological paradigm that explains how listening achieves physiological and psychological effects. It is primarily based on the conceptualization presented in *The Music Effect* (Schneck & Berger, 2006). MinMuList is justified by, and draws content from, the EMMA. As the heart of the EMMA is a hard core that has three tenets, with each treated as axiomatic. The first tenet holds that the human body is a controlled system that has six levels of organization, and each level can respond to music. The response mechanisms are subject to control by the Standard Engineering Feedback/Feed-forward Model. The second tenet is that the human body engages in ambiensomatic perception, meaning one perceives, interprets, and react to information from without and within himself (Ornstein & Thompson, 1984; Schneck & Berger, 2006, pp. 76). Proprioception is monitoring of the physical orientation of the body to the environment and other parts of itself; this monitoring system shares circuits with the auditory sytem (Nicholls, et al, 2001). The third tenet is that the human body responds in a purposeful and adaptive way through the path of least resistance in order to survive (Schenk, 1990, 2003). Each of the three tenets are important topics to address in MinMuList as they are foundational for the EMMA.

Critical processes are rules and assumptions that adapt to new research. Critical processes of the EMMA will now be explored in the same style that they would be discussed in MinMuList. Critical Process 1 postulates that the human body is constantly engaged in detection of stimuli in order to preserve homeorhesis. The body will compare detected ambiensomatic information against internal set-points housed in the thalamus and make changes to maintain optimum operating parameters. Any difference between current physical settings and set-points generates error signals in regards to proportional control, differential control, and integral control.

Critical process 2 assumes that that set-points control physiological function and can be modified through entrainment. A forcing function is energy input that changes a physiological process from its set-point. The change is called an accommodation. For example, music as a forcing function may increase one's heart rate through a strong rhythm. The resulting accommodations can be short, medium, or long-term. The primary short-term accommodation is Autonomic Nervous System (ANS) activity and it achieved through neurotransmitter signaling. This activity is short-lived but powerful, and primarily affects heart rate, blood flow, and attention (Tortora & Gerbowsk, 1993). The Endocrine System is involved in medium-term accommodations through release of hormones that support calm or energetic psychophysiological states. For example, this is achieved through modification of cellular metabolism and modification of blood sugar levels. The Immune System is implicated in long-term accommodations to music. Music listening changes antigen and antibody component production, resulting in support or impedance of maintenance of health. Entrainment is a permanent change of a set-point through regular application of music as a forcing function. Entrainment is achieved in four main ways. The first is through modification of neuronal activity and connections (Bear, Connors, & Paradiso, 2007). The second is through modification of gene expression, such as protein levels (Russel, 2005). The third is through mobilization or deactivation of proteins, such as second-messenger systems (Campbell & Farnell, 2006; Ornstein & Thompson, 1984). The fourth is through biasing of central nervous system information-processing networks, such as modification of cognitive schema (Nichols, et al, 2001).

Critical Process 3 is about biofeedback and modifying setpoints. It essentially holds that a person can monitor somatic activity and use information to make informed decisions (Libet, 2002; Shevrin et al, 2002). Critical Process 4 discussed Information-processing principles and restraints. The Gestalt laws of proximity, directionality, similarly, closure, and Prägnanz are of particular importance. Each is self-explanatory, except Prägnanz, which holds that objects are perceived as simply as possible; for example two Vs, VV, is seen as one W. Gestalt laws are important because of their immediate and implicit effect on information organization (Coren and Ward, 1989;

Haerich, 2010). Of course, information has to make it fairly far into the information-processing pathway for Gestalt laws to play a role. Prior to that point, sensory constraints eliminate a significant amount of external stimuli. The sensory window refers to the limited number of forms and ranges of energy that can be detected by human senses (Schneck & Berger, 2006). Also, there is a tempering of auditory input, where two similar sounds may be heard as one sound. The rate of transduction is another limit, because sensory organs have to signal detection, sensory systems have to pass information on, filters catch a portion of information, meaning networks process information, and higher order cognitive systems integrate multiple meanings. Each step takes time, so some information is lost. As seen, there is a stepwise process to music detection. The three levels of the information-processing hierarchical pathway are the Reticular Formation, the Spinothalamic Tract, and the Limbic System and are basically responsible for assembly, comparison to set-points, and identification of valence of incoming information, respectively. Information that makes it to the Limbic System is concurrently processes in primary auditory cortex, where Gestalt Laws play a role.

Critical Process 5 describes how the Limbic System and Primary Sensory cortex process the emotion, temporality, and meaning of incoming information in parallel, and how these dimensions contribute to memory formation (Berger, 2002; Berger & Schneck, 2003; Schneck, 1997). The Limbic System is intimately linked to the Autonomic Nervous System (ANS) and it is composed of two branches. The branches are the Parasympathetic Nervous System (PNS) and the Sympathetic Nervous System (SNS), each responsible for the “rest and digest” response and the “fight or flight (or freeze)” response, respectively. In short, highly emotional content truncates higher order processing and predict the strength of a memory formation, both in the interest of survival (Damasio & Moss, 2001). Persistent ANS activity prevents higher order thinking, leads to maladaptive behavior, and poor interpersonal patterns (Berger & Schneck, 2003; LeDoux, 2002; Schneck, 1997; Schneck & Berger, 1999; Andreasen, 1997; Couley, 2003; Goldman, 1996; Dolan, 2002; Holden, 2003; Javitt & Coyle, 2004). A so called fear-spiral can emerge, and this can prevent health and wellness (Berger, 2002; Schneck 1990; Schneck & Berger, 2006; LeDoux, 1998, 2002).

The sixth and final Critical Process of EMMA holds that music listening can be therapeutic. Given that music is derived from language circuits, has clear psychophysiological effects on the human body, and is non-invasive, it has clear therapeutic value (MacLean, 1990; Berger, 2002; Damasio, 1999, 2001, 2003; LeDoux, 1998, 2002; Schneck & Berger, 2006). MinMuList would then provide an introduction of each of these critical processes as another way to educate music listeners about the process in which they engage on a regular basis. This will support a broader appreciation of music listening, support relaxation, and support overall health and wellness.

Principal Elements of Music

Music is the result of the interaction of six main elements of music; those elements being rhythm, melody, harmony, timbre, dynamics, and form. Each was explored above. Rhythm and melody are the principal elements because they are the focus around which music is built. Rhythm is principle for pop music, while melody is principle is classical music. MinMuList will discuss the principal elements in greater depth than the other elements of music to support a greater appreciation of these central phenomena. This will be to support higher order functioning that will translate to improved quality through better time management, judgment, and reasoning. Plus appreciation for the central ingredients of music will lead to appreciation of all musical styles and non-musical events that have their own type of rhythm and melody.

Rhythm

Rhythm has been found to be foundational in numerous human phenomena, such as perception, attention, memory, time management, speech, and even consciousness (Krumhansl, 2000; Grondin, 2010; Farbood, Rowland, Marcus, & Ghitza, 2015). It is composed of pulse, pace, and pattern. Pulse is the alternation of strong and weak beats. One's heart rate will conform to the pulse of a song (Standley, 2000). Pace is the frequency of beats over time. A quicker pace will feel energetic, even frantic, while a slower pace will feel calm. People tend to spontaneously generate a pace that has a 500 - 600 millisecond inter-beat-interval, such as when walking (Friberg & Sundberg, 1995; Fraisse, 1982).

Research indicates that people tend to rely on how the timing of events relate to one another rather than the absolute timing of the events (Krumhansl, 2000; Fraisse, 1978; Fraisse, 1982). People tend to group auditory events into groups of twos and fours. This grouping is based on familiarity with style, goodness-of-fit judgments, and memory of earlier parts of a musical piece (Palmer & Krumhansl, 1990). Performers will emphasize certain beats to suggest how the listener is to mentally segment the music (Drake & Palmer, 1993, 2010). Research also suggests that rhythm supports selective attention (Krumhansl, 2000). When target stimuli occurred on beat, subjects had more flexible attention (Treisman, 1960, 1964) and better judgment about the timing, length, and tonality of target stimuli (Jones & Boltz, 1989; Jones, Moynihan, MacKenzie, &

Puente, 2002; Jones, Boltz, & Kidd, 1982; McAuley & Fromboluti, 2014). This is likely support by identified cognitive circuits that enhance brain activity when musical events occur on beat (Large & Snyder, 2009; Nozaradan, Peretz, & Mouraux, 2012).

The SNS is typically the focus of physiological research on rhythm. Common proxies for SNS activity are heart rate, skin conductance response, and blood pressure. Compared to silence, each of these physiological activities' levels is elevated when a subject is listening to music (Koelsch, Gunter, Wittfoth, & Sammler, 2005; Koelsch, 2013). There is a correlation between musical pace and physiological reactivity (Carpentier & Potter, 2007). Furthermore, listeners are able to report when they aware of experiencing tension in response to a musical piece, as corroborated by physiological reactivity (Huron, 2006). This information has been translated into multiple interventions that utilized or identified rhythm as the primary stimulus of change. Research has found this to be the case for speech rehabilitation (Adamek, Gervin, & Shiraishi, 2002), reduction of epileptiform events (Hughes, 2001; Lahiri & Duncan, 2007), and stress reduction paired with improved quality of life (Sidorenko, 2000).

Melody

Melody is the subjectively satisfying flow of pitches and is considered by many to be the ultimate goal of music. It is the lead of Western Classical music and establishes the theme of the musical piece. Furthermore, identifying, tracking, and predicting melody involves analysis of numerous musical dimensions which happen quickly, much the same way people go about their daily lives (Marmel, Perrin, & Tillman, 2011). For MinMuList, melody will be explored in depth because it will teach music listeners how to organize information, identify critical elements, and verbalize themes in order to make better predictions about subsequent events. These skills will support insight, communication skills, and future-oriented planning. In the Aristotelian sense, to understand melody and melodic analysis, one must understand the material, formal, and final causes of melody, which are pitch, key signature, and scale/chord, respectively. The efficient cause is the actual sounding of a melody by instrument or recording; this is less important for MinMuList.

Pitch

The pitch is the frequency of a note. The higher the frequency, the higher the pitch; the lower the frequency the lower the pitch. The human ear hears only a range of frequencies, and can only discriminate similar pitches so finely. Furthermore, the qualitative experience of frequency appears cyclical and based on integer relationships to a fundamental frequency. That is, 440 Hertz (Hz) is the fundamental frequency of the note A, known as A440. The fundamental frequency A440 features harmonics that make the aural qualities of 880 Hz, 1,320 Hz, and 1,760 Hz almost identical, with the only difference being that each sounds comparatively higher or lower as suggested by the Hz. If one starts at A440 and increases the frequency of a tone, each time the tone changes in quality, it is the next note, A#; continue to increase the frequency and one will arrive at B, then C, then C#, then D, then D#, then E, then F, then F#, then G, then G#, and then back to A where this pattern repeats on up the frequency ladder. Recall that for notation # means sharp, while b means flat, each representing the tone unique to the half-step difference between whole notes.

Key Signature

The key signature identifies the starting pitch for a musical piece. This will act as the sonic home for the piece and determine acceptable musical events within the piece. The make-up of the musical event must match the key signature to be acceptable, or, consonant. Consonance is the name for the subjectively pleasing experience of two simultaneously sounded notes. Dissonance is the name for the subjectively displeasing experience of two simultaneously sounded notes. Typically, note combinations with simple ratios are consonant and pleasing, while note combinations with complex ratios are dissonant and displeasing. At times, dissonance can be an effective technique and this is an important point to consider during MinMuList. Overall, what is consonant and matches the key signature is in large part determined by what scale is used.

Scales

Scales are groups of notes that fit well together based on their relative frequencies. There are many types of scales and each can start on any note. The pitch relationships are the same for each type of scale regardless of the starting. The major scale is the most common scale in Western music and it is thought of as a happy scale. A C-major scale includes the notes C-D-E-F-G-A-B-C. The minor scale is also very common in Western music and it is thought of as a sad scale. A C-minor scale includes the notes C-D-Eb-F-G-Ab-Bb-C.

Chords

Chords are vertical melodies where multiple notes from a scale are sounded at the same time. There are numerous common structures that use a note from the key signature as the root of the chord, where the root is the lowest sounding note. For example, the C-major chord is made up of C-E-G; the C-minor chord is made up of C-Eb-G. At times, more notes are added, like in a C-7 chord, which is C-E-G-B. The chord can be inverted, where another note is the root, like in C-7 first inverse, which is E-G-B-C; the second inverse is G-B-C-E. In general, a major chord sounds happy and a minor chord sounds sad (Howard, Rosen, & Broad, 1992); this notion is supported by event-related potential (ERP) research (Bakker & Martin, 2014; Herring, Taylor, White, Crites, & Stephen, 2011).

Schematic is Top-down and Veridical is Bottom-up

Psychophysiological research on melody has long been guided by the assumption that the music listener engages in a simultaneous top-down and bottom-up approach to melodic tracking (Frijida, 1986). This notion has received support in a variety of ways for many years (Narmour, 1991; Bharucha, 1996; Marmel, Perrin & Tillman, 2011; Cuddy & Lunney, 1995; Krumhansl, 1995a). Schematic expectancies are the top-down approach to melodic predictions and are strongly based on familiarity with a style and in cultural learning. It is typically conceptualized as a neural network, given that relatedness judgments, memory judgments, and expectancies appeared to follow schematic rules (Krumhansl, 2000; Tillman, Bharucha, & Bigand, 2000; Bharucha, 1987, 1991; Bharucha & Olney, 1989). Veridical expectancies are the bottom-up approach to melodic predictions, based in experience with the current musical piece, and can be formed quickly, even with unfamiliar styles (Bharucha & Todd, 1989; Meyer, 1956). This may be because Gestalt Laws and archetypes influence both schematic and veridical expectancies (Cuddy & Lunney, 1995; Krumhansl, 1991a, 1995a; Rosner & Meyer, 1982, 1986; Schmuckler, 1990). EEG data supports that incongruent sound events elicited late positive potentials (Besson, Faïta,, & Requin, 1994; Besson & Faïta, 1995; Janata, 1995), which is similar brain activity in response to semantic incongruences (Patel, 1998, 2003; Patel, Gibson, Ratner, Besson, & Holcomb, 1998). However, other research appeared to indicate separate melodic and language processing areas (Besson, Faita, Peretz, Bonnel, & Requin, 1998; Patel, Gibson, Ratner, Besson, & Holcomb, 1998). Information about schematic and veridical approaches to melodic predictions is important to teach in MinMuList because it can provide cognitive tools that apply to music and can generalize to everyday life.

Schematic Models of Melodic Predictions

Schematic models are mathematical models that have benefitted from the emergence of computers. The Tonal-Harmonic Hierarchy is one schematic model of melodic prediction that is based on identification of the key-signature (Krumhansl, 1990). Context is important, as one note or chord is stable in one key, but not another (Bharucha & Krumhansl, 1983). Cognitive and affective data support this model (Bigand & Pineau, 1997; Bigand, Madurell, Tillman, & Pineau, 1999).

The Implication-Realization (I-R) Model is another schematic model that found that a listener's predictive accuracy is unrelated to his familiarity and expertise, as 5-year-olds appeared to employ parts of this predictive model (Schellenberg, Adachi, Purdy, & McKinnon, 2002). The I-R Model holds that a listener uses tow components to make predictions: pitch proximity and pitch reversal. Pitch proximity is the process of identification of the note that is closest to the current note and in the same ascending or descending direction as the last two notes. That is, C sounds, then D, then E, where E is the target. Pitch reversal is the process of identification of the proximal note in the reverse direction of the current note if the current note was further away from the previous note than the proximal would have been. That is, C sounds, then E, then D, where D is the target (Cuddy & Lunney, 1995; and Schellenberg, 1996, 1997).

Melodic Anchoring is a schematic model that holds that certain notes act as anchors in the context of a music piece (Krumhansl, 1990). Predictions are bases on identification of stable notes as a melody unfolds, where stable notes are under the constraints of proximity and asymmetry. Proximity means the stable note is two or less semitones away from the unstable note. Asymmetry holds that the stable tone must be closer than the tone prior to the unstable tone. Both constraints generate a vector and the vectors are summed to generate a tonal prediction (Bharucha, 1996). Research on this model found that a salient leading tone will recruit more attention (Deutsch, 1978), and a note will be perceived as more related when it is followed by a stable tone compared to a less stable tone (Krumhansl, 1979).

