

Musical Bonding

by

Hannah Margaret Percival

Thesis Submitted in Partial Fulfillment

of the Requirements for the Degree of

Masters of Arts

Counseling (Non-Licensure)

Criswell College

Spring 2015

MUSICAL BONDING

MUSICAL BONDING

Copyright © 2015 Hannah Margaret Percival

All rights reserved. Criswell College has permission to reproduce and disseminate this document in any form by any means for any purposes chosen by the College, including, without limitation, preservation or instruction.

MUSICAL BONDING

Approval Sheet

MUSICAL BONDING

Hannah Margaret Percival

Dr. Katherine Pang, Associate Professor of Psychology and Counseling, Thesis Chair

Dr. Misti Poulos, Adjunct Instructor

Prof. Brandon Seitzler, Assistant Professor of Politics and Economics

Date _____

MUSICAL BONDING

Abstract

This thesis proposes a new theory of musically induced Altered States of Consciousness (ASC) labeled Musical Bonding (MB). MB is built on Rouget's (1985) and Becker's (2004) foundational research regarding music and trance, as well as McNeill's (1995) theory regarding muscular bonding. MB proposes that music, within certain social conditioning environments, could facilitate physiological processes (entrainment, an increase in alpha brain waves, and Autonomic Nervous System (ANS) arousal) and correlated psychological perceptions (awareness of group identity, diminished cognitive processes, and emotional arousal) which could lead to a bonding experience as traditional boundaries between self and others diminish. This thesis considers this theory of MB as applicable to the context of Electronic Dance Music (EDM) events. This thesis proposes a preliminary method for gathering normative baselines of the physiological processes associated with MB using the biofeedback instrument of EmWave2.

Keywords: Altered States of Consciousness (ASC), EmWave, Electronic Dance Music (EDM), Musical Bonding (MB), Trance.

Acknowledgments

First of all, I want to praise my Heavenly Father for his unending faithfulness and love. *Soli Deo Gloria*. Second, I want to thank all of the amazing professors at Criswell College who invested in my life and research. Dr. David Henderson, thank you for suggesting this thesis topic and for your clear insight in revision comments. Dr. Misti Poulos, I am eternally grateful for your wisdom and encouragement throughout this entire process. Dr. Katherine Pang, thank you for facilitating the refinement of my thesis and supporting my passion for music cognition research. Professor Brandon Seitzler, thank you for your patience and insight during the construction of the methods section. Dr. Steve Hunter, thank you for teaching me how to live authentically. Thank you so much to Dr. Joe Wooddell, Philip Nott, and Valeri Knight for facilitating the completion of this thesis through countless emails and InterLibrary Loans. Criswell College, thank you so much for allowing me to pursue this unique research!

Thank you to my music mentors who supported me in my growth as a music scholar: Carol Sharp, Jane Aten, Dr. Jerry Wallace, Dr. Graham Hunt, Dr. Sean Atkinson and Katie Richardson. I would not have experienced the joy of music without your sustaining friendship. Lastly, thank you so much to my precious family and friends. This thesis would not have been possible without my thesis support team who listened to my frustrations, put up with my absent-mindedness and sarcasm, and faithfully supported me in prayer.

Hannah Percival

Dallas, TX

April 2015

MUSICAL BONDING

Contents

Abstract	v
Acknowledgments.....	vi
Chapter 1: Significance.....	1
Significance.....	1
ASC.....	1
EDM Events	3
Interdisciplinary research.....	3
Music cognition.....	4
Musical Bonding (MB).....	5
Empirical research.....	5
Definition of Terms.....	7
Chapter Two: Literature Review	10
ASC.....	10
EDM events.....	12
Social Conditioning.....	13
Physiological Processes Associated with Musically Induced ASC	15
Entrainment.....	16
Alpha brain waves.....	18
ANS arousal.....	18
Psychological Perceptions Associated with Musically Induced ASC	19
Focus on group identity.....	20
Diminished cognitive processes.....	21
Emotional arousal.....	22
Summary	22
Chapter Three: Theory of Musical Bonding.....	24
McNeill’s Theory of Muscular Bonding.....	24
Musical Bonding.....	26
MB at EDM Events.....	28
Linking Physiological and Psychological Elements	30