Chord predictions are also common, though there is no schematic model that deals specifically with chord predictions; however, research shows that most chord predictions are based on learned frequencies of musical structures (Deliege, 1989). Most listeners were found to use surface clues, rather than structural information, to make predictions (Deliege, Melen, Stammers, & Cross, 1996). In one experiment, novices were as accurate as music students at identification of unusual chord progressions, although they tended to prefer common progressions while music students preferred uncommon progression (Smith & Melara, 1990).

Categorical Perception

Intervals are of paramount importance to melody, both for harmonic relationships that determine consonance and for melodic predictions. Musicians judged intervals of consecutive and concurrently sounded notes as categorical absolutes, much like how language is processed (Burns & Ward, 1978; Zatorre & Halpern, 1979). Judgment was improved when the interval was played at the end of a phrase (Wapnick, Bourassa, & Sampon, 1982). Categories are determined by cultural and stylistic norms (Perlman & Krumhansl, 1996). Non-musicians' judgment accuracy had an inverse relationship with ambiguity of musical context (Siegel & Siegel, 1977); however, non-musicians' judgments accuracy markedly improved even in the course of one experiments (Howard, Rosen, & Broad, 1992), lending support to the postulated efficacy of MinMuList.

Gestalt Therapy Theory and Mindfulness

MinMuList will target specific psychological mechanisms that will foster greater insight, improve communication, and support overall wellbeing. While the social engagement featured by the workshop setting will likely account for a portion of the positive outcomes assumed, the lions share are hypothesized to be accounted for by the careful application of information about music, music theory, and the psychophysiological effects of music. An introduction to Gestalt Therapy Theory and a brief literature review on mindfulness will offer a clear and convincing link between the careful application of the material presented thus far and psychological change.

Gestalt Therapy Theory

I and Thou (Buber, 1923/1996) provides the existential framework for Gestalt Therapy. It is an exploration of how man relates to any aspect of experience, including other people and himself, in one of two ways: I and It, or I and Thou. An I and It approach serves to separate the two, and I objectifies It. An I and Thou approach serves to bind the two, and I honors Thou. Fritz Perls was of upmost importance to the development of Gestalt Therapy theory in America during the 1940s, ‘50s, ‘60s, and ‘70s. His approach was unapologetic, honest, and respectful. This characterizes Gestalt Therapy theory well, and while many of the major concepts remain in place, *Gestalt Therapy: An Introduction to the Basic Concepts of Gestalt Therapy* (Hostrup, 2010) offers a recent version that will now be the focus of discussion.

Process Approach

Gestalt Therapy theory (GTT) is dialogic and process-oriented with a phenomenological focus. This means therapy is discussion-based and focused on how a patient perceives, organizes, and acts on information. The goal is to raise the patient’s awareness around how he experiences and interacts with the world.

Awareness

Awareness is a sense of understanding what, how, and that one experiences. It is an ongoing process of contact between the self and the field. When one has greater awareness, one can make healthier decisions. The self is the entirety of one’s physical, cognitive, emotional, and existential aspects. The field is every other than the self, such as other people, the immediate environment, and the entire expanse of time and space. The self and the field are dynamic and interrelated, and the boundary changes. Culture is a clear example of the dynamic, interrelated nature of the self and the field that has a fluid boundary. A person cannot separate himself from his culture, even though culture is a theoretical construct. Similarly, what is healthy for a person changes over time.

Awareness is knowing how and when one’s needs, wants, and values change. Awareness is the process of understanding one’s current experience and one’s conceptualized self, it is therefore a phenomenological and metacognitive process. This is a clear parallel to the construct of mindfulness, which will be discussed later. This will then be a focus of MinMuList.

Gestalt Figure Formation and Resolution Process

The Gestalt figure formation and resolution process (GFFRP) is the conceptualization for one’s moment-to-moment experience. The figure is that which is most prominent in one’s awareness; it can be a need, want, sensation, etc. The figure is in the foreground of awareness while the ground is the background of awareness. The figure organizes the ground, and the ground gives meaning to the figure. For example, a yell is the figure and its meaning changes when the ground is a sporting event or a dark alley. The GFFRP is always occurring and it endlessly repeats; hopefully the figure is destroyed. If it is not, it remains in one’s self and alters the landscape of the ground in one’s awareness.

Steps of Gestalt Figure Formation and Resolution Process

The dynamic process of organizing figure and ground described by the GFFRP has the following steps: (a) undifferentiated field; (b) figure formation; (c) figure sharpening; (d) scanning; (e) planning; (f) execution; (g) assimilation; (h) undifferentiated field. Essentially, one has a clear mind (well, as clear as one’s mind can be), then an idea or sensation begins to form, then one enhances the ids, then one checks with one’s abilities and the environment to act upon this idea or sensation, then one plans how to act, then one acts, then one debriefs on the whole process. Each step is important, and can become automatic.

Zones of Awareness

This theoretical construct holds that one has three domains of information to organize: (a) mind, (b) body, (c) environment. The mind is a remarkable zone, as it seems to be ethereal and exist at the boundary of the body and the environment. While the existence of the mind, consciousness, and even the idea of zones of awareness are interesting topics of debate, for the sake on this manuscript, their equivocal presences will be treated as axiomatic. Thus, one must learn how to scan, organize, integrate, and act upon information from each zone. Over time, through explicit and implicit learning, one develops characteristic ways of doing this for each zone. Health is balancing each zone and requires selective, flexible attention. Illness is imbalance among the zones, with hypervigilant focus on one area at the cost of neglect of another area.

Forms of Contact

The forms of contact describe how a person relates to the field. They are learned in step-wise, developmental fashion and each is healthy at a different time and place. The forms of contact are: (a) confluence; (b) introjection; (c) projection; (d) retroflection; (e) deflection; (f) full contact. Confluence is full identification with some portion of the field, a loss of identity, so to say. Introjection is allowing the field to define the self in some way, such as one's identity. Projection is seeing one's self in a portion of the field without realizing it. Retroflection is holding in energy that manifests in a different way, such as when one does not express anger and instead gets a stomachache. Deflection is brushing off some energy from the field, such as making an excuse for a compliment or an insult one receives. Full contact is when one can relate to another in an honest, respectful, and open way; this represents the existential goal of existence. Health is awareness around and choice in how one comes into contact with the field. Illness is when one does not have awareness around or choice in how one comes into contact with the field.

Gestalt Therapy Theory and MinMuList

Each component of Gestalt Therapy theory presented above is of critical important for MinMuList. The absolute nature of music requires awareness of relationships that exists within the field of the musical piece. This means that one must understand that must is a process of tonal unfolding of which one must be fully aware to truly appreciate. Furthermore, one must be able to track the concurrent Gestalt figure formation and resolution processes of the music, the mind, and the body. One must be able to decide how to organize, integrate, and act upon information from each of these zones in order to fully appreciate the music itself. MinMuList will offer the information and skills training that will support these abilities, abilities that will be taught through mindful music listening and apply to the moment-to-moment experience of daily life.

Mindfulness

Mindfulness has been important to the field of psychotherapy since the third wave of Cognitive Behavioral Therapy programs started in the 1980s. It is a major component of leading therapy protocols, such as Dialectical Behavioral Therapy (DBT) and Acceptance and Commitment Therapy (ACT; Brown & Ryan, 2003). Mindfulness is widely studied and broadly accepted as effective treatment for numerous mental health disorders (Khoury, Lecomte, Fortin, Masse, Therien, Bouchard, Chapleau, Paquin, & Hofmann, 2013).

Defined

The operational definition of mindfulness includes a brief description and two components. As an approach to experience, mindfulness was defined as a non-elaborative, non-judgmental, present-centered awareness where each figure of awareness is acknowledged and accepted as it is. The components include: (a) self-regulation of attention; (b) attitude of curiosity, openness, and acceptance (Bishop, Lau, Shapiro, Carlson, Anderson, Carmody, Segal, Abbey, Speca, Velting, & Devins, 2004).

Self-regulation of Attention

The veridical, phenomenological component to mindfulness holds that one is to remain aware of a chosen aspect of one's moment-to-moment experience. This requires intentional attention. One is to simply notice one's experience, not elaborate upon it through fantasy, assumption, or judgment; if one does do this, one gently returns his focus to the pre-selected aspect of one's experience. This will allow for deeper, fuller contact with experience as one shifts from an about to a direct experience (Teasdale, Segal, & Williams, 1995). This also supports selective, flexible attention (Bishop et al, 2004).

Attitude of Curiosity, Openness, and Acceptance

The schematic, overarching worldview of mindfulness holds that one is maintain an attitude of curiosity, openness, and acceptance. It means one allows one's self to be as one is. Curiosity is noticing any figure that emerges, refraining from elaboration. Openness is acting as a receptacle for experience, simply allowing figures to enter and leave one's awareness. Acceptance is a non-emotional, non-judgmental welcoming of any figure. This attitude is applied to all aspects of experience, the self and field alike. One must be patient with himself and choose to employ a non-elaborate approach as he cultivates mindfulness, which is an ongoing, active process (Bach, Gaudiano, Pankey, Herbert, & Hayes, 2006). A mindful attitude fosters a metacognitive approach to the self and the field that supports insight and awareness. It will lead to numerous health benefits, such as improvements in distress tolerance, emotional awareness, psychological mindedness, self-awareness, and reality testing (Bishop et al, 2004).

Clinical Research on Mindfulness

Research shows that mindfulness supports overall well-being and effectively treats many physical and mental health disorders (Baer, 2003). Research found that patients from numerous demographic backgrounds with a variety of mental illnesses benefitted from the therapy protocol Mindfulness-Based Stress Reduction (MSBR; Grossman, Niemann, Schmidt, & Walach, 2004). The Mindfulness Attention and Awareness Scale (MAAS) found that persons with higher levels of mindful attention had higher levels of well-being, enhanced self-awareness, and lower levels of mood disturbance and stress (Brown & Ryan, 2003).

Mood Disorders

Mindfulness-Based Cognitive Therapy (MBCT) is effective at relapse prevention for episodes of depression (Teasdale, Segal, & Williams, 1995; Segal, Williams, & Teasdale, 2012; Ma & Teasdale, 2004; Teasdale, Segal, Williams, Ridgeway, Soulsby, & Lau, 2000). MBCT combined with psychotropic medications was effective in reducing anxious and depressive symptoms, and suicidal ideations between bipolar episodes

(Williams, Alatiq, Crane, Barnhofer, Fennell, Duggan, Hepburn, & Goodwin, 2008). MBCT combined with psychotopic medication was minimally effective at reducing manic and anxious symptoms (Miklowitz, Alatiq, Goodwin, Geddes, Fennell, Dimidjian, Hauser, & Williams, 2009).

Anxiety Disorders

Mindfulness is also effective at treating anxiety disorders, such as generalized anxiety disorder (Evans, Ferrando, Findler, Stowell, Smart, & Haglin, 2008; Vøllestad, Sivertsen, & Nielsen, 2011; Lee, Ahn, Lee, Choi, Yook, & Suh, 2007). Longitudinal data supported consolidation of gains from 8-weeks of mindfulness meditation training (Miller, Fletcher, Kabat-Zinn, 1995). Data was less promising for treatment of social anxiety disorder (Koszycki, Benger, Shlik, & Bradwejn, 2007; Lee, et al., 2007).

Substance Use Disorders

Mindfulness-Based Relaxation Program (MBRP) was utilized with stable subjects that were inpatients or in intensive outpatient programs. MBRP was effective in the treatment of addictive behaviors and cravings associated with alcohol, cannabis, and stimulants (Witkiewitz, Marlatt, & Walker, 2005; Witkiewitz & Bowen, 2010). These effects were more pronounced when participants completed homework, attended group, and were satisfied (Bowen, Chawla, Collins, Witkiewitz, Hsu, Grow, Clifasefi, Garner, Douglass, Larimer, & Marlatt, 2009). Mindfulness was an effective treatment approach with an incarcerated population as well, where they were less likely to use substances after release to the community (Bowen, Witkiewitz, Dillworth, Chawla, Simpson, Ostafin, Larimer, Blume, Parks, & Marlatt, 2006). However, research with the general population is limited, and less conclusive. Specifically, one study found that college students that were more mindful had higher levels of tobacco use and binge drinking (Leigh, Bowen, & Marlatt, 2005). Overall, research on the effectiveness of mindfulness as a treatment of substance use needs to be strengthened, as one meta-analysis noted limitations due to methodological analysis and a lack of clear mechanisms of action in many studies (Zgierska, Rabago, Chawla, Kushner, Koehler, & Marlatt, 2009).

Psychotic Disorders

In general, mindfulness based treatments are not recommended for the treatment of psychotic disorders. However, recent research offers some promise for mindfulness in conjunction with pharmacological treatment (Chadwick, Taylor, & Abba, 2005; Jacobsen, Morris, Johns, & Hodkinson, 2011), especially in the treatment of the negative symptoms of psychotic disorders (Khoury, Lecomte, Gaudiano, & Paquin, 2013) and distressing thoughts and images, but not for distressing voices (Chadwick, Hughes, Russell, Russell, & Dagnan, 2009). One study reported that ACT had moderate success in the treatment of severe, persistent mental illness (Bach et al, 2006).

Personality Disorders

Mindfulness is critically important in the treatment of parasuicidal behavior, which is a key symptom of Borderline Personality Disorder (BPD). Therefore, mindfulness is a core component of Dialectical Behavioral Therapy, the preferred treatment of BPD (Linehan, 1993; Baer, 2003; Lynch, Trost, Salsman, & Linehan, 2007). There is a dearth of research on how well mindfulness treats other personality disorders.

Other Mental Health Disorders

Research shows that mindfulness is effective in the treatment of disordered eating (Wanden-Berghe, Sanz-Valero, & Wanden-Berghe, 2010). Survivors of breast cancer had greater levels of posttraumatic growth and there was less preponderance of anger, anxiety, and depression due to MBSR treatment (Garland, Carlson, Cook, Landsell, & Speca, 2007). Other studies laid out clear guidelines for mindfulness based treatment of trauma (Follette, Palm, & Pearson, 2006). Mindfulness was also an effective addition to traditional CBT treatment of obsessive compulsive disorders (Fairfax, 2008).

Select Neurological Studies

An fMRI study reported that mindfulness supported neuronal communication pathways and preserved cognitive functioning for aging subjects (Gutman & Schindler, 2007). Another fMRI study found increased prefrontal cortex activity and decreased amygdala activity during mindful processing of emotion (Creswell, Way, Eisenberger, & Lieberman, 2007). Further fMRI data suggests that maintenance of balance between abstract and visceral reactions to emotional states could be a cognitive mechanism of mindfulness (Farb, Anderson, Mayberg, Bean, McKeon, & Segal, 2010). Another fMRI study found a pattern of activation that would suggest disidentification with the self because mindfulness meditation led to a decreased activity in neural structures responsible for interoception (Ives-Deliperi, Solms, Meintjes, 2011). One study found that after an eight-week mindfulness training program, subject has increased electrical activity in the left anterior portion of their brains, more positive mood, and greater immune response compared to controls (Davidson, Kabat-Zinn, Schumacher, Rosenkranz, Muller, Santorelli, Saki, Urbanowski, Harrington, Bonus, & Sheridan, 2003).

Mindfulness and MinMuList

Research demonstrated that mindfulness training is effective in the treatment of many types of mental health disorders, and that it supported health and wellness in general. Mindfulness was clearly defined and that definition provides clear direction on how one can enhance his own mindfulness through practice. One way in which someone could practice mindfulness is through the type of mindful music listening taught by MinMuList.

Summary

The universal phenomenon of music has its roots in evolutionary biology. The cognitive circuits responsible for music have significant overlap with those responsible for language. Music itself it a real, physical stimulus that exerts an effect on the human body that goes beyond the auditory process. Direct effects include changes in physiology and enhanced memory. Indirect effects include improved communication, enhanced executive functioning, and reduction of symptoms for a host health conditions, such as chronic pain and epileptiform events.

Music is the result of six main elements, which are rhythm, melody, harmony, timbre, dynamics, and form. One becomes acquainted with the common and preferred structures of music. Familiarity with music comes from repeated exposure to music, both through music listening and formal training. One who is sophisticated will recognize that music is inherently meaningless without a music listener and that the meaning comes from how one relates to the musical piece, as well as how it relates to itself and the style from which it comes. One then relates to the music through learned behaviors. One relates the music to itself through Gestalt Laws of perception, especially those of proximity, directionality, similarly, closure, and Prägnanz. A music listener brings a schematic understanding to a song and employs veridical data collection through music listening. The music listener then uses this information to make predictions about what will happen in the musical piece; predictions are typically intuitive and instinctual. These methods of information collection, information organization, and prediction generation are systems with which composers and performers interact to create affective responses in music listeners. Affect is generated when instincts are frustrated; in the case of music, affect results when instinctual predictions are frustrated.

The music listener must then analyze the unfolding and sum of the music and his affective responses to extract the full meaning. This analysis follows clear pathways that filter out irrelevant stimuli and assess for emotional content while determining higher order meaning. It is the physical push of the music and the affective processes that result that will lead to short, medium, and long-term responses to music. Neurotransmitters are fleeting, such as a sense of joy or thrills and chills. Hormones last somewhat longer, such as an energetic response to a rock concert. The immune system offers a long-term response to music, as it generates more antibodies that support health.

The two primary elements of music are rhythm and melody and they offer the best understanding of how music achieves an effect on humans. Both rhythm and melody are made up of numerous components, such as pulse and scales, respectively. Rhythm creates a sense of forward momentum. It moves the music listener and makes him want to dance. It is the most important element of pop music. Melody is the aesthetic focus. It is the primary target of subjective reaction. It is the most important element of classical music.

In the context of Gestalt Therapy theory, when pop music is the ground, rhythm is the figure, and when classical music is the ground, melody is the figure. In general, figures form and sharpen, then solutions are considered, planned, and executed, then the whole process is reflected upon for learning purposes. Each person does this for figures that emerge from the zones of the mind, the body, and the environment. Each person can relate to information through confluence, introjection, projection, retroflection, deflection, and full contact. Each person handles figures and relates to each zone in characteristic manners. A person is healthy when they are aware and choose how he perceives, organizes, reacts to, and relates to figures and zones. Gestalt Therapy theory is dialogic, process-oriented, and phenomenological. The focus is how a person relates to the field. There is a veridical, moment-to-moment awareness, as well as a schematic approach to the meaning of life. Health is choiceful balance of and relating to the veridical and the schematic dimensions across the three zones of awareness. Mindfulness provides a clear definition of how one can achieve this kind of health through specific attitudes and behaviors. *Music Listening as Therapy* has offered the summation of these aspects of music and psychology here. MinMuList will offer a user-friendly, widely applicable translation of these aspects of music and psychology.

References

Abikoff, H., Courtney, M. E., Szeibel, P. J., and Koplewicz, H. S. (1996). The effects of auditory stimulation on the arithmetic performance of children with ADHD and nondisabled children, *Journal of Learning Disabilities,* 29, 238-246.

Abumrad, J., & Krulwich, R. (2006, April 1). Musical language. *Radiolab*. Podcast retrieved from http://www.radiolab.org/story/91512-musical-language/

Adamek, M. S., Gervin, A. P., & Shiraishi, I. M. (2000). Music therapy and speech rehabilitation with brain-injured patients: Research, intervention models, and assessment. In C. Furman & E. Charles (Eds.), *Effectiveness of Music Therapy Procedures: Documentation of Research and Clinical Practice* (3rd ed.). Silver Spring, MD: American Music Therapy Association.

Adorno, T. W., & Gillespie, S. (1993). Music, language, and composition. *Musical Quarterly*, 401-414.

Alten, S. R. (2005). *Audio in media*. Belmont, CA: Wadsworth Publishing Company.

Altenmüller, E., Schürmann, K., Lim, V. K., & Parlitz, D. (2002). Hits to the left, flops to the right: different emotions during listening to music are reflected in cortical lateralisation patterns. *Neuropsychologia*, *40*(13), 2242-2256.

Andreasen, N. C. (1997). Linking mind and brain in the study of mental illnesses: A project for scientific psychopathology. *Science, 275*, 1586-1593.

Angier, R. P. (1927). The conflict theory of emotion. *The American Journal of Psychology*, 390-401.

Askenfelt, A. (1986). Measurement of bow motion and bow force in violin playing. *Journal of the Acoustical Society of America. 80,* 1007-1015.

Austerlitz, R. (1983). Meaning in music. *The American Journal of Semiotics*, *2*(3), 1-11.

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

Bach, P. A., Gaudiano, B., Pankey, J., Herbert, J. D., & Hayes, S. C. (2006). Acceptance, Mindfulness, Values, and Psychosis: Applying Acceptance and Commitment Therapy (ACT) to the Chronically Mentally Ill. In R.A. Baer (Ed.). *Mindfulness-based treatment approaches: Clinician's guide to evidence base and applications* (pp. 93-116). San Diego, CA: Elsevier Academic Press.

Bakker, D. R., & Martin, F. H. (2015). Musical chords and emotion: Major and minor triads are processed for emotion. *Cognitive, Affective, & Behavioral Neuroscience, 15*, 15-31.

Bartlett, D.L. (1996). Physiological responses to music and sound stimuli. In: D. H. Hodges (Ed.), *Handbook of Music Psychology* (2nd ed.). San Antonio, TX: IMR Press.

Baumgartner, T., Esslen, M., & Jäncke, L. (2006). From emotion perception to emotion experience: Emotions evoked by pictures and classical music. *International Journal of Psychophysiology*, *60*(1), 34-43.

Baumgartner, T., Lutz, K., Schmidt, C. F., & Jäncke, L. (2006). The emotional power of music: how music enhances the feeling of affective pictures. *Brain research*, *1075*(1), 151-164.

Bear, M. F., Connors, B. W. & Paradiso, M. A. (2007). *Neuroscience: Exploring the Brain*, 3rd edition. Baltimore, MD: Lipincott Williams & Wilkins.

Békésy, G. von (1960). *Experiments in Hearing*. New York, NY: McGraw-Hill.

Békésy, G. von & Rosenblith, W. (1951). The mechanical properties of the ear. In: S. Stevens (Ed.), *Handbook of Experimental Psychology*. New York, NY: John Wiley.

Bengtsson, I., & Gabrielsson, A. (1983). Analysis and synthesis of musical rhythm. *Studies of music performance*, *39*, 27-60.

Berger, D. S. (2002). *Music Therapy, Sensory Integration, and the Autistic Child*. London, England: Jessica Kingsley Publishers.

Berger, D. S. & Schneck, D. J. (2003). The use of music therapy as a clinical intervention for physiologic functional adaptation. *Journal of Scientific Exploration, 17*, 4, 687-703.

Bernstein, N. 1967. *The Co-ordination and Regulation of Movements*. New York, NY: Pergamon Press.

Besson, M., & Faita, F. (1995). An event-related potential (ERP) study of musical expectancy: Comparison of musicians with nonmusicians. *Journal of Experimental Psychology: Human Perception and Performance*, *21*(6), 1278-1296.

Besson, M., Faita, F., Peretz, I., Bonnel, A. M., & Requin, J. (1998). Singing in the brain: Independence of lyrics and tunes. *Psychological Science*, *9*(6), 494-498.

Besson, M., Faïta, F., & Requin, J. (1994). Brain waves associated with musical incongruities differ for musicians and non-musicians. *Neuroscience letters*, *168*(1), 101-105.

Bharucha, J. J. (1987). Music cognition and perceptual facilitation: A connectionist framework. *Music Perception: An Interdisciplinary Journal, 5*(1), 1-30.

Bharucha, J. J. (1991). Pitch, harmony, and neural nets: A psychological perspective. *Music and connectionism*, *2*(4), 84-99.

Bharucha, J. J. (1996). Melodic anchoring. *Music Perception: An Interdisciplinary Journal, 13*(3), 383-400.

Bharucha, J. J., & Olney, K. L. (1989). Tonal cognition, artificial intelligence and neural nets. *Contemporary Music Review*, *4*(1), 341-356.

Bharucha, J. J., & Todd, P. M. (1989). Modeling the perception of tonal structure with neural nets. *Computer Music Journal*, 44-53.

Bigand, E., & Pineau, M. (1997). Global context effects on musical expectancy. *Perception & Psychophysics*, *59*(7), 1098-1107.

Bigand, E., Filipic, S., & Lalitte, P. (2005). The time course of emotional responses to music. *Annals of the New York Academy of Sciences*, *1060*(1), 429-437.

Bigand, E., Madurell, F., Tillmann, B., & Pineau, M. (1999). Effect of global structure and temporal organization on chord processing. *Journal of Experimental Psychology: Human Perception and Performance*, *25*(1), 184.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., Segal, Z. V., Abbey, S., Speca, M., Velting, D., & Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice*, *11*(3), 230-241.

Blood, A. J., & Zatorre, R. J. (2001). Intensely pleasurable responses to music correlate with activity in brain regions implicated in reward and emotion. *Proceedings of the National Academy of Sciences*, *98*(20), 11818-11823.

Bowen, S., Chawla, N., Collins, S. E., Witkiewitz, K., Hsu, S., Grow, J., Clifasefi, S., Garner, M., Douglass, A., Larimer, M. E., & Marlatt, A. (2009). Mindfulness-based relapse prevention for substance use disorders: a pilot efficacy trial. *Substance Abuse*, *30*(4), 295-305.

Bowen, S., Witkiewitz, K., Dillworth, T. M., Chawla, N., Simpson, T. L., Ostafin, B. D., Larimer, M. E., Blume, A. W., Parks, G. A., & Marlatt, G. A. (2006). Mindfulness meditation and substance use in an incarcerated population. *Psychology of Addictive Behaviors*, *20*(3), 343.

Bregman, A. S., & Pinker, S. (1978). Auditory streaming and the building of timbre. *Canadian Journal of Psychology/Revue Canadienne de Psychologie*, *32*(1), 19-31.

Broadbent, D. E. (1958). The selective nature of learning. In *Perception and Communication* (244 – 267). Elmsford, NY: Pergamon Press.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of personality and social psychology*, *84*(4), 822-848.

Buber, M. (1996). *I and thou.* (W. Kaufmann trans.). New York, NY: Touchstone. (Originally published in 1923)

Budd, M. (2002). *Music and the emotions: The philosophical theories*. London, England: Routledge.

Burns, E. M., & Ward, W. D. (1978). Intervals, scales, and tuning. In D. Deutsch (Ed.) *The Psychology of Music* (pp. 215-264). New York, NY: Academic Press, Inc.

Campbell, M. K. & Farrell, S. O. (2006). *Biochemistry*, 5th edition. United State: Thomson Books/Cole.

Carroll, J. (1998). Steven Pinker's cheesecake for the mind. *Philosophy and Literature*, *22*(2), 478-485.

Castro, M., Tillmann, B., Luauté, J., Corneyllie, A., Dailler, F., André-Obadia, N., & Perrin, F. (2015). Boosting Cognition With Music in Patients With Disorders of Consciousness. *Neurorehabilitation and Neural Repair*, 1545968314565464.

Chadwick, P., Taylor, K. N., & Abba, N. (2005). Mindfulness groups for people with psychosis. *Behavioural and Cognitive Psychotherapy*, *33*(03), 351-359.

Cherry, E. C. (1953). Some experiments on the recognition of speech, with one and with two ears. *The Journal of the acoustical society of America*, *25*(5), 975-979.

Clarke, E. F. (1985). Structure and expression in rhythmic performance. In Howell, P., Cross, I., & West, R. (Eds.) *Musical Structure and Cognition* (209-236). London, England: Academic.

Clarke, E. F. (1987). Levels of structure in the organization of musical time. *Contemporary Music Review*, *2*(1), 211-238.

Clarke, E. F. (1993). Imitating and evaluating real and transformed musical performances. *Music Perception, 10*, 317-341.

Clarke, E. F. (1997). Rhythm and timing in music. In D. Deutsch (Ed.), *The Psychology of Music, Vol. 2* (pp. 100-121). New York, NY: Academic.

Clynes, M. (1986). When time is music. In Evans, J. R. & Clynes, M. (editors) *Rhythm in Psychological, Linguistic and Musical Processes*. (pp. 169-224). Springfield, IL: Thomas.

Clynes, M., & Walker, J. (1986). Music as time's measure. *Music Perception, 4*(1), 85-119.

Cone, E. T. (1968). *Musical form and musical performance*. New York, NY: W.W. Norton.

Coren, S. & Ward, L.M. (1989). *Sensation and Perception*, 3rd edition. San Diego, CA: Harcourt Brace Jocanovich.

Cowley, G. (2003). Our bodies, our fears. *Newsweek*, 24 February, p. 42.

Cox, R. W. (2001). Effects on academic achievement for fifth-grade students in a band pull-out program. (Masters thesis, California State University, Fresno). Masters Abstracts International, 40 (01), 26.

Craton, L. G. (2008). What is Music for? Perhaps to give Evolutionary Psychologists work. *Evolutionary Psychology, 6*(3), 550-554.

Creswell, J. D., Way, B. M., Eisenberger, N. I., & Lieberman, M. D. (2007). Neural correlates of dispositional mindfulness during affect labeling. *Psychosomatic Medicine*, *69*(6), 560-565.

Cross, I. (2001). Music, cognition, culture, and evolution. *Annals of the New York Academy of Sciences*, *930*(1), 28-42.

Cross, I. (2005). Music and meaning, ambiguity and evolution. *Musical Communication*, 27-43.

Cross, I. (2009). The evolutionary nature of musical meaning. *Musicae Scientiae*, *13*(2 suppl), 179-200.

Cuddy, L. L., & Lunney, C. A. (1995). Expectancies generated by melodic intervals: Perceptual judgments of melodic continuity. *Perception & Psychophysics*, *57*(4), 451-462.

Cytowic, R.E. (1999). *The Man Who Tasted Shapes*. Cambridge, MA: MIT Press.

Dainow, E. (1977). Physical effects and motor responses to music. *Journal of Research in Music Education*, *25*(3), 211-221.

Damasio, A.R. (1999). *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*. New York, NY: Harcourt Brace.

Damasio, A.R. (2001). Emotion and the brain. In: A.R. Damasio, A. Harrington, J. Kagan, B.S. McEwen, H. Moss, and R. Shaikh (editors) *Unity of Knowledge: The Convergence of Natural and Human Science*. New York, NY: Annals of the NY Academy of Sciences.

Damasio, A.R. (2003). *Looking for Spinoza: Joy, Sorrow, and the Feeling Brain*. New York, NY: Harcourt Brace.

Damasio, A.R. & Moss, H. (2001). Emotion, cognition, and the human brain. In: A.R. Damasio, A. Harrington, J. Kagan, B.S. McEwen, H. Moss, and R. Shaikh (editors) *Unity of Knowledge: The Convergence of Natural and Human Science*. New York, NY: Annals of the NY Academy of Sciences.

Darwin, C. (1998). *The Expression of the Emotions in Man and Animals, 3rd Edition*. (First published in 1872). New York, NY: Oxford University Press.

Davidson, J. W. (1993). Visual perception of performance manner in the movements of solo musicians. *Psychology of Music*, *21*(2), 103-113.

Davidson, J. W. (1994). Which areas of a pianist's body convey information about expressive invention to an audience?. *Journal of Human Movement Studies*, *26*(6), 279-301.

Davidson, J. W. (2001). The role of the body in the production and perception of solo vocal performance: A case study of Annie Lennox. *Musicae Scientiae*, *5*(2), 235-256.

Davidson, R. J., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S. F., Saki, F. Urbanowski, F. Harrington, A. Bonus, K. & Sheridan, J. F. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic medicine*, *65*(4), 564-570.

Deacon, T. W. (1997). *The Symbolic Species: The Co-evolution of Language and the Brain*. New York, NY: W.W. Norton and Co.

Deliege, I. (1989). A perceptual approach to contemporary musical forms. *Contemporary Music Review*, *4*(1), 213-230.

Deliege, I., Melen, M., Stammers, D., & Cross, I. (1996). Musical schemata in real-time listening to a piece of music. *Music Perception*, 117-159.

Desain, P., & Honing, H. (1991). Towards a calculus for expressive timing in music. *Computers in Music Research*, *3*, 43-120.

Desain, P., & Honing, H. (1994). Does expressive timing in music performance scale proportionally with tempo?. *Psychological Research*, *56*(4), 285-292.