MUSICAL BONDING

General System Theory	31
Entrainment and group identity.	33
Alpha brain waves and diminished thought processes.	34
ANS arousal and emotional arousal.	36
Investigation	39
Chapter Four: Proposed Method Section	41
Discussion of Variables.....	41
Instrument.....	43
Participants	47
Research Study	47
Limitations	49
Extension of the Research	50
Chapter Five: Summary and Areas for Future Research	52
Literature Review.	52
Theory of Musical Bonding.....	53
Methods Section.	55
Discussion of Possible Results	56
Areas for Future Research.....	58
Neurochemical aspects of MB.....	58
MB in other contexts.	59
Ethical issues related to MB.	60
Conclusion.....	60
References	63
Appendix.....	68

Chapter 1: Significance

Music, a seemingly simple combination of sound waves striking the human ear drum, creates strong physiological and psychological reactions in individuals. Music, ubiquitous throughout a variety of cultures, unifies groups of people belonging to the same social conditioning environment. Music, a powerful intervention, has the capacity to facilitate Altered States of Consciousness (ASC). Music, through this state of ASC, has the capability to diminish boundaries between self and others, creating a bonding experience. Chapter three of this thesis will propose a theory regarding this phenomenon, which will be labeled Musical Bonding (MB). Chapter Four of this thesis will outline a proposed method for gathering empirical research regarding normative baselines for the theory of MB.

Significance

This capacity for music to facilitate a bonding experience is the crux of this thesis. As Benzon (2001) poetically stated,

the music is a vehicle for a collective intentionality, one that slips beneath the barriers of individuality and the imperatives of autonomous selves. Music is a means of sharing what is otherwise an individual, private experience, that of trance. In music deeply shared, my rhythms and your rhythms are the same, and thus we are the one. (p. 157)

This unifying process is quite complex. Aspects of this thesis intersect a variety of new emphases for research. A few of these areas include musically induced ASC and Electronic Dance Music (EDM). These issues can be accurately addressed through an interdisciplinary approach with a focus on music cognition.

ASC. This thesis reflects an intersection of several new research emphases. First of all, research regarding the occurrence of ASC in the Western world is rather sparse. Ludwig (1966)

coined the term ASC as broad definition for a wide range of states of consciousness but it is generally regarded with skepticism in the Western world (Becker, 2004; Jankowsky, 2007). Although the fifth edition of the Diagnostic and Statistic Manual of Mental Disorders (DSM-5) allows for culturally normative states, ASC are not specifically mentioned (Diagnostic and Statistical Manual of Mental Disorders: DSM-5, 2013). Perhaps the following is the closest reference to ASC in the DSM-5: "The majority of possession states around the world are normal, usually part of spiritual practice, and do not meet criteria for dissociative identity disorder" (2013, pp. 293-294). However, possession states do not encompass the broad range of ASC implied in Ludwig's definition. In particular, it does not accurately reflect Rouget's (1985) concept of trance states associated with music. In contrast to the popular concept of trance appearing similar to hypnosis, Rouget defines trance as encompassing the following characteristics: "movement, noise, in company, crisis, sensory overstimulation, amnesia, no hallucinations" (p. 11). This definition of trance is similar to musically induced ASC (Becker, 2004; Benzon, 2001; Bonny & Pahnke, 2002; Herbert, 2011; Pilch, 2006; Rouget, 1985).

This thesis will focus on musically induced ASC. Referencing the power of music to impact consciousness, Jourdain (1997) wrote the following:

It lifts us from our frozen mental habits and makes our minds move in ways they ordinarily cannot. When we are embraced by well-written music, we experience understandings that outstrip those of our mundane existence, and that are usually beyond recollection once the music stops (unless we recall the music itself). When the sound stops, we fall back into our mental wheelchairs. (pp. 303-304)

This description mirrors evocative descriptions by participants at Electronic Dance Music (EDM) events: "feeling that this is what life's all about... rushes of joy and love towards

everything” (Rill, 2010, p. 146). Participants have specifically cited music as being a vital part of this experience (Hutson, 2000; Rill, 2010). EDM events are one of the few environments in the Western world in which musically induced ASC has been frequently reported (Becker-Blease, 2004; Hutson, 2000; Rill, 2010). For this reason, this thesis will focus on the demographic of EDM participants.

EDM Events. Another new area of research that this thesis engages with concerns the genre of EDM. EDM events are a more recent evolution of raves that came into vogue in the 1990s (Rill, 2010). EDM events are multi-sensorial experiences complete with special lighting effects, pulsating music, dancing crowds, and prevalent drug use (Becker-Blease, 2004; Butler, 2006; Fachner, 2011; Hutson, 2000; Rill, 2010). Although there are studies that investigate cultural and psychological issues surrounding EDM events (Becker-Blease, 2004; Hutson, 2000; Rill, Identity Discourses on the Dance floor, 2010), there is a dearth of scholarly research on the musical genre as a whole (Butler, 2006). There is also a significant lack of empirical research regarding physiological reactions to the EDM genre. Interdisciplinary research may perhaps be one of the most effective ways to pursue these new areas of research.

Interdisciplinary research. Becker (2004), one of the most prominent music and trance experts, advocated for an interdisciplinary approach when conducting scholarly research regarding musically induced ASC. Specifically, Becker integrated research from ethnomusicology, psychology, and neuroscience in order to create a more robust understanding of musically induced ASC (Herbert, 2011). In a similar way, this thesis will utilize an interdisciplinary approach. This thesis will utilize ethnomusicology and musicology sources (Becker, 2004; Jankowsky, 2007; Jourdain, 1997; Karim, 2011; Levitin, 2006; Margulis, 2014; Pilch, 2006; Rill, 2010; Rouget, 1985; Sacks, 2008), psychology and counseling sources (Bonny

& Pahnke, 2002; Becker- Blease, 2004; Diagnostic and Statistical Manual of Mental Disorders: DSM-5, 2013; Fachner, 2011; Horesh, 2006; Ludwig, 1966; McGuiness & Overy, 2011.; McNeill, 1995; Van Dyke, Jones, & Butman, 2011), and neurology and physiology sources (Clayton, Sager, & Will, 2005; Freeman, 2000; Kandler & Katz, 1995; McCraty, Atkinson, Tomasino, & Bradley, 2006; Thurber, 2006). Many of the sources listed above are quite interdisciplinary in nature, similar to Becker's philosophy. In fact, many of these sources utilize elements of an emerging field interdisciplinary of research, music cognition.

Music cognition. As defined by the Eastman School of Music, “music cognition is an interdisciplinary field concerned with applying the methods of cognitive science—experimental, computational, and neurological—to musical issues and problems” (Music Cognition at Eastman School of Music/University of Rochester). As opposed to the more empirical nature of cognitive science, much of the previous research regarding both musically induced ASC and EDM events are more observational in nature, taking the anthropological philosophy that removing the music from the social conditioning environment inherently diminishes the validity of the study (Herbert, 2011; Hutson, 2000; Jankowsky, 2007; Rill, 2010; Rouget, 1985). The issues raised in this thesis benefit from both an anthropological focus and an empirical focus, both of which can be addressed from the perspective of music cognition. Building on the wealth of information uncovered by this anthropological focus, this thesis will propose a theory of musically induced ASC as well as propose a method for empirical research of this theory. In Chapter Four of this thesis, a preliminary research study will be proposed towards gathering empirical data regarding physiological processes encompassed by musically induced ASC using interventions from the EDM genre. Chapter Three will propose a theory regarding how these physiological processes

and associated psychological perceptions are facilitated by music within a set social conditioning environment to create a bonding experience by diminishing boundaries between individuals.

Musical Bonding (MB). Music has the unique ability to unite individuals. “In the view of many anthropologists, music first evolved to strengthen community bonds and resolve conflicts.” (Jourdain, 1997, p. 308). McNeill (1995) theorized that engaging in collective group activities such as marching, dancing, and experiencing music unite individuals and could create a euphoric experience. McNeill suggested that this state is accompanied by loss of individual boundaries and an increase in a unified group mentality. This concept of bonding is an important element of the theory of Musical Bonding (MB) proposed in this thesis. Chapter Two of this thesis will examine extant research to highlight individual elements that comprise the theory of MB. Chapter Three will propose a theory regarding the interaction of these elements that constitute MB in order to provide a conceptual framework for future empirical research proposed in Chapter Four.

Empirical research. As MB is a new theory, empirical research will need to be developed in order to further explore this theory. Music cognition could be an effective approach to researching MB due to the interdisciplinary and empirical approach of music cognition. Although many of the individual elements in MB have been previously researched, as discussed in Chapter Two, the integration of the elements into this particular theoretical orientation has not yet been tested. As such, the theory of MB could potentially serve as a basis for a variety of research studies discussing the integration of the various elements of MB. The theory of MB encompasses a vast amount of variables including the following: social conditioning environments, music, physiological processes, psychological perceptions, and the bonding of individuals through the diminishing of traditional boundaries between self and others. An

interdisciplinary, empirical investigation of theory, in the vein of Becker's (2004)

interdisciplinary approach, would yield a more robust understanding of this complex theory.