Deutsch, D. (Ed.). (1978). *The psychology of music*. New York, NY: Academic Press, Inc.

Dewey, J. (1894). The theory of emotion. *Psychological Review, 1*, 553-569.

Diallo, Y. & Hall, M. (1989). *The Healing Drum: African Wisdom Teachings*. Rochester, VT: Healing Books.

Dillman-Carpentier, F. R., & Potter, R. F. (2007). Effects of music on physiological arousal: Explorations into tempo and genre. *Media Psychology*, *10*(3), 339-363.

Dolan, R.J. (2002). Emotion, cognition, and behavior. *Science, 298*, 1190-1194.

Drake, C. (1993). Perceptual and performed accents in musical sequences. *Bulletin of the Psychonomic Society*, *31*(2), 107-110.

Drake, C., Dowling, W. J., & Palmer, C. (1991). Accent structures in the reproduction of simple tunes by children and adult pianists. *Music Perception*, 315 – 334.

Drake, C., & Palmer, C. (1993). Accent structures in music performance. *Music Perception*, 343-378.

Drake, C., & Palmer, C. (2000). Skill acquisition in music performance: Relations between planning and temporal control. *Cognition*, *74*(1), 1-32.

Durbin, M. A. (1971). Transformational models applied to musical analysis: theoretical possibilities. *Ethnomusicology*, 353-362.

Ellis, D. S., & Brighouse, G. (1952). Effects of music on respiration-and heart-rate. *The American journal of psychology*, 39-47.

Ericsson, K. A. (2004). Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. *Academic Medicine*, *79*(10), S70-S81.

Essens, P. J. (1986). Hierarchical organization of temporal patterns. *Perception & Psychophysics*, *40*(2), 69-73.

Essens, P. J., & Povel, D. J. (1985). Metrical and nonmetrical representations of temporal patterns. *Perception & Psychophysics*, *37*(1), 1-7.

Evans, S., Ferrando, S., Findler, M., Stowell, C., Smart, C., & Haglin, D. (2008). Mindfulness-based cognitive therapy for generalized anxiety disorder. *Journal of Anxiety Disorders*, *22*(4), 716-721.

Faienza, C. (editor) (1994). *Music, Speech, and the Developing Brain*, Milan, Italy: Guerrini e Associati.

Fairfax, H. (2008). The use of mindfulness in obsessive compulsive disorder: suggestions for its application and integration in existing treatment. *Clinical Psychology & Psychotherapy*, *15*(1), 53-59.

Farb, N. A., Anderson, A. K., Mayberg, H., Bean, J., McKeon, D., & Segal, Z. V. (2010). Minding one's emotions: mindfulness training alters the neural expression of sadness. *Emotion*, *10*(1), 25.

Farbood, M. M., Rowland, J., Marcus, G., Ghitza, O., & Poeppel, D. (2015). Decoding time for the identification of musical key. *Attention, Perception, & Psychophysics*, *77*(1), 28-35.

Feeney, T. (2012). Weakness, Ambience and Irrelevance: Failure as a Method for Acoustic Variety. *Leonardo Music Journal*, *22*, 53-54.

Follette, V., Palm, K. M., & Pearson, A. N. (2006). Mindfulness and trauma: Implications for treatment. *Journal of Rational-Emotive and Cognitive-Behavior Therapy*, *24*(1), 45-61.

Fraisse, P. (1978). Time and rhythm perception. In E. C. Carterette & M. P. Friedman (Eds.), Handbook of Perception (Vol. 8, pp. 203-254), New York: Academic Press.

Fraisse P. (1982). Rhythm and tempo. *The Psychology of Music*, ed. D Deutsch, pp. 149–80. New York: Academic.

Friberg, A., & Sundberg, J. (1995). Time discrimination in a monotonic, isochronous sequence. The Journal of the Acoustical Society of America, 98(5), 2524-2531.

Friedman, M. & Rosenman, R.H. (1974). *Type A Behavior and Your Heart*. London, England: Wildwood House.

Gabrielsson, A. (1982). Perception and performance of musical rhythm. In *Music, mind, and brain* (pp. 159-169). Springer US.

Gabrielsson, A. (1995). Expressive intention and performance. In *Music and the mind machine* (pp. 35-47). Springer Berlin Heidelberg.

Gabrielsson, A. (1999). The performance of music. *The psychology of music*, *2*, 501-602.

Gabrielsson, A., & Juslin, P. N. (1996). Emotional expression in music performance: Between the performer's intention and the listener's experience. *Psychology of music*, *24*(1), 68-91.

García-Albea, J. E., Del Viso, S., & Igoa, J. M. (1989). Movement errors and levels of processing in sentence production. *Journal of Psycholinguistic Research*, *18*(1), 145 – 161.

Gardner, M. (1992). *Fractal Music, Hypercards, and More: Mathematical Recreations from* Scientific American Magazine. New York, NY: W.H. Freeman & Co.

Gazzaniga, M. S., Ivry, R. B., & Mangun, G.R. (2009) *Cognitive Neuroscience: The Biology of the Mind, Third Edition*. New York, NY: W. W. Norton and Company.

Gerber, R. (1996). *Vibrational Medicine: New Choices for Healing Ourselves*. Santa Fe, NM: Bear & Co.

Geringer, J. M., & Madsen, C. K. (1987). Programmatic research in music: Perception and performance of intonation. *Applications of research in music behavior*, 244 – 53.

Gold, C., Heldal, T. O., Dahle, T., & Wigram, T. (2005). Music therapy for schizophrenia or schizophrenia-like illnesses. *Cochrane Database Systematic Reviews*, 2. Art. No.: CD004025. DOI: 10.1002/14651858.CD004025.pub2.

Gold, C., Solli, H. P., Krüger, V., & Lie, S. A. (2009). Dose–response relationship in music therapy for people with serious mental disorders: Systematic review and meta-analysis. *Clinical psychology review*, *29*(3), 193-207.

Goldberger, A. L. (1996a). Fractals and the birth of Gothic: Reflections on the biologic basis of creativity. *Molecular Psychiatry, 1*, 99 – 104.

Goldberger, A. L. (1996b). Non-linear dynamics for clinicians: Chaos theory, fractals, and complexity at the bedside. *Lancet, 347*, 1312 – 1314.

Goldman, D. (1996). High Anxiety. *Science, 274*, 1438 – 1490.

Goldstein, A. (1980). Thrills in response to music and other stimuli. *Physiological Psychology, 8*, 126 – 129.

Gosselin, N., Peretz, I., Hasboun, D., Baulac, M., & Samson, S. (2011). Impaired recognition of musical emotions and facial expressions following anteromedial temporal lobe excision. *cortex*, *47*(9), 1116-1125.

Gosselin, N., Peretz, I., Johnsen, E., & Adolphs, R. (2007). Amygdala damage impairs emotion recognition from music. *Neuropsychologia*, *45*(2), 236-244.

Gosselin, N., Peretz, I., Noulhiane, M., Hasboun, D., Beckett, C., Baulac, M., & Samson, S. (2005). Impaired recognition of scary music following unilateral temporal lobe excision. *Brain*, *128*(3), 628-640.

Grewe, O., Nagel, F., Kopiez, R., & Altenmüller, E. (2007). Emotions over time: Synchronicity and development of subjective, physiological, and facial affective reactions to music. *Emotion, 7*, 774–788.

Grondin, S. (2010). Timing and time perception: a review of recent behavioral and neuroscience findings and theoretical directions. *Attention, Perception, & Psychophysics, 72*(3), 561-582.

Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research*, *57*(1), 35-43.

Grunow, R. F., & Gordon, E. (1989). *Jump right in: the instrumental series: teacher's guide. Guide*. Boston, MA: Gia Publications.

Gutman, S. A., & Schindler, V. P. (2007). The neurological basis of occupation. *Occupational Therapy International*, *14*(2), 71-85.

Hebb, D. O. (1949). *The organization of behavior: A neuropsychological theory*. New York, NY: Psychology Press.

Heller, W. (1993). Neuropsychological mechanisms of individual differences in emotion, personality, and arousal. *Neuropsychology*, *7*(4), 476.

Herring, D. R., Taylor, J. H., White, K. R., & Crites Jr, S. L. (2011). Electrophysiological responses to evaluative priming: the LPP is sensitive to incongruity. *Emotion*, *11*(4), 794.

Herz, R. S. (1998). An examination of objective and subjective measures of experience associated to odors, music, and paintings. *Empirical Studies of the Arts*, *16*(2), 137-152.

Hodges, D.H. (Ed.) (1996). *Handbook of Music Psychology*, second edition. San Antonio, TX: IMR Press.

Hodges, D. A., & O'Connell, D. S. (2005). The impact of music education on academic achievement. *The University of North Carolina at Greensboro. Retrieved August*, *20*, 2010.

Holden, C. (2003). Deconstructing Schizophrenia. *Science, 299*, 333 – 335.

Holmes, D. M. (1997). An examination of fifth grade instrumental music programs and their relationships with music and academic achievement (band). (Doctoral dissertation, University of Washington). Dissertation Abstracts International, 58 (06), 2126A.

Hostrup, H. (2010). *Gestalt Therapy: An introduction to the basic concepts of Gestalt Therapy*. (D. H. Silver trans.). Copenhagen, Denmark: Museum Tusculanum Press. (Original work published 2010)

Howard, D., Rosen, S., & Broad, V. (1992). Major/minor triad identification and discrimination by musically trained and untrained listeners. *Music Perception, 10*(2), 205-220.

Hsu, K. J., & Hsu, A. (1990). Fractal geometry of music. *Proceedings of the National Academy of Science USA, 87*, 938 – 941.

Hughes, J.R. (2001). The Mozart effect, *Epilepsy and Behavior*, 2, 396–417.

Hughes, J. R. (2002). The Mozart effect: additional data. *Epilepsy & Behavior*, *3*(2), 182-184.

Huron, D. B. (2006). *Sweet anticipation: Music and the psychology of expectation*. Boston, MA: MIT press.

Ikeda, T. (1992). Concentration-effect and underestimation of time by acoustic stimuli. *Shinrigaku Kenkyu, 63*, 157 – 162.

Iakovides, S. A., Iliadou, V. T., Bizeli, V. T., Kaprinis, S. G., Fountoulakis, K. N., & Kaprinis, G. S. (2004). Psychophysiology and psychoacoustics of music: Perception of complex sound in normal subjects and psychiatric patients. *Annals of General Psychiatry*, *3*(1), 6.

Ives-Deliperi, V. L., Solms, M., & Meintjes, E. M. (2011). The neural substrates of mindfulness: an fMRI investigation. *Social Neuroscience*, *6*(3), 231-242.

Iwanaga, M. (1995a). Harmonic relationship between tempi and heart rate. *Perceptual and Motor Skills, 81*, 67 – 71.

Iwanaga, M. (1995b). Relationship between heart rate and preference for tempo of music. *Perceotual and Motor Skills, 81*, 435 – 440.

Iwanaga, M., Kobayashi, A., & Kawasaki, C. (2005). Heart rate variability with repetitive exposure to music. *Biological psychology*, *70*(1), 61-66.

Jacobsen, P., Morris, E., Johns, L., & Hodkinson, K. (2011). Mindfulness groups for psychosis; key issues for implementation on an inpatient unit. *Behavioural and Cognitive Psychotherapy*, *39*(03), 349-353.

Javitt, D.C., & Coyle, J.T. (2004). Decoding Schizophrenia. *Scientific American, 290*, 48 – 55.

Jensen, K. L. (2001). The effects of selected classical music on self-disclosure. *Journal of music therapy*, *38*(1), 2-27.

Johnson, C. M. (1996). Musicians' and nonmusicians' assessment of perceived rubato in musical performance. *Journal of Research in Music Education*, *44*(1), 84-96.

Jones, M. R., Boltz, M., & Kidd, G. (1982). Controlled attending as a function of melodic and temporal context. *Perception & Psychophysics*, *32*(3), 211-218.

Jones, M. R., Moynihan, H., MacKenzie, N., & Puente, J. (2002). Temporal aspects of stimulus-driven attending in dynamic arrays. *Psychological science*, *13*(4), 313-319.

Jourdain, R. (1997). *Music, the Brain, and Ecstasy*. New York, NY: Avon Books.

Kendall, R. A., & Carterette, E. C. (1990). The communication of musical expression. *Music Perception*, 129-163.

Keele, S. W. (1968). Movement control in skilled motor performance. *Psychological bulletin*, *70*(6, Part 1), 387-403.

Keele, S. W., & Summers, J. J. (1976). The structure of motor programs. In G. E. Stelmach (Ed.), *Motor Control: Issues and Trends* (pp. 109-142). New York: Academic.

Khoury, B., Lecomte, T., Fortin, G., Masse, M., Therien, P., Bouchard, V., Chapleau, M. A., Paquin, K., & Hofmann, S. G. (2013). Mindfulness-based therapy: A comprehensive meta-analysis. *Clinical Psychology Review*, *33*(6), 763-771.

Khoury, B., Lecomte, T., Gaudiano, B. A., & Paquin, K. (2013). Mindfulness interventions for psychosis: a meta-analysis. *Schizophrenia Research*, *150*(1), 176-184.

Koelsch, S. (2010). Towards a neural basis of music-evoked emotions. *Trends in Cognitive Sciences*, *14*(3), 131-137.

Koelsch, S., Fritz, T., & Schlaug, G. (2008). Amygdala activity can be modulated by unexpected chord functions during music listening. *Neuroreport*, *19*(18), 1815-1819.

Koelsch, S., Gunter, T. C., Wittfoth, M., & Sammler, D. (2005). Interaction between syntax processing in language and in music: An ERP study. *Journal of Cognitive Neuroscience*, *17*(10), 1565-1577.

Koelsch, S., Kilches, S., Steinbeis, N., & Schelinski, S. (2008). Effects of unexpected chords and of performer's expression on brain responses and electrodermal activity. *PLoS One*, *3*(7), e2631.

Koelsch, S., & Mulder, J. (2002). Electric brain responses to inappropriate harmonies during listening to expressive music. *Clinical Neurophysiology*, *113*(6), 862-869.

Koelsch, S., Skouras, S., Fritz, T., Herrera, P., Bonhage, C., Küssner, M. B., & Jacobs, A. M. (2013). The roles of superficial amygdala and auditory cortex in music-evoked fear and joy. *NeuroImage*, *81*, 49-60.

Kohut, D. L. (1985). *Musical Performance: Learning Theory and Pedagogy*. New Jersey: Prentice-Hall.

Koszycki, D., Benger, M., Shlik, J., & Bradwejn, J. (2007). Randomized trial of a meditation-based stress reduction program and cognitive behavior therapy in generalized social anxiety disorder. *Behaviour Research and Therapy*, *45*(10), 2518-2526.

Kreutz, G., Murcia, C. Q., & Bongard, S. (2012). Psychoneuroendocrine research on music and health: an overview. *Music, Health, and Wellbeing*, 457-476.

Kronman, U., & Sundberg, J. (1987). Is the musical ritard an allusion to physical motion. *Action and perception in rhythm and music*, *55*, 57-68.

Krumhansl, C. L. (1979). The psychological representation of musical pitch in a tonal context. *Cognitive Psychology*, *11*(3), 346-374.

Krumhansl, C. L. (1990). Tonal hierarchies and rare intervals in music cognition. *Music Perception*, 309-324.

Krumhansl, C. L. (1991a). Melodic structure: Theoretical and empirical descriptions. In J. Sundberg (Ed.), *Music, Language, Speech, and the Brain* (pp. 269-283). London, England: MacMillan.

Krumhansl, C. L. (1991b). Music psychology: Tonal structures in perception and memory. *Annual review of psychology*, *42*(1), 277-303.

Krumhansl, C. L. (1995). Music psychology and music theory: Problems and prospects. *Music Theory Spectrum*, *17*(1), 53-80.

Krumhansl, C. L. (1996). A perceptual analysis of Mozart's Piano Sonata K. 282: Segmentation, tension, and musical ideas. *Music Perception*, 401-432.

Krumhansl, C. L., & Kessler, E. J. (1982). Tracing the dynamic changes in perceived tonal organization in a spatial representation of musical keys. *Psychological Review*, *89*(4), 334-368.

Lahiri, N., & Duncan, J. S. (2007). The Mozart effect: encore. *Epilepsy & Behavior*, *11*(1), 152-153.

Lai, V. T., Hagoort, P., & Casasanto, D. (2012). Affective primacy vs. cognitive primacy: dissolving the debate. *Frontiers in Psychology*, *3*, 243.

Large, E. W. (2008). Resonating to musical rhythm: theory and experiment. *Psychology of time*, 189-232.

Large, E. W., & Snyder, J. S. (2009). Pulse and meter as neural resonance. *Annals of the New York Academy of Sciences*, *1169*(1), 46-57.

Large, E. W., Palmer, C., & Pollack, J. B. (1995). Reduced memory representations for music. *Cognitive Science*, *19*(1), 53-96.

Lashley K. 1951. The problem of serial order in behavior. In Jefferss, L. A. (editor) *Cerebral Mechanisms in Behavior: The Hixon Symposium* (pp. 112–36. New York, NY: Wiley

LeDoux, J. (1998). *The Emotional Brian: The Mysterious Underpinnings of Emotional Life*. New York, NY: Simon and Schuster.

LeDoux, J. (2002). *Synaptic Self: How Our Brains Become Who We Are*. New York, NY: Viking Penguin.

Lehmann, A. C., & Ericsson, K. A. (1993). Sight-reading ability of expert pianists in the context of piano accompanying. *Psychomusicology: Music, Mind & Brain, 12(2),* 182-195.

Lehne, M., Rohrmeier, M., & Koelsch, S. (2013). Tension-related activity in the orbitofrontal cortex and amygdala: an fMRI study with music. *Social Cognitive and Affective Neuroscience*, 141.

Leigh, J., Bowen, S., & Marlatt, G. A. (2005). Spirituality, mindfulness and substance abuse. *Addictive behaviors*, *30*(7), 1335-1341.

Lévi-Strauss, C. (1970). *The Raw and the Cooked*. New York, NY: Harper & Row.

Levitin, D. J., & Menon, V. (2003). Musical structure is processed in "language" areas of the brain: a possible role for Brodmann Area 47 in temporal coherence. *Neuroimage*, *20*(4), 2142-2152.

Levitin, D. J., & Tirovolas, A. K. (2009). Current advances in the cognitive neuroscience of music. *Annals of the New York Academy of Sciences*, *1156*(1), 211-231.

Levy, J. M. (1995). Beginning-ending ambiguity: consequences of performance choices. *See Rink*, *1995*, 150-69.

Lerdahl, F. (1996). Calculating tonal tension. *Music Perception*, 319-363.

Lerdahl, F., & Jackendoff, R. (1983). *A generative theory of tonal music*. MIT press.

Libet, B. (2003). The timing of mental events: Libet's experimental findings and their implications. *Consciousness and Cognition, 12*, 291 – 299.

Libet, B. (2003). Timing of conscious experience: Reply to the 2002 Commentaries on Libet's Findings. *Consciousness and Cognition, 12*, 321 – 331.

Linehan, M. (1993). *Cognitive-behavioral treatment of borderline personality disorder*. New York, NY: Guilford Press.

Llinas, R.R. (2002). *I of the Vortex: From Neurons to Self*. Cambridge, MA: MIT Press.

Lynch, T., Trost, W., Salsman, N. & Linehan, M. (2007). Dialectical behavioural therapy for borderline personality disorder. *Annual Review of Clinical Psychology, 3*, 181–205.

Ma, S. H., & Teasdale, J. D. (2004). Mindfulness-based cognitive therapy for depression: replication and exploration of differential relapse prevention effects. *Journal of Consulting and Clinical Psychology*, *72*(1), 31-40.

MacLean, P.D. (1990). *The Triune Brain in Evolution: Role in Paleocerebral Functions*. New York, NY: Plenum Press.

Marmel, F., Perrin, F., & Tillmann, B. (2011). Tonal expectations influence early pitch processing. *Journal of Cognitive Neuroscience*, *23*(10), 3095-3104.

McAuley, J. D., & Fromboluti, E. K. (2014). Attentional entrainment and perceived event duration. *Philosophical Transactions of the Royal Society of London: Biological Sciences*, *369*(1658), 20130401.

McPherson, G. E. (1995). The assessment of musical performance: Development and validation of five new measures. *Psychology of Music*, 23(2), 142-161.

Miller, J. J., Fletcher, K., & Kabat-Zinn, J. (1995). Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders. *General Hospital Psychiatry*, *17*(3), 192-200.

Milsum, J.H. (1966). *Biological Control Systems Analysis*. New York, NY: McGraw-Hill.

Miklowitz, D. J., Alatiq, Y., Goodwin, G. M., Geddes, J. R., Fennell, M. J., Dimidjian, S., Hauser, M. & Williams, J. M. G. (2009). A pilot study of mindfulness-based cognitive therapy for bipolar disorder. *International Journal of Cognitive Therapy*, *2*(4), 373-382.

McPherson, G. E., Bailey, M., & Sinclair, K. E. (1997). Path analysis of a theoretical model to describe the relationship among five types of musical performance. *Journal of Research in Music Education*, *45*(1), 103-129.

Menon, V., & Levitin, D. J. (2005). The rewards of music listening: response and physiological connectivity of the mesolimbic system. *Neuroimage*, *28*(1), 175-184.

Mead, G. H., & Mind, H. (1934). *Self and society*. Chicago, IL: University of Chicago.

Meyer, L. B. (1956). *Emotion and meaning in music*. Chicago, IL: University of Chicago Press.

Meyer, L. B. (1957). Meaning in music and information theory. *Journal of Aesthetics and Art Criticism*, 412-424.

Meyer, L. B. (1973). *Explaining music: Essays and explorations*. Los Angeles, CA: University of California Press.

Meyer, L. B. (1983). Innovation, choice, and the history of music. Critical Inquiry, 517-544.

Miller, G. F. (2000). Evolution of human music through sexual selection. In N. L. Wallin, B. Merker, & S. Brown (Eds.), *The Origins of Music* (pp. 329-360). New York: MIT.

Moore, R. S. (1994). Effects of age, sex, and melodic/harmonic patterns on vocal pitch-matching skills of talented 8-11-year-olds. *Journal of Research in Music Education*, *42*(1), 5-13.

Nakamura, T. (1987). The communication of dynamics between musicians and listeners through musical performance. *Perception & psychophysics*, *41*(6), 525-533.

Narmour, E. (1996). Analyzing form and measuring perceptual content in Mozart's Sonata K. 282: A new theory of parametric analogues. *Music Perception*, 265-318.

Narmour, E. (1990). *The Analysis and Cognition of Basic Melodic Structures: The Implication-Realization Model.* Chicago, IL: University of Chicago.

Nicholls, J. G., Martin, A. R., Wallace, B. G., & Fuchs, P.A. (2001). *From Neuron to Brain*, 4th edition. Sunderland, MA: Sinauer Associates, Inc.

Nuki, M. (1984). Memorization of piano music. *Psychologia, 27*, 157-63.

Nummenmaa, L., Hyönä, J., & Calvo, M. G. (2010). Semantic categorization precedes affective evaluation of visual scenes. *Journal of Experimental Psychology: General*, *139*(2), 222.

Ornstein, R. & Thompson, R. F. (1984). *The Amazing Brain*. Boston, MA: Houghton Mifflin.

Palmer, C. (1989). Mapping musical thought to musical performance. *Journal of Experimental Psychology: Human Perception and Performance*, *15*(2), 331.

Palmer, C. (1992). The role of interpretive preferences in music performance. In M. R. Jones & S. Holleran (Eds.), *Cognitive Bases of Musical Communication* (pp. 249-262). Washington, DC: American Psychological Association.

Palmer, C. (1996). Anatomy of a performance: Sources of musical expression. *Music Perception*, 433-453.

Palmer, C. (1997). Music performance. *Annual Review of Psychology*, *48*(1), 115-138.

Palmer, C., & Krumhansl, C. L. (1990). Mental representations for musical meter. *Journal of Experimental Psychology: Human Perception and Performance*, *16*(4), 728.

Palmer, C., & Van de Sande, C. (1993). Units of knowledge in music performance. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *19*(2), 457-470.

Palmer, C., & Van de Sande, C. (1995). Range of planning in music performance. *Journal of Experimental Psychology: Human Perception and Performance*, *21*(5), 947.

Panskepp, J. (1995). The emotional sources of "chills" induced by music. *Music Perception, 13*, 171-207.

Patel, A. D. (1998). Syntactic processing in language and music: different cognitive operations, similar neural resources?. *Music Perception16*(1), 27-42.

Patel, A. D. (2003). Language, music, syntax and the brain. *Nature neuroscience*, *6*(7), 674-681.

Patel, A., Gibson, E., Ratner, J., Besson, M., & Holcomb, P. (1998). Processing syntactic relations in language and music: An event-related potential study. *Cognitive Neuroscience, Journal of*, *10*(6), 717-733.

Patrick, G. (1999). The effect of vibroacoustic music on symptom reduction. *IEEE Engineering in Medicine and Biology, 18*, 97-100.

Perlman, M., & Krumhansl, C. L. (1996). An experimental study of internal interval standards in Javanese and Western musicians. *Music Perception*, 95-116.

Pinker, S. (1997). How the mind works. 1997. *NY: Norton*.

Potter, R. F., Lang, A., & Bolls, P. D. (2008). Identifying structural features of audio: Orienting responses during radio messages and their impact on recognition. *Journal of Media Psychology: Theories, Methods, and Applications*, *20*(4), 168.

Pratt, G., Henson, M., & Cargill, S. (1990). *Aural awareness: Principles and practice*. Milton Keynes: Open University Press.

Prophet, E.C. & Sparado, P. (2000). *Your Seven Energy Centers*. Corwin Springs, MO: Summit University Press.

Priest, P. (1993). Putting listening first: A case of priorities. *British Journal of Music Education*, *10*(02), 103-110.

Rasch, R. A. (1979). Synchronization in performed ensemble music. *Acta Acustica United with Acustica*, *43*(2), 121-131.

Repp, B. H. (1989). Expressive microstructure in music: A preliminary perceptual assessment of four composers "pulses". *Music Perception*, 243-273.

Repp, B. H. (1990). Patterns of expressive timing in performances of a Beethoven minuet by nineteen famous pianists. *The Journal of the Acoustical Society of America*, *88*(2), 622-641.

Repp, B. H. (1992). Probing the cognitive representation of musical time: Structural constraints on the perception of timing perturbations. *Cognition*, *44*(3), 241-281.

Repp, B. H. (1995). Detectability of duration and intensity increments in melody tones: A partial connection between music perception and performance. *Perception & Psychophysics*, *57*(8), 1217-1232.

Rosenbaum, D. A., Weber, R. J., Hazelett, W. M., & Hindorff, V. (1986). The parameter remapping effect in human performance: Evidence from tongue twisters and finger fumblers. *Journal of Memory and Language*, *25*(6), 710-725.

Rosner, B. S., & Meyer, L. B. (1982). Melodic processes and the perception of music. In D. Deutsch (Ed.) *The Psychology of Music*, 317-341, New York, NY: Academic Press, Inc.

Rosner, B. S., & Meyer, L. B. (1986). The perceptual roles of melodic process, contour, and form. *Music Perception, 4*(1), 1-40.

Russell, P.J. (2005). *iGenetics: A Mendelian Approach*. New York, NY: Benjamin Cummings.

Schellenberg, E. G. (1996). Expectancy in melody: Tests of the implication-realization model. *Cognition*, *58*(1), 75-125.

Schellenberg, E. G. (1997). Simplifying the implication-realization model of melodic expectancy. *Music Perception*, 295-318.

Schellenberg, E. G., Adachi, M., Purdy, K. T., & McKinnon, M. C. (2002). Expectancy in melody: tests of children and adults. *Journal of Experimental Psychology: General*, *131*(4), 511-537.

Schenker, H. (1933). *Five Graphic Music Analyses (Fünf Urlinie-Tafeln)*. Courier Dover Publications.

Schleuter, S. L. (1984). *A Sound Approach to Teaching Instrumentalists: An Application of Content and Learning Sequences*. Kent State University Press.

Schmuckler, M. A. (1989). Expectation in music: Investigation of melodic and harmonic processes. *Music Perception*, 109-149.

Schmuckler, M. A. (1990). The performance of global expectations. *Psychomusicology: A Journal of Research in Music Cognition*, *9*(2), 122-147.

Schmuckler, M. A., & Boltz, M. G. (1994). Harmonic and rhythmic influences on musical expectancy. *Perception & Psychophysics*, *56*(3), 313-325.

Schneck, D. J. (1990). *Engineering Principles of Physiologic Function*. New York, NY: New York University Press.

Schneck, D. J. (1992). *Mechanics of Muscle* (2^{nd} ed.). New York, NY: New York University Press.

Schneck, D. J. (1997). A paradigm for the physiology of human adaptation. In: D.J. Schneck and J.K. Schneck (Eds.) *Music in Human Adaptation*, St. Louis, MD: MMB Music.

Schneck, D. J. (2002). Bad stress. *American Laboratory, 34*, 4.

Schneck, D. J. (2003). The physiology of relativity. *American Biotech Laboratory, 21*, 4.

Schneck, D. J. & Berger, D. S. (1999). The role of music in physiologic accommodation: Its ability to elicit reflexive, adaptive, and inscriptive responses. *IEEE Engineering in Medicine and Biology, 18*, 44-53.

Schneck, D. J. & Berger, D. S. (2006). *The Music Effect*. Philadelphia, PA: Jessica Kingsley Publishers.

Schneck, J. K. & Schneck, D. J. (1996). Sensory integration and differentiation of auditory information as it relates to music. Technical Report VPI-E-96-02. Polytechnic Institute & State University, Blacksburg, VA.

Seashore, C. E. (Ed.). (1936). *Objective analysis of musical performance, 4*. The University Press.

Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2012). *Mindfulness-based cognitive therapy for depression*. Guilford Press.

Shaffer, L. H. (1981). Performances of Chopin, Bach, and Bartok: Studies in motor programming. *Cognitive Psychology*, *13*(3), 326-376.

Shaffer, L. H. (1984). Timing in solo and duet piano performances. *The Quarterly Journal of Experimental Psychology*, *36*(4), 577-595.

Shaffer, L. H., & Todd, N. P. (1987). The interpretive component in musical performance. *Action and perception in rhythm and music*, 139-152.

Shevrin, H., Ghanam, J.H., & Libet, B. (2002). A neural correlate of consciousness related to repression. *Consciousness and Cognition, 11*, 334-341.

Shinar, D., & Jones, M. R. (1973). Effects of set-inducing instructions on recall from dichotic inputs. *Journal of experimental psychology*, *98*(2), 239 - 245.

Shove, P., & Repp, B. H. (1995). Musical motion and performance: Theoretical and empirical perspectives. *The practice of performance*, 55-83.

Sidorenko, V. N. (2000). Effects of the medical resonance therapy music in the complex treatment of epileptic patients. *Integrative Physiological and Behavioral Science*, *35*(3), 212-217.

Siegel, J. A., & Siegel, W. (1977). Absolute identification of notes and intervals by musicians. *Perception & Psychophysics*, *21*(2), 143-152.

Sidorenko, V. N. (2000). Effects of the medical resonance therapy music® on haemodynamic parameter in children with autonomic nervous system disturbances. *Integrative Physiological and Behavioral Science*, *35*(3), 208-211.

Sloboda, J. (1974). The Eye-Hand Span--An Approach to the Study of Sight Reading. *Psychology of Music*.

Sloboda, J. A. (1976). The effect of item position on the likelihood of identification by inference in prose reading and music reading. *Canadian Journal of Psychology/Revue Canadienne de Psychologie*, *30*(4), 228-237.

Sloboda, J. A. (1983). The communication of musical metre in piano performance. *The Quarterly Journal of Experimental Psychology*, *35*(2), 377-396.

Sloboda, J. A. (1985). Expressive skill in two pianists: Metrical communication in real and simulated performances. *Canadian Journal of Psychology/Revue Canadienne de Psychologie*, *39*(2), 273-293.

Sloboda, J. A., Davidson, J. W., Howe, M. J., & Moore, D. G. (1996). The role of practice in the development of performing musicians. *British journal of psychology*, *87*(2), 287-309.

Sloboda, J. A. (2005). *Exploring the musical mind: Cognition, emotion, ability, function*. Oxford University Press, USA.