Definition of Terms

Alpha brain waves: A brain wave pattern centered around 8-15 Hz as identified by an Electroencephalogram (EEG) scan. Often associated with changes in consciousness such as increased relaxation or trance states.

Altered State of Consciousness (ASC): Defined by Ludwig (1966) as any observable change in mental state that constitutes a deviation from the individual's normative, awake consciousness that can be induced through a variety of means. In the context of this thesis, ASC refers to Rouget's (1985) definition of trance which occurs in a group context characterized by movement, noise, sensory stimulation. This thesis is specifically referring to ASC that is induced by music.

Ambient music: An EDM genre usually listened to in solitude. It is slower and more introspective than other EDM genres.

Autonomic Nervous System (ANS) arousal: A region of the peripheral nervous system, ANS facilitates involuntary muscle movements (such as those involved in digestion, blood flow, and heart rate) and some of the glands. ANS arousal is associated with emotion. The two branches of ANS coordinate arousal and calming of the body. The sympathetic branch arouses the body to respond to a perceived threat in the environment while the parasympathetic branch counteracts the effects of the sympathetic branch in order to return to homeostasis after the perceived threat is resolved. In the context of this thesis, ANS arousal will be investigated as a facilitator of emotional arousal.

Biofeedback: A training tool designed to assist cognitive assessment of psychological distress as manifested through physiological arousal. When a person is aware of how their body reacts to stress, they can retrain their body to adjust back to a well-functioning state.

Coherence: See Biofeedback, EmWave2, and Heart Rate Variability. It is a “global shift in psychophysiological functioning, which is marked by a distinct change in the rhythm of heart activity. This global shift generates a state of optimal function, characterized by increased synchronization, harmony, and efficiency in the interactions within and among the physiological, cognitive, and emotional systems”(McCraty, Atkinson, Tomasino, & Bradley, 2006, p. 3). Characterized by a smooth HRV pattern centered around 0.1 Hz.

Electronic Dance Music (EDM): A primarily instrumental type of electronic music that is specifically designed for dancing. There are a vast number of genres and sub-genres with the EDM category.

Electronic Dance Music (EDM) event: A more modern evolution of a rave. EDM is spontaneously created by expert DJ’s who specifically design the music to encourage an atmosphere conducive to group dancing.

EDM Participants: Also known as ravers, EDM participants are usually within the demographic of eighteen to thirty years old. EDM participants’ vivid experience at EDM events is often characterized by continual dancing and drug usage.

EmWave2: See Biofeedback, Coherence, and Heart Rate Variability. A biofeedback machine designed by the Institute of HeartMath that specifically measures Heart Rate Variability (HRV) patterns to determine states of coherence.

Entrainment: The process by which two entities with individual rhythmic patterns synchronize with each other.

General systems theory: A theory that describes the manner in which elements interact in an independent yet inter-dependent manner. This theory was conceptualized by von Bertalanffy (1968) as way to discuss the manner in which manners interact in a systematic

manner, rather than a linear progression. Von Bertalanffy (1968) specifically designed this theory to be applicable across a variety of disciplines.

Heart Rate Variability (HRV): See Biofeedback, Coherence, and EmWave2. A product of neurocardiac functioning. Changes in HRV rhythm can be indications of emotional states.

Muscular bonding: McNeill's (1995) theory regarding a psychological bonding that occurs when individuals are united in group movement such as marching or dancing.

Musical Bonding (MB): This theory proposes that within a specific social conditioning environment, music facilitates linked physiological processes and psychological perceptions which create a group bonding experience as normal boundaries between self and others dissolve. The linked physiological processes and psychological perceptions are as follows: entrainment with a focus on group identity, alpha brain wave patterns with a decrease in cognitive processes, and ANS arousal with emotional arousal. Although preliminary research will focus on these elements in isolation, future MB research will examine the presentation of these elements in the group context inherent in MB.

Trance (Music): In the context of this thesis, trance music is a genre of Electronic Dance Music (EDM) usually experienced in a group setting. It is characterized by an upbeat tempo around 120-150 beats per minute.