Smith, J. D., & Melara, R. J. (1990). Aesthetic preference and syntactic prototypicality in music: 'Tis the gift to be simple. *Cognition*, *34*(3), 279-298.

Strandley, J.M. (2000). Music research in medical treatment. In: *Effectiveness of Music Therapy Procedures: Documentation of Research and Clinical Practice*, 3rd edition. Silver Spring, MD: National Music Therapy Association.

Standley, J.M. & Prickett, C.A. (editors) (1994). *Research in music therapy. A tradition of excellence: Outstanding reprints from the journal of music therapy 1964-1993*. Silver Spring, MS: National Music Therapy Association.

Steinbeis, N., Koelsch, S., & Sloboda, J. A. (2006). The role of harmonic expectancy violations in musical emotions: Evidence from subjective, physiological, and neural responses. *Journal of Cognitive Neuroscience*, *18*(8), 1380-1393.

Steyn, M. H. (2013). *The impact of psychological skills and mindfulness training on the psychological well-being of undergraduate music students* (Doctoral dissertation, University of Pretoria).

Sundberg, J., Friberg, A., & Fryden, L. (1991). Common secrets of musicians and listeners: An analysis-by-synthesis study of musical performance. *Representing musical structure*, 161-197.

Sutoo, D. E., & Akiyama, K. (2004). Music improves dopaminergic neurotransmission: demonstration based on the effect of music on blood pressure regulation. *Brain research*, *1016*(2), 255-262.

Taylor, R. P., Micolich, A.P., and Jonas, D. (1999). Fractal analysis of Pollock's Drip Paintings. *Nature, 399*, 422-423.

Teasdale, J. D., Segal, Z., & Williams, J. M. G. (1995). How does cognitive therapy prevent depressive relapse and why should attentional control (mindfulness) training help? *Behaviour Research and therapy*, *33*(1), 25-39.

Teasdale, J. D., Segal, Z. V., Williams, J. M. G., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. *Journal of Consulting and Clinical Psychology*, *68*(4), 615-623.

Tillmann, B., Bharucha, J. J., & Bigand, E. (2000). Implicit learning of tonality: a self-organizing approach. *Psychological review*, *107*(4), 885.

Todd, N. (1985). A model of expressive timing in tonal music. *Music Perception*, 33-57.

Todd, N. P. M. (1992). The dynamics of dynamics: A model of musical expression. *The Journal of the Acoustical Society of America*, *91*(6), 3540-3550.

Todd, N. P. M. (1995). The kinematics of musical expression. *The Journal of the Acoustical Society of America*, *97*(3), 1940-1949.

Tomaino, C.E. (2000). Working with images and recollection with elder patients. In: D. Aldridge (Ed.) *Music Therapy in Dementia Care*. London, England: Jessica Kingsley Publishers.

Tortora, G.J. & Grabowski, S.R. (1993). *Principles of Anatomy and Physiology*, 7th edition. New York, NY: Harper Collins College Publishers.

Trehub, S. E., Becker, J., & Morley, I. (2015). Cross-cultural perspectives on music and musicality. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, *370*(1664), 20140096.

Treisman, A. M. (1960). Contextual cues in selective listening. *Quarterly Journal of Experimental Psychology*, *12*(4), 242-248.

Treisman, A. (1964). Monitoring and storage of irrelevant messages in selective attention. *Journal of Verbal Learning and Verbal Behavior*, *3*(6), 449-459.

Tsai, C. G., Chen, R. S., & Tsai, T. S. (2014). The arousing and cathartic effects of popular heartbreak songs as revealed in the physiological responses of listeners. *Musicae Scientiae*, 1029864914542671.

Verleger, R. (1990). P3-evoking wrong notes: unexpected, awaited, or arousing?. *International Journal of Neuroscience*, *55*(2-4), 171-179.

Vorberg, D., & Hambuch, R. (1984). Timing of Two□Handed Rhythmic Performance. *Annals of the New York Academy of Sciences*, *423*(1), 390-406.

Vøllestad, J., Sivertsen, B., & Nielsen, G. H. (2011). Mindfulness-based stress reduction for patients with anxiety disorders: Evaluation in a randomized controlled trial. *Behaviour Research and Therapy*, *49*(4), 281-288.

Wallin, N. L. (1991). *Biomusicology: Neurophysiological, neuropsychological, and evolutionary perspectives on the origins and purposes of music* (Vol. 68). Pendragon Press.

Wanden-Berghe, R. G., Sanz-Valero, J., & Wanden-Berghe, C. (2010). The application of mindfulness to eating disorders treatment: a systematic review. *Eating Disorders*, *19*(1), 34-48.

Wapnick, J., Bourassa, G., & Sampson, J. (1982). The perception of tonal intervals in isolation and in melodic context. *Psychomusicology: A Journal of Research in Music Cognition*, *2*(1), 21.

Williams, J. M. G., Alatiq, Y., Crane, C., Barnhofer, T., Fennell, M. J., Duggan, D. S., Hepburn, S. & Goodwin, G. M. (2008). Mindfulness-based cognitive therapy (MBCT) in bipolar disorder: Preliminary evaluation of immediate effects on between-episode functioning. *Journal of Affective Disorders*, *107*(1), 275-279.

Wilson, D. (1986). Symmetry and its "love-hate" role in music. *Computers & Mathematics with Applications*, *12*(1), 101-112.

Witkiewitz, K., & Bowen, S. (2010). Depression, craving, and substance use following a randomized trial of mindfulness-based relapse prevention. *Journal of Consulting and Clinical Psychology*, *78*(3), 362-374.

Witkiewitz, K., Marlatt, G. A., & Walker, D. (2005). Mindfulness-based relapse prevention for alcohol and substance use disorders. *Journal of Cognitive Psychotherapy*, *19*(3), 211-228.

Woody, C.D. (1982). *Memory, Learning, and Higher Function*. New York, NY: Springer-Verlag.

Wright, C. (2013). *Listening to Western Music*. Boston, MA: Cengage Learning.

Yalch, R., & Spangenberg, E. (1990). Effects of store music on shopping behavior. *Journal of Consumer Marketing*, *7*(2), 55-63.

Zatorre, R. J. & Halpern, A. R. (1979). Identification, discrimination, and selective adaptation of simultaneous musical intervals. *The Journal of the Acoustical Society of America*, *65*(S1), S40-S40.

Zatorre, R. J., & Halpern, A. R. (2005). Mental concerts: musical imagery and auditory cortex. *Neuron*, *47*(1), 9-12.

Zgierska, A., Rabago, D., Chawla, N., Kushner, K., Koehler, R., & Marlatt, A. (2009). Mindfulness meditation for substance use disorders: A systematic review. *Substance Abuse*, *30*(4), 266-294.

APPENDIX A

MinMuList Workbook

MinMuList

Mindful Music Listening Workbook

David M. Rosenblatt, M.A.

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But let’s call it blank.

Table of Contents

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General Information about MinMuList

Target Audience for MinMuList

You!

- MinMuList is designed for everyone
    - Anyone can participate in and expect benefit from MinMuList
        - Regardless of your age, education, culture, music background, mental health concerns, etc.
        - Even if you are attending outpatient therapy, currently in inpatient therapy, just interested in therapy, or just interested in learning about mindfulness
- MinMuList can be completed by an individual or in a group setting (with or without a group leader)
    - If completing by yourself:
        - Please journal during the specified check-in and check-out times
            - This will help you process and consolidate information
        - Keep in mind that discussion will help you understand the material in greater depth
            - A group leader will have skills that help to facilitate discussion
    - If completing in a group:
        - Please respect every participant's opinion and experience
        - Consider journaling on your own to consolidate information
- <u>*You are asked to commit to the specified outline and agenda*</u>
    - Please feel free to seek out further information and integrate it

Overall Structure of MinMuList: Mindful Music Listening Workshop

The big picture

- There will be ten total parts
    - Each part has specified content (please see "Outline of MinMuList" below)
- Each part will last 50 minutes
    - A general agenda specified (please see "Outline of MinMuList" below)
    - It is okay if any one session deviates from the schedule
- Each part will employ multimodal learning techniques
    - This will generate interest and support learning
- The workshop will be a combination of psychoeducation and experiential learning
    - Therefore, a balance between teaching and discussion will be the goal
- <u>*MinMuList practice at home will be encouraged*</u>
    - *The more practiced one is with MinMuList, the easier mindful music listening will be and the greater the benefit to your daily life*

Please note that MinMuList is not intended to replace professional psychological, psychiatric, or medical care. If you have any thoughts of hurting yourself or someone else, please seek immediate professional care or call 911.

Outline of MinMuList

Content Areas Covered by MinMuList

Topic for each part

Part	Topic
1	Introduction to MinMuList
2	Mindfulness Defined
3	Mindfulness Skills
4	Music as Such
5	Gestalt Therapy Theory
6	Music Cognition
7	Engineering Model of Music Audition
8	Principal Elements of Music - Rhythm
9	Principal Elements of Music - Melody
10	Wrap-up

General Session Structure

Timing of each session

Minutes	Topic
5	Review Agenda and Learning Objectives
10	Check-in
15	Theory Discussion
10	Mindful Music Listening Experience
10	Check-out

Please note that Part 1 and Part 10 will slightly deviate from this agenda

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Part 1: Introduction to MinMuList

Expectations and Rules

To support structure and safety, we begin with a discussion of expectations and rules.

You are asked to approach each part and your personal practice with the following:

1. Attentiveness
    a. Focus on the matter at hand is essential for a structured and safe workshop; please attend to whomever is speaking
2. Curiosity
    a. Approaching the current activity from a place of curiosity will make the experience more interesting, informative, and insightful
3. Openness
    a. Each participant is encouraged to share openly and honestly; this will foster a sense of safety and greater insight
4. Acceptance
    a. Each participant will have different levels of knowledge about music and mindfulness; this provides an opportunity to learn from one another

What are your expectations and personal goals for this workshop?

General Part Structure

Parts will have a set structure to support timing and learning.

Each part will have the following activities:

1. Review Agenda and Learning Objectives
    a. Establish clear expectations for what will be covered that day
2. Check-in
    a. Settle in to the moment to get the most out of the workshop
        i. Verbalize current emotional state and bodily felt sense
        ii. Review mindful music listening practice
3. Theory Discussion
    a. Presentation of content for the day
4. Mindful Music Listening Experience
    a. Blend mindfulness practice and music theory
5. Check-out
    a. Reflect on the mindful music listening experience and theory for that day
    b. Consider how to apply this to daily life

Content

Why so serious?

Each content area was chosen specifically in order to give a comprehensive understanding of mindfulness, music, and music listening. This evidence-based approach will provide the best experience and most effective results.

The Power of Music
General effects of music listening

- Music is a universal phenomenon that helped humans evolve communication
  - Brain circuits that are responsible for music and language overlap
    - Both are processed all over the brain, but specifically, music is processed on the right and lyrics on the left
- Background music affects:
  - How much we share when we speak about emotion
    - Slow, positive feeling music supported open discussion
  - Brain activity
    - Music directs attention and emphasizes what to remember
    - Music even reduced aging and seizure events
- Music is emotion
  - Almost anyone can almost always identify the emotion of a song
  - Music brings up emotion in listeners
  - Music causes *thrills and chills*, especially when a voice first enters, a new section begins, and the chorus is about to arrive
  - Regular music listening makes all people feel better
- Music causes changes in body activity, like heart rate, sweating, and tension

Music Performance
Research

- Music performers see benefits from regular performance that include:
  - Better academic performance, memory, hjand-eye coordination, and *executive functions* (like attention, planning, and judgment)

Mindful Music Listening Experience (MMLE): Notice Emotions and Physical Sensations
Musical piece: Mozart, Requiem Mass in D minor (K.626), III. Sequentia, Lacrimosa

- Directions
  - Sit comfortably, with chest upright and open, and take deep breaths
  - Focus on breathing for five minutes, then play the musical piece
  - Notice any physical sensations and emotions, then refocus on the music

Check-out
Reflect on your personal experience with music

- What physical sensations did you feel during the MMLE?
  - What aspects of the music contributed to that feeling?
- When has music helped you remember something?
- What song brings up emotion for you?
- Have you performed music before?
- How can you incorporate the ideas presented here to your daily life?

Part 2: Mindfulness Defined

Review Agenda and Learning Objectives
What we are doing in this part

- Part 2 Learning Objectives
    - Understand the definition of mindfulness
    - Identify the benefits of mindfulness

Check-in
Settle in to the moment

- How are you feeling right now?
- How strong is that emotion, 1 to 10 (weak to strong)?
- How did MinMuList practice go at home?

Theory Discussion
Mindfulness: history, definition, and benefits

Mindfulness is similar to meditation because:

- Both call for a person to bring a focused gentleness to current experience
- Both have goals of attaining a deeper connection to:
    - The current moment
    - The physical, emotional, and mental selves
    - The surroundings, culture, and the world in general
- Both require daily practice to maintain

Mindfulness has been important to psychotherapy since the 1980s

- Corresponding to the "third wave of Cognitive-Behavioral Therapy"
    - Mindfulness is a major component in Dialectical Behavioral Therapy (DBT) and Acceptance and Commitment Therapy (ACT), as well as in various Somatic Psychotherapy approaches
- Mindfulness is safe, effective, and has lasting positive effects when people choose to be mindful
    - According to research on over 12,000 subjects!

One can be mindful for any period of time about anything

- A mindful pause can help you focus on writing an important email
- A mindful prayer can settle unpleasant emotion around loss
- A mindful outlook can guide wise decision making
- *Regular mindful music listening can support a mindful attitude which will translate to numerous health benefits*

The broad definition of Mindfulness

- A lifestyle that focuses on the here-and-now through a non-judgmental, observational present-centered approach where each figure of experience is acknowledged and accepted as it is

    Say that ten times fast!

The two components of mindfulness

- Self-regulation of attention
    - Choose the focus of your attention
        - It is okay if you become distracted, just gently return your attention to your focus
    - Approaching each moment this way will support a deeper experience
- Attitude of curiosity, openness, and acceptance
    - Accept yourself as your are in the moment, rather than deny a part of yourself, or force yourself to be a certain way (be mad if your mad, rather than say, "I have to be happy"
        - *Curiosity* means you notice thoughts feelings, or sensations
        - *Openness* means you are a container for your experience; you are lasting and experience is temporary
        - *Acceptance* means you have a matter-of-fact take on your current experience
    - Actively choosing this worldview supports insight into your true self

A mindful lifestyle will lead to feeling more relaxed and satisfied

- Your behavior will be aligned with your true values and desires
- You will be more in tune with yourself and others

Benefits of mindfulness
What the data show

- Mindfulness helps reduce:
    - Unpleasant mood states; symptoms of depression and anxiety; disordered eating (such as eating too much); cravings to use substances; suicidal ideations
- Mindfulness helps increase:
    - Distress tolerance; Whole-brain activity; integration of all available information; informed decision making; positive mood; immune system function; overall health and wellness

Mindful of what?
Pieces of experience towards which we can be mindful

- Thoughts: like memories, wants, goals, or "should" statements
- Emotions: like happiness, sadness, joy, or anger
- Bodily felt sensations: like tension in your shoulders, butterflies in your stomach, clenched fists, or even feeling "grounded in the moment"
- External sensations: like what we see, hear, taste, feel, or smell

Mindful Music Listening Experience (MMLE): Track Mental Images
Musical piece: Tchaikovsky, Swan Lake, Swan Theme

- Directions
  - Sit comfortably, with chest upright and open
  - Take regular, deep breaths
  - Focus on breathing for five minutes, then play the musical piece
  - Focus on the music, notice any mental images that come up, and refocus on music

Check-out
Reflect on your personal experience with mindfulness

- What mental images did you notice during the MMLE?
  - What aspects of the music contributed to those images?
- Are there other times in life when you notice mental images paired with sounds?
- What is your personal experience with mindfulness?
- When and where are you most mindful?
- How can you incorporate mindfulness into your daily life?

Please find journal space on the next page…

Journal space
Write any of your reflections on today's work here

Part 3: Mindfulness Skills

Review Agenda and Learning Objectives
What we are doing in this part

- Part 3 Learning Objectives
  - Understand how to practice mindfulness
  - Be able to recite one mindfulness script

Check-in
Settle in to the moment

- How are you feeling right now?
- How strong is that emotion, 1 to 10 (weak to strong)?
- How did MinMuList, and mindfulness, practice go at home?