Trance (state of consciousness): See Altered State of Consciousness. This thesis utilizes Rouget's (1985) definition of trance as being characterized by "movement, noise, in company, crisis, sensory overstimulation, amnesia, [and] no hallucinations." (p.11) For the sake of clarity, this thesis refers to trance as musically induced ASC in order to distinguish it from trance as an EDM music genre.

Chapter Two: Literature Review

This chapter will investigate musically induced ASC. This thesis will discuss the influence of the social conditioning environment on musically induced ASC. Physiological processes encompassed by musically induced ASC include entrainment, alpha brain wave patterns, and ANS arousal. These physiological processes will be linked with the psychological perceptions of a focus on group identity, diminished cognitive processes, and increased sensorial awareness. This chapter will also discuss the manner in which these elements can facilitate the diminishing of boundaries. This will lay the foundation for the exposition of a theory of MB regarding how these elements interact. The theory of MB suggests that for individuals in the same social conditioning environment, music facilitates linked physiological processes and psychological perceptions which create a group bonding experience as normal boundaries between self and others dissolve. Chapter Four of this thesis will propose a preliminary study of MB targeted to the demographic of participants at EDM events in order to determine prospective normative baselines for physiological processes encompassed by MB.

ASC

The term Altered States of Consciousness (ASC) was coined in the 1960s as a broad designation for atypical states of mind occurring during certain actions such as dreaming, utilizing psychedelic drugs, trancing, meditating, or listening to music (Benzon, 2001). Ludwig (1966), the creator of the term ASC, defined it as

Any mental state (s), induced by physiological, psychological, or pharmacological maneuvers or agents, which can be recognized subjectively by the individual himself (or by an objective observer of the individual) as representing a sufficient deviation in

subjective experience or psychological functioning from certain general norms for that individual during alert, waking consciousness. (p. 225)

ASC is characterized by the participant's subjective awareness of a change in cognitive processing when compared to typical mental states (Bonny & Pahnke, 2002). A crucial element in ASC is the dissipation of traditional boundaries between self and others (Becker- Blease,2004; Becker, 2004; Benzou, 2001; Biswas, 2011; Herbert, 2011; Hutson, 2000; Jourdain, 1997; Margulis, 2014; McGuinness & Overy, 2011; McNeill, 1995; Rill, 2010). Regarding this dissipation of traditional boundaries associated with ASC at EDM events, a common occurrence is

the dissolution of self as a bounded ego, resulting in a collapse of the typical categories by which personhood is defined. At raves [EDM events] the egocentric self is replaced by an experiential model wherein the "I" is superceded by "We" and thinking is second to feeling. (Rill, 2010, p. 145)

This dissipation of boundaries between individuals facilitates a group identity.

The Western world has often viewed ASC with skepticism. Fear of demonic influence contributed to this skepticism of ASC (Becker, 2004). Another reason for the skepticism is because ASC appears to conflict with the Western mindset of maintain rational boundaries between self and others or self and experience (Jankowsky, 2007).

Western culture socializes individuals to develop a metasef, a critical observer who monitors and comments on experience. The metasef does not allow the total absorption in lived experience, which is the very essence of highly focused altered states of consciousness.(Pilch, 2006, p. 43)

The most recent edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM V) does not explicitly discuss ASC (Diagnostic and Statistical Manual of Mental Disorders: DSM-5, 2013). The DSM V does, however, allow for culturally accepted states, such as shamanic healings at religious ceremonies that would not typically be found in Western culture.

Several of these culturally normative events that lead to ASC traditionally involve music (Becker, 2004; ; Jankowsky, 2007; Herbert, 2011; Hutson, 2000; Rouget, 1985). Research suggests that ASC can be induced by music (Becker, 2004; Benzon, 2001; Bonny & Pahnke, 2002; Herbert, 2011; Pilch, 2006; Rouget, 1985). In fact, the boundary dissipation discussed earlier is most commonly associated with the type of ASC induced by music; this boundary dissipation associated with musically induced ASC further enhances the community mindset (Benzon, 2001).

The category of ASC examined in this thesis is congruent with Rouget's (1985) concept of trance, rather than ecstasy. Rouget defined ecstasy as having the following characteristics: "immobility, silence, solitude, no crisis, sensory deprivation, recollection, hallucinations" (p. 11). This is in contrast to his definition of trance: "movement, noise, in company, crisis, sensory overstimulation, amnesia, no hallucinations" (p.11). Occasionally, the difference in translation of these two terms from French to English creates confusion. The ASC discussed in this paper is similar to Rouget's definition of trance due to the elements of "movement, noise, in company... [and] sensory overstimulation" (p. 11).