Theory Discussion
Mindfulness Skills

Review of Mindfulness

- Mindfulness is an approach to life where someone chooses to attend to a specific piece of experience, such as the breath, while maintaining a curios, open, and accepting attitude
- This means the person does not get carried away with thoughts, or believes a thought to be truth
- The person steps back from his thoughts and emotions in order to recognize that he will live for many years, while the thoughts and emotions are temporary
- Mindfulness is a way of being that is cultivated through practice

Mindfulness Practice

- Just like any other hobby or skill, it takes practice to make it effective and enjoyable
  - Some people find being mindful difficult, or they become more nervous when they first start practicing mindfulness
    - That's okay! Stick with it, and you see the benefits of mindfulness
- Anyone can practice mindfulness at any time
  - The key is to figure out what works for you
  - Remember: if you want to change, you must change your approach to life; avoiding change is like supporting things as they are
    - If you choose to be mindful even when you are busy, you prioritize health

- There are three important ways to become more mindful:
    - o 1) Set aside time each day to be mindful
        - ▪ Try to put this into your schedule; do it *even though* you are busy
        - ▪ Start with 20+ minutes when first you wake up or are going to sleep
            - A MinMuList part would be a good start
    - o 2) Gently remind yourself throughout the day to be mindful
        - ▪ Try a reminder on your phone, or carry an index card in your pocket
        - ▪ Take a 30-second time-out to refocus and ground yourself
            - The MinMuList "Check-in" would be a good start

  3). Being a client in mindfulness-based psychotherapy.
- Search out other people and resources to grow your mindfulness network
    - o Friends may also adopt a mindful attitude; the internet has mindful audio tracks

"Labeling": a mindfulness script to get you started

- So that you can focus on being mindful, familiarize yourself with the script beforehand, or record yourself reading it aloud, or have someone read the script to you
- It should last at least 10 minutes, although you can spend as much time as you like

Labeling Script: *Read a line every 30 seconds or so*

- Find a quiet space and silence your cell phone
- Sit upright in a chair with your hands in your lap, or lay on the floor with your hands at your sides
- Close your eyes, or gaze at a spot ahead of you
- Focus on your breathing, just noticing it
- Feel the air fills your lungs, and feel your lungs empty of air
- Notice if your inhale touches your exhale, or if there is a pause
- Notice if something distracts you from your breath
- It may be tempting to elaborate on the distraction
- However, simply label the distraction, like "Thought," or, "Emotion," or ,"Sound"
- Refocus on your breath
- Continue to label any distractions, and refocus on your breath
- With each exhale, notice your bodily felt sensations
- Now slowly bring your attention back to the room
- Notice the sensation of your body in the chair
- Notice any sounds
- Notice the temperature of the air
- Slowly open your eyes, notice what you see
- Rejoin the flow of the day.

Mindful Music Listening Experience (MMLE): Notice relaxation building
Musical piece: Chopin, Nocturne No.2 in E-flat major, Opus 9

- Directions
    - Sit comfortably, with chest upright and open, and take regular, deep breaths
    - Focus on breathing for a moment, then play the musical piece
    - Focus on the music and notice how your body follows the flow of the music

Check-out
Reflect on your personal experience with mindfulness

- What relationship between the music and your body did you notice during the MMLE?
    - What aspects of the music contributed to those effects?
- Where else in life do external events affect how you feel?
- What was it like to be mindful?
- What thought themes emerged during the mindful experience?
- How can you further incorporate mindfulness into your daily life?

Please find journal space on the next page…

Journal space

Write any of your reflections on today's work here

Part 4: Music as Such

Review Agenda and Learning Objectives
What we are doing in this part

- Part 4 Learning Objectives
  - Have a simple understanding of physics of music and auditory system
  - Name the elements of music and some rules of Western classical music

Check-in
Settle in to the moment

- How are you feeling right now?
- How strong is that emotion, 1 to 10 (weak to strong)?
- How did MinMuList practice, and general mindfulness practice, go at home?

Theory Discussion
Music as Such

Physics of music

- Music is kinetic energy in the form of precisely controlled sound waves
- Sound waves are created by energy released by a noise generator, such as:
  - A vibrating object, like a guitar string, or colliding objects, like hands clapping
- Noise generators precisely control sound waves and can create specific sounds
  - Change any aspect of the noise generator, and the sound changes
    - For example, changing the thickness or length of a guitar string
- Sound waves have physical properties, such as a cycle that looks like a peak and a valley when it is graphed out mathematically
  - The faster the cycle, the higher the pitch
    - A mouse squeak is high pitched, while a lion roar is low pitched
  - The taller the peak and lower the valley, the louder the sound
    - A whisper has a short peak/shallow valley; a jet has a tall peak/low valley
- Kinetic energy is the potential for a moving object to hit and move another object
  - Think of a billiard ball hitting another billiard ball
    - The faster the first ball is moving, the louder the “clack” when they hit and the faster the second ball will move after they hit

Auditory system

- Essentially, the sound takes the following pathway to the brain:
  - Sound → ear drum → ossicles → cochlea → hair cells → nerve → brain
- A sound wave goes out in all directions, like a ripple of water in a pond
- When the sound wave reach an ear, the sound wave is funneled into the ear canal
- The sound waves bump up against the eardrum, and the eardrum vibrates the ossicles
  - Ossicles are a series of three small bones
- The ossicles vibrate the oval window, which then vibrates liquid in the cochlea
  - The cochlea is spiral shaped, like a snail shell, and it tapers in diameter
- The liquid then vibrates hair cells attached to the cochlea that match the wave cycle
  - There are many hair cells, each one matches a different wave cycle/pitch
- The vibrating hair cells then send electrical signals through the auditory/cochlear nerve
  - The auditory nerve also carries information about balance
- The auditory nerve sends signals to the cochlear nucleus, which send information to the superior olivary nucleus, which sends information to the inferior colliculus, which sends information to the medial geniculate body, which sends information to the limbic system and primary auditory cortex

Elements of Music

- *Elements of Music* are the ways in which sound is precisely controlled to make music
- They are:
  - **Rhythm**: regular pattern of sound events that alternates with silence; moves you
    - Examples: ONE-two-ONE-two; or one-TWO-one-TWO
  - **Melody**: the sounding of related pitches over time; the tune you hum
    - Example: lyrics, such as, “Mary had a little lamb”
  - **Harmony**: the sounding of two, related melodic lines at the same time
    - Example: singing along with a guitar
  - **Timbre**: the color, quality, or texture of a sound
    - Example: the sound of a violin compared to the sound of a flute
  - **Dynamics**: volume
  - **Form**: the overall result of the elements within the song structure selected
    - Example: a rock song compared to a symphony

Some Rules of Western Classical Music

- Notes are: C-C#-D-D#-E-F-F#-G-G#-A-A#-B; or C-Db-D-Eb-E-F-Gb-G-Ab-A-Bb-B
    - o "#" is a sharp, "b" is a flat; they represent the half-step between whole notes
- Octave: the notes repeat and sound "the same," but higher or lower; e.g., C1-C2
- The *tonic* acts as the home for the musical piece; the melodies and chords relate to it
- Melodies will flow along adjacent notes and reverse direction after a jump
    - o Example: C-D-E-G-A-B-C; or C-D-A-G-E-D-C
- Chords are the sounding of multiple notes at once; there are many types of chords
- Chord progressions follow patterns: you can make safe predictions about what's coming
- Common instruments types (examples): strings (violins, bass); woodwinds (flute, clarinet); brasses (trumpet, trombone); and percussion (cowbell, timpani)
    - o Instruments are usually grouped based on how they generate sound
- Music is thought of as the cycle: build tension – release tension

Mindful Music Listening Experience (MMLE): Track the Note Progression
Musical piece: Handel, Messiah Overture

- Directions
    - o Sit comfortably, with chest upright and open, and take regular, deep breaths
    - o Focus on breathing for five minutes, then play the musical piece
    - o Focus on the music, notice the relationship of the notes over time

Check-out
Reflect on your experience with note progressions

- What did you notice about the relationship of the notes during the MMLE?
- Did you begin to predict what notes would be played?
- How did you feel when your predictions were accurate?
- How can you use music theory to make your daily life healthier?

Please find journal space on the next page…

Journal space

Write any of your reflections on today's work here

Part 5: Gestalt Therapy Theory

Review Agenda and Learning Objectives

What we are doing in this part

- Part 5 Learning Objectives
  - Develop a general understanding of primary concepts of Gestalt Therapy Theory
  - Be able to name the "Forms of Contact"

Check-in

Settle in to the moment

- What emotion are you feeling right now?
- How strong is that emotion, 1 to 10 (weak to strong)?
- How did MinMuList practice, and application of basic music theory, go at home?

Theory Discussion

Gestalt Therapy Theory

Broadly

- Gestalt Therapy Theory is an existential, phenomenological, process-oriented therapy
- It is the theoretical foundation for the psychological mechanisms of change
- The goal is to enhance moment-to-moment awareness about *how* you perceive, organize, and react to information based on *what* you know and believe
- I-Other: the basic division; there is an "I," and there is "Other"
  - I: a person and everything about that person (e.g., his body, mind, and emotions)
  - Other: everything outside of the I (e.g., the air, other people, history, future, etc.)

Awareness

- Understanding the dynamic flow of how "I" interact with "myself" and the "other"
- Low awareness: "I" act out of emotion; "I" try to live up to others' standards for "me"
- High awareness: "I" follow my values; "I" take care of my health, then help others
- Enhance awareness by asking yourself these questions:
  - "What am I doing?"
  - "What am I thinking?"
  - "What am I feelings?"
  - "What am I expecting?"
  - "What am I avoiding?"
  - "How do I know this?"

Gestalt Figure Formation and Resolution Process (GFFRP)

- Each person has a mind; each mind has a predictable way to organize and act upon information; that way is called the Gestalt Figure Formation and Resolution Process
- Health is when this is a smooth process; illness is when the process is interrupted
- Figure: whatever is most prominent in the mind (e.g., a thought, feeling, or sensation)
- Ground: what person knows about the figure (e.g., traits of the figure; current context)
- The figure organizes the ground, and the ground gives meaning to the figure
    - For example, a yell is a figure, and a rock concert is the ground; the meaning of the yell is different if the yell occurs in a dark alley
- Figures may be simple, like an itch, or complex and long-lasting, like raising a child
- The steps in the GFFRP:
    - **Figure formation**: I begin to become aware of something
    - **Figure sharpening**: I become clearer about what is popping up in my mind
    - **Self/environmental scan**: I see what I can do about the figure
    - **Plan**: I decide on what to do about the figure, then organize my behavior
    - **Execute**: I carry out my plan
    - **Assimilate**: I reflect on the experience to recognize the figure and act quicker

Zones of Awareness

- Each person has three Zones of Awareness that must be balanced to achieve health
    - **Mind**: the realm of thoughts, memories, and learning
    - **Body**: the physical person, such as appearance, heart rate, and emotions
    - **Environment**: the “other” that exists outside of the person’s mind and body
- A person may become fixated on one zone, or the boundary may change
    - For example, someone may fixate on appearance and forget to be friendly
    - Or, a person may let anxiety overpower the possibility of enjoyment
- In general, a person relates to each zone in a characteristic way that can change

Forms of Contact

- Health is when a person *chooses how to relate* based on *current awareness*
- The forms of contact are learned in step-wise fashion, and can be healthy
- Each person relates to each zone of awareness and each step of the GFFRP
    - This in a characteristic way that way learned at some point
- The forms are:
    - **Confluence**: loss of division between "I" and "other"; what you feel is what I feel
    - **Introjection**: "I" define "myself" based on what "other" says; such as, "I am weak," or, "I can't do what I want to do"
    - **Projection**: "I" confuse "other" with myself; when I am mad I ask, "Are you mad?"
    - **Retroflection**: "I" won't do what I need, so it manifests differently; I get a headache because I won't express that I am upset
    - **Deflection**: "I" block an insult or compliment from "other"
    - **Full contact**: "I" respect, and relate openly and honestly to, "other"

Mindful Music Listening Experience (MMLE): Track the Song, Emotion, Mental Images

Musical piece: Beethoven, Rage over a lost penny, Opus 129

- Directions
    - Sit comfortably, with chest upright and open, and take regular, deep breaths
    - Focus on breathing for a moment, then play the musical piece
    - Focus on song rhythm and melody as they affect emotion and mental images

Check-out

Reflect on your experience during the MMLE

- How did the song's rhythm and melody affect your emotion and mental images?
- What was the dynamic flow of emotion and mental images like?
- How does this relationship of events, emotion, and mental images play out in daily life?
- How can you use Gestalt Therapy Theory in your daily life?

Please find journal space on the next page…

Journal space
Write any of your reflections on today's work here

Part 6: Music Cognition

Review Agenda and Learning Objectives
What we are doing in this part
- Part 6 Learning Objectives
  - o Develop a general understanding of the process of Music Cognition
  - o Be able to describe the difference between affect and emotion

Check-in
Settle in to the moment
- What emotion are you feeling right now?
- How strong is that emotion, 1 to 10 (weak to strong)?
- How did MinMuList practice, and application of Gestalt Therapy Theory, go at home?

Theory Discussion
Music Cognition

Leonard B. Meyer's book *Emotion and Meaning in Music* (1956) incorporated information from numerous academic disciplines, like psychology and musicology, to establish the conceptual framework for music cognition, which will now be explored:
- **Music cognition**: how people perceive, organize, and make meaning about music
  - o Strongly influenced by learning; why MinMuList discusses so many things
- **Absolute perspective of music**: music only has meaning when it is compared to itself
  - o Music does not refer to ideas or events outside of music; although lyrics can
- **Affect vs. Emotion**: the difference between sensations and meanings of sensations
  - o Affect: frustrated expectations; music is absolute and therefore affective
  - o Emotion: explaining affect; when people relate music to other life experiences
- **Meaning**: the perception of the relationship of an event and the result of the event
  - o Different attributions lead to different meanings; no attribution, no meaning
  - o Perspective is important: wisdom and health is choosing a flexible perspective
- **Patterns**: patterns in music are important; common patterns include:
  - o **Repetition**: repeating a sound term will make it seem more likely to occur again
  - o **Ambiguity**: unclear, unexpected, or inconsistent musical events

- **Probabilities**: odds that a musical event will happen in a certain way or at a certain time; based in learned relationships
  - **Weakening of shape**: a repeated sound term changes, and requires processing to understanding; the harder you work to understand it, the more satisfying
  - **Saturation**: continued repetition of a sound term, creates expectation for change
- **Gestalt laws**: typical ways in which people perceive and organize information; influenced by learning; Meyer identified the most important as:
  - **Proximity**: sound events that occur close in time are seen as related
  - **Directionality**: sound events are expected to move in the same direction
  - **Similarity**: sound events that are similar are seen as related
  - **Closure**: the mind will automatically fill in the gaps, or separate dissimilar objects
  - **Prägnanz**: you see the simplest form of a stimulus; e.g., “VV” is perceived as “W”
- **Preparatory set**: the mental and physical preparation for music listening
  - Depends on context and sets the stage for the perceived meaning of the music
  - This is why MinMuList teaches *mindful* listening: to create a mindful experience!

Meyer also drew a distinction between subjective and objective evidence

- **Subjective** evidence is a reaction, opinion, or feeling
  - It cannot be proven, and must be viewed only as a possibility
- **Objective** evidence is a measurement of some kind
  - It is data, and supports logical explanations for how it occurred
- For music: if you expect the chorus, but instead the song ends, you may become upset
  - The ending is objective, because it really happened; the upset feeling is subjective, because it is a reaction, and another person may have felt happy
- The point is that objective information is the same no matter who looks at it, while subjective information is personal
  - Mindfulness will help a person to manage personal, subjective reactions to objective evidence

Essentially, Meyer believed that:

- People perceive information in characteristic ways and are influenced by learning
- People form expectations based on what they perceive
- Affect arises when expectations are not met
- Mindful people then try to explain: how unfulfilled expectations led to affect

Essentially, Meyer believed that….

- They examine the relationship between *objective* evidence and *subjective* evidence to understand *what* led them to *feel* a certain way

- If they come up with a satisfactory answer, they calm down; if they cannot come up with a satisfactory answer, they become upset
- The person then keeps this in mind the next time they listen to music
- One could see how this information applies to music listening *and* daily life!