EDM events

Extant research concurs with Rouget's definition of trance being similar to the ASC observed at EDM events (Becker-Blease, 2004; Hutson, 2000; Rill, Identity Discourses on the Dance floor, 2010), the social conditioning environment examined by this thesis. EDM events,

the most recent version of raves, are characterized by large crowds of people dancing to music that is spontaneously created by master DJs to encourage an atmosphere conducive to dancing (Butler, 2003). The demographic at these events is generally middle-class, 18-30 year olds (Rill, 2010). Rill (2010) defines EDM events (also known as raves) as “an alternate reality of dancing, release, and free expression. From glow sticks to glittered lips, rave is about fascination, youthfulness, and play” (p. 141). EDM events were chosen for this thesis because of the frequency of ASC reported in a group environment interacting with music (Becker- Blease, 2004; Hutson, 2000; Rill, 2010). ASC are frequently reported at group music events in other cultures, such as shamanic healings or possession rituals (Hutson, 2000; Jankowsky, 2007). However, the ASC examined in this thesis is distinct from possession trances as the element of spiritual possession is not a central element at EDM events (Hutson, 2000). Although ASC at group music events are less common in the Western world (Becker, 2004; Hutson, 2000; Rouget, 1985), EDM events share some of the social aspects of other occurrences of musically induced ASC such as a focus on group identity, diminished cognitive processes, and emotional arousal (often described as a spiritual experience) (Becker- Blease, 2004; Hutson, 2000; Rill, 2010). As such, EDM events are an avenue in the Western world that can serve as a model for ASC in group music events.

Social Conditioning

There is debate regarding the amount of social conditioning on ASC. Rouget (1985) postulated that musically induced ASC is largely a product of social conditioning. Rouget believed that musical elements removed from the social conditioning atmosphere would not necessarily facilitate ASC. Rouget argued against the notion that a steady drum beat creates

ASC; he argued that many African cultures frequently use drums but are not continually experiencing ASC. Rouget explains,

Every one of these instruments...delivers acoustic signals too radically different from one another to be able to produce, at the level of auditory physiology, the same effects on the listener. ... Although all these instruments are associated with trance, and more particularly with entry into trance, this association is not related to the physical impact created by the sounds they produce. (p. 78)

This quote in particular reveals the extent to which Rouget's theory upholds social conditioning. Rouget's philosophy stated that social conditioning is primarily responsible for musically induced ASC (Benzon, 2001; Fachner, 2011; Jankowsky, 2007; Pilch, 2006). Rouget followed the traditional ethnomusicologist approach, which holds a high regard for cultural context. This anthropological perspective proposes that taking music out of the cultural context inherently diminishes the meaning because the social conditioning environment prescribes the various reactions (Becker, 2004; Benzon, 2001; Fachner, 2011; Jankowsky, 2007; Rill, 2010).

Centuries prior to Rouget's work, Rousseau also believed ASC induced by music was a product of social conditioning (Becker, 2004). Rousseau gave the example of tarantella music that would be performed when a person was bitten by a tarantula; the rapid dancing that would coincide with the music was thought to rid the person of the poison. Societies would experience ASC when hearing tarantella music from their own culture but would not experience ASC when hearing tarantella music from other cultures. In other words, the music which facilitated ASC in one specific cultural context music did not facilitate ASC in other cultural contexts. Benzon (2001) stated that group experiences of musically induced ACS are dependent on the individuals

sharing a common musical culture which creates similar physiological responses throughout the group.

Becker (2004) expounded upon Rouget's (1985) theory to include more recent neurological research; this research indicates that musically induced ASC is associated with specific physiological processes. These physiological processes could suggest that musically induced ASC is not only a product of social conditioning, but also a physiological response to the music. Becker examined the complexities of social conditioning and physiological processes that coexist during musically induced ASC; her philosophy suggested that both components were important to understanding musically induced ASC. While the impact of social conditioning continues to be a large consideration in current theories of musically induced ASC, recent advances in medical technology have revealed physiological aspects of musically induced ASC.