Biomusicology

- Biomusicology is the field of study of music's evolutionary benefit
- The most common belief is that music support the evolution of language circuits
- Some critics call music, "Auditory cheesecake," because it is just for pleasure
- Many well-respected psychologists say that the ability to create abstract/imaginary relationships and meaning gave humans an advantage over other animals

Mindful Music Listening Experience (MMLE): Track song patterns and your expectations

Musical piece: Mozart, Symphony No. 25 in G minor, K 183, First Movement

- Directions
    - Sit comfortably, with chest upright and open, and take regular, deep breaths
    - Focus on breathing for a moment, then play the musical piece
    - Focus on how song patterns relate to your expectations and affect

Check-out

Reflect on your experience during the MMLE

- How did the song's patterns relate to your expectations and affect?
- How did you track the song's patterns? By using words, or movements?
- How do you track information in daily life?
- How do you separate objective evidence from subjective evidence?
- How can you use Music Cognition theory to make healthier decisions in your daily life?

Please find journal space on the next page…

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Write any of your reflections on today's work here

Part 7: Engineering Model of Music Audition

Review Agenda and Learning Objectives

What we are doing in this part

- Part 7 Learning Objectives
  - Develop a general understanding of the Engineering Model of Music Audition
  - Be able to describe how mindfulness can help with constant fear or anxiety

Check-in

Settle in to the moment

- What emotion are you feeling right now?
- How strong is that emotion, 1 to 10 (weak to strong)?
- How did MinMuList practice, and application of Music Cognition theory, go at home?

Theory Discussion

Engineering Model of Music Audition (EMMA)

Broadly

- The Engineering Model of Music Audition describes the physical/physiological ways that music is processed by your body, and how music changes how you feel
  - It is based on the book *The Music Effect* by Daniel J. Schneck and Dorita S. Berger (2006)
  - The theory has a hard core made up of facts, and critical processes that explain how the body works like a machine to process and react to music

EMMA Hard Core

1) The human body is a controlled system
   a. The body is a machine that has different levels of organization that increase in size and function, and each level responds to music
   b. Each level has distinct responsibilities, follow specific rules, and is subject to limitations
   c. The levels are: atoms; molecules; cells; tissues; organs; and systems
2) The human body collects ambiensomatic information
   a. Ambient information is information from the environment
      i. It is collected through the senses: hearing, vision, smell, taste, and touch

    b. Somatic information is information about the body
        i. It is collected through internal sensors, like proprioceptors in joints to determine where a limb is located in space relative to the rest of the body
3) The human body responds to information in a purposeful and adaptive way
    a. This is done to support survival, and it follows the path of least resistance

EMMA Critical Processes

1) Detection of stimuli
    a. Stimuli is information collected by the human body
    b. Stimuli is checked against "operating set-points" to make sure that the body is operating at optimal levels
2) Physiological control and entrainment
    a. If stimuli indicate that the human body is not operating at optimal levels, then the body will put out energy to return to optimal levels
    b. Responses can be short, medium, or long-term
    c. Practicing mindfulness will lead to a long-term change
3) Biofeedback and modifying set-points
    a. Biofeedback is mindful monitoring of physiological activities, like heart rate
    b. Biofeedback allows a person to notice when they are feeling anxious so they know when to enact calming behaviors
        i. For example: when breathing rapidly, breathe slowly to relax
4) Information-processing principles and constraints
    a. Stimuli are "transduced" from one form of energy to another: sound is changed from mechanical vibrations to electrical/chemical impulses in the nervous system
    b. Gestalt Laws, described in Part 6, dictate how that information is organized
    c. Each sense has limitations
        i. Sensory window: we cannot hear a dog whistle, or see X-rays
        ii. Tempering of input: tones that are close together are heard as the same
        iii. Rate of processing: the senses and brain can only work so fast
5) ***Information-processing: information has to be organized, passed on, and checked for threat before meaning is made***
    a. **This is a critical component to understand because when you are anxious or scared, you cannot think logically**
    b. When you get used to being scared, you will always be scared
    c. The limbic system is a very old part of the brain that is responsible for emotion, mindfulness is one way we can think ourselves into calmness

6) Music listening can be used as a form of therapy
    a. Music was thought to originate as emotional expression and communication
    b. Each person has a unique response to music that can be understood used in a therapeutic manner

Taken as a whole, EMMA shows that the human body is a machine that can be modified through careful application of music; mindfulness will help make music more therapeutic.

Mindful Music Listening Experience (MMLE): Notice responses to different instruments
Musical piece: Haydn, Symphony No. 104 in D major, First movement, Adagio

- Directions
    - Sit comfortably, with chest upright and open, and take regular, deep breaths
    - Focus on breathing for a moment, then play the musical piece
    - Focus on how instruments relate to your experience throughout the song

Check-out
Reflect on your experience during the MMLE

- How did you respond to each instrument, especially the drums and strings?
- How did you respond to the changes in pace? Any changes in breathing or heart rate?
- How do you respond to changes in pace in daily life?
- Track information in your body throughout the day?
- How can you use EMMA theory to make healthier decisions in your daily life?

Please find journal space on the next page…

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Write any of your reflections on today's work here

Part 8: Principal Elements of Music – Rhythm

Review Agenda and Learning Objectives
What we are doing in this part

- Part 8 Learning Objectives
  - Develop a general understanding of rhythm and its effects on people
  - Be able to name the three components of rhythm

Check-in
Settle in to the moment

- What emotion are you feeling right now?
- How strong is that emotion, 1 to 10 (weak to strong)?
- How did MinMuList practice, and application of the EMMA theory, go at home?

Theory Discussion
Rhythm

Rhythm is the regular, repeating flow of tones through a musical piece

- It is the detectable and predictable undercurrent that provides the forward momentum
- It can be found in many aspects of life, including breathing rate, heart rate, walking, and the changing of the seasons
- It is the focus of pop music
- Rhythm has the power to make you want to move

Rhythm is made up of three components:

1) **Pulse**
   a. The regular alternating of a beat and silence, like the ticking of a clock
   b. The body will align with the pulse:
      i. Heart rate will match the pulse of a song
      ii. You want to tap your foot in time with the pulse of a song
2) **Pace**
   a. The number of beats per minute (BPM)
   b. A ticking clock has 60 BPM
   c. People tend to prefer 100 BPM for common activities, like walking
3) **Pattern**
   a. The repeating set of strong and weak beats in relation to the pulse
   b. For example, a clock regularly alternates sounds: “tick-tock-tick-tock”
   c. Songs will change pattern to keep you interested because the mind would automatically block out a song that has the same pattern the whole time

Research on Rhythm

- Grouping:
    - People group based on the relative timing of events, not the absolute timing
    - People prefer to group music events in twos or fours
    - Performers use rhythm to suggest how a person should segment a musical piece
- Attention:
    - People shift attention around and they will tend to focus on the music on the beat
- Neuronal entrainment
    - The brain will create its own rhythm that magnifies brain responses to musical events that align with the brain's rhythm
- Physiological reactivity
    - When a musical event occurs later than expected, the body reacts physiologically by increasing heart rate and sweating
    - Furthermore, the faster the pace, the greater the physical activation
- Speech
    - Speech is described as having rhythm, and music with a strong rhythm has been used to help people with speech issues
- Judgment
    - People make better judgments about the timing, length, and fit of a musical event when it was on-beat compared to when it was off-beat

Common Rhythms

- Western music typically has duple or triple meter
    - Duple is a count of two
    - Triple is a couple of three
- Most music is duple-duple, also known as quadruple
    - The first beat is the most emphasized, then the third, then the second and fourth
        - This sounds like:
            - ONE-two-Three-four-ONE-two-Three-four
        - Try counting along to any song and you will likely find that same emphasis and rhythm
- Triple meter is more common in waltzes and other dances from the classical era
    - The first beat is the most emphasized
        - This sounds like
            - ONE-two-three-ONE-two-three

- Syncopation is placement of a stressed beat where there would normally not be one
    - A normal beat would be:
        - ONE-two-ONE-two-ONE-two-ONE-two
    - A syncopated beat would be:
        - one-TWO-one-TWO-one-TWO-one-TWO

Mindful Music Listening Experience (MMLE): Notice responses to different rhythms
Musical piece: Mussorgsky, Night on bald mountain

- Directions
    - Sit comfortably, with chest upright and open, and take regular, deep breaths
    - Focus on breathing for a moment, then play the musical piece
    - Focus on how changing song rhythms relate to your affect and physical response

Check-out
Reflect on your experience during the MMLE

- How did you respond to the changing rhythms, especially across instruments?
- How did you use rhythm to group musical events and predict what would happen next?
- How do you use rhythm to make predictions in your daily life?
- How do you use rhythm to shape your behavior in your daily life?
- How can you use information about rhythm to make healthier decisions in your daily life?

Please find journal space on the next page…

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Write any of your reflections on today's work here

Part 9: Principal Elements of Music – Melody

Review Agenda and Learning Objectives
What we are doing in this part

- Part 9 Learning Objectives
  - o Develop a general understanding of melody and its effects on people
  - o Be able to name the four important aspects of melody

Check-in
Settle in to the moment

- What emotion are you feeling right now?
- How strong is that emotion, 1 to 10 (weak to strong)?
- How did MinMuList practice, and application of information about rhythm, go at home?

Theory Discussion
Melody

Melody is the tune of the song

- It is the subjectively satisfying rhythmic flow of pitches
- It is the goal of classical music
- It captures your attention when you pause to focus on music
- Melody is what gets stuck in your head after you hear a song

Melody has four important aspects

1) **Pitch**
   a. The frequency of the sound; the higher the frequency, the higher the sound
   b. Each pitch is a different note
      i. The smallest difference in pitch detected by the human ear is a "half-step" of a note, which is denoted when one goes from C, to C# (C-sharp), to D
   c. Each pitch has harmonics: these give the note its texture
      i. They also relate notes to each other because the harmonics are fractions of the total length of the sound wave of the pitch
2) **Key signature**
   a. The key is the starting note, or the "home" or "tonic," of a musical piece
   b. It determines the starting point to determine what notes are appropriate, depending on the scale
3) **Scale**
   a. A scale is the set of notes that will be used within a musical piece
   b. There are many scales, each one determines the notes based on their relationship to the key note

c. Most of the time, notes are selected based on how pleasantly they fit with the key note, though sometimes notes are intentionally selected because they do not fit
   i. Usually the simpler the ratio between the pitches' wavelengths, the more pleasant they fit together

4) Chord

a. A chord is a like a concurrent melody, where multiple notes are sounded at the same time; the same rules applies for chords and for a melody

Research on melody

- Schematic expectations: similar to neural nets
  - o People tend to form melodic expectations based on prior knowledge about tonal relationships
    - ▪ This means they have stronger affective responses when a note did not occur when, or sound like, it was supposed to
  - o Likely due to melodic archetypes
    - ▪ People have an *ideal* of how a melody should unfold
- Veridical expectations: similar to learning
  - o People can learn about a current musical piece and modify predictions
    - ▪ Strongly influenced by Gestalt laws of perception
  - o People can quickly develop familiarity with entirely new style of music
- Melody: processed like language
  - o Brain activity while listening to a melody is similar to brain activity while listening to speech; however, research tends to show only *overlapping* circuits
- Probabilities guide expectations
  - o The most often a combination is heard, the more likely someone is to expect it
- Implication-Realization model
  - o Predictions of the next depend on the previous two notes
- Melodic anchoring
  - o The key note acts as an anchor for the rest of the musical piece
- Categorical perception
  - o Notes are perceived as they fit in to predetermined categories, and familiarity with common categories strongly influences accuracy

Common melodic rules

- A melody will tend to flow in one direction, across adjacent notes in the scale, and when there is a jump in notes, the flow will reverse directions
  - o For example (the jump-reverse is bolded): C-D-E-G-A-B-C-**D-A-G**-E-D-C
- Stable notes are preferred and unstable notes are used only to generate tension in the listener while waiting for stability and release of tension

Mindful Music Listening Experience (MMLE): Notice responses to melodic return

Musical piece: Strauss II, The blue Danube waltz

- Directions
    - Sit comfortably, with chest upright and open, and take regular, deep breaths
    - Focus on breathing for a moment, then play the musical piece
    - Focus on how changing song rhythms relate to your affect and physical response

Check-out

Reflect on your experience during the MMLE

- How did you respond to the return of the melody?
- How did you use melody to segment the piece and predict what would happen next?
- How do you use the idea of melody to make predictions in your daily life?
- How do you use the idea of melody to shape your behavior in your daily life?
- How can you use information about melody to make healthier decisions in your daily life?

Please find journal space on the next page…

Journal space
Write any of your reflections on today's work here

Part 10: Wrap-up

Review Agenda and Learning Objectives
What we are doing in this part
- Part 10 Learning Objectives
    - o Recall important concepts from MinMuList workbook
    - o Identify personal gains from completing the MinMuList workbook

Check-in
Settle in to the moment
- What emotion are you feeling right now?
- How strong is that emotion, 1 to 10 (weak to strong)?
- How did MinMuList practice, and application of information about melody, go at home?

Theory Discussion
Review of content covered in the MinMuList workbook

General Information
- MinMuList is designed for anyone in any setting
- It can be done be by yourself or with a group
- Jounaling can help to process and consolidate information

Part 1: Introduction to MinMuList
- You were asked to approach each part with and your personal practice with:
    - o Attentiveness
    - o Curiosity
    - o Openness
    - o Acceptance
- Each content area was explained to be important because it provides a comprehensive and evidence-based approach
- Music listening was explained to have powerful positive effects on communication, attention, memory, and emotion

Part 2: Mindfulness Defined
- Mindfulness was defined: a focused, gentle approach to the here-and-now that requires:
    - o Self-regulation of attention
    - o Attitude of curiosity, openness, and acceptance
- Mindfulness will support overall health and wellness, and help you live the life you want

Part 3: Mindfulness Skills

- Four important points for cultivating mindfulness were discussed:
    - Practice is important
    - Set aside time each day to be mindful
    - Gently remind yourself to be mindful throughout the day
    - Search out other people and resources to grow your mindfulness network
- You learned a "Labeling" script

Part 4: Music as Such

- Physics of music and auditory system were introduced
- Elements of music were identified: rhythm, melody, harmony, timbre, dynamics, form
- Some rules of Western classical music were stated

Part 5: Gestalt Therapy Theory (GTT)

- GTT is an existential, phenomenological, process-oriented theory that is concerned with *what* people notice and *how* they notice it
- GTT explains the psychology of the mind and why MinMuList and mindfulness leads to change
- Awareness is how standing how "I" interact with "myself" and the "other"
- Gestalt Figure Formation and Resolution Process (GFFRP)
    - How the mind processes experience; the steps are: Figure formation → Figure sharpening → Self-environmental scan → Plan → Execute → Assimilate
- Zones of Awareness: mind; body; environment
- Forms of contact: how we relate to each step of GFFRP and each zone
    - Confluence; Introjection; Projection; Retroflection; Deflection; Full Contact

Part 6: Music Cognition

- Leonard B. Meyer's book, *Emotion and Meaning in Music* (1956) was discussed
- Music is absolute, and people apply any extra musical meaning
- Affect and emotion are different
- Music uses patterns to illicit affect
- Preparatory set is how someone prepares to listen to music

Part 7: Engineering Model of Music Audition

- The body is machine-like, responds physiologically to music, and can be modified through persistent application of music

Part 8: Principal Elements of Music - Rhythm

- Rhythm is a combination of: pulse, pace, and pattern
- It is the regular, repeating flow of tones through music, drives the music, suggests how to group musical events, directs attention, and makes you want to dance
- Most Western music is in quadruple time: ONE-two-Three-four

Part 9: Principal Elements of Music - Melody

- Melody is the subjectively satisfying rhythmic flow of pitches in music; it is the focus of the music; the tune that gets caught in your head
- Melody is determined by how well pitches fit the key signature and scale
- People predict melody based on schematic expectations based on prior learning and veridical expectations based on the current musical piece

This brings up to now! You completed the entire MinMuList workbook! Way to go!

Moving forward…

- Keep up your mindfulness practice…MinMuList was just an introduction!
- Please feel free to complete the workbook again or share this workbook with anyone!

Namaste

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Extra Journal Space

MinMuList

Mindful Music Listening Workbook

David M. Rosenblatt, M.A.