Physiological Processes Associated with Musically Induced ASC

Without negating the importance of social conditioning, this thesis will also emulate Becker's style of examining the physiological processes that occur during musically induced ASC. Becker (2004) stated, "Sound properties of music accompanying [musically induced ASC] can be both biological and cultural" (p. 38). Becker broadened the discussion of musically induced ASC occurring in a variety of situations by utilizing diverse perspectives such as ethnomusicology, philosophy, psychology, and neurology. In a similar manner, Herbert (2011) investigated musically induced ASC that occurring when listening to music in solitude, a situation not explicitly addressed in Rouget's (1985) theory. Although residual social conditioning bias would still be present in a person listening to music in solitude, there is less immediate influence from social conditioning bias when music is experienced in solitude. The

existence of musically induced ASC in solitude gives more credence to the influence of physiological processes.

Music can have powerful implications on human physiology (Becker, 2004; Benzon, 2001; Jourdain, 1997; Levitin, 2006; Margulis, 2014; Sacks, 2008). Becker (2004) stated, “It is undeniable that strong rhythms and drum timbres have a direct impact on our bodies as physical organisms” (p. 37). Freeman (2000) explained, “music as sound appeals to the ear, but making and appreciating it involve[s] the entire body through the somatosensory and motor systems of the performer and the active audience” (p. 420). Some of the physiological processes that have been documented with musically induced ASC include entrainment (Becker, 2004; Benzon, 2001; Clayton et al., 2005; Jankowsky, 2007; Levitin, 2006; Nozaradan, Isabelle, & Mouraux, 2012; Sacks, 2008), an increase in alpha brain waves (Bonny & Pahnke, 2002; Fachner, 2011), and ANS arousal (Becker, 2004; Herbert, 2011; McCraty, Atkinson, Rein, & Watkins, 1996; McNeill, 1995).

Entrainment. A crucial component of Becker’s (2004) theory is entrainment (Herbert, 2011; Jankowsky, 2007). Entrainment is the process by which two entities with individual rhythmic patterns synchronize with each other. This process has been observed in entities as varied as pendulums, fireflies, and humans. In humans, entrainment has been observed in both aspects of social conditioning, such as speech patterns and non-verbal gestures, as well as internal physiological processes such as breathing and heart rates (Clayton et al., 2005).

Rhythmic entrainment can be observed through changes in breathing rates and cardiac rhythms in response to music (Clayton et al., 2005). Research has shown that neurons in the auditory cortex have the capability to synchronize with auditory stimuli (Nozaradan et al., 2012). As Benzon (2001) phrased it, “a nervous system would do well to have its own intrinsic rhythms

and to interact with the world by entraining its rhythms to the world's rhythms, thus allowing it to track that world, to anticipate its moves, to live in it and act upon it" (p. 51). Becker (2004) stated that entrainment could be a physiological process that could explain musically induced ASC occurring as the brain synchronizes with music. Entrainment can also occur between individuals as they interact with each other (Clayton et al., 2005). This type of entrainment can be learned through social conditioning (Becker, 2004). The social conditioning influences on entrainment between people could lend credence to Rouget's (1985) theory concerning the impact of the social conditioning environment on musically induced ASC.

Entrainment between individuals could also be a physiological aspect of Rouget's theory that can now be explored with recent technological advances. Both the entrainment of an individual's physiological rhythms to music and the entrainment between individuals as a result of the social conditioning environment are associated with musically induced ASC (Becker, 2004; Benzon, 2001; Clayton et al., 2005; Herbert, 2011; Sacks, 2008).

Music, as an external oscillator entraining our internal oscillators, has the potential to affect not only our sense of time but also our sense of being in the world. ... Entrainment appears, therefore, to be one of the fundamental processes providing an intimate connection between individuals, others, and the world around them. (Clayton et al, 2005, pp. 14-15)

Also, this process suggests that "entrainment may relate phenomenologically to a sense of social belonging, or of one's subjectivity relating to "something larger": impressions that are frequently linked to musicking" (Clayton et al., 2005, p. 7). This relates to the concept of diminishing of boundaries associated with musically induced ASC. It also suggests that the process of entrainment is also associated with a feeling of being unified with a group identity. Although

entrainment is a very important process in musically induced ASC, other physiological processes have also been documented in conjunction with musically induced ASC.

Alpha brain waves. Another characteristic of ASC is a low alpha brain wave pattern (8-10 Hz); this pattern is specifically characteristic of states such as trance, meditation, or listening to music (Fachner, 2011). Alpha waves have been noted in conjunction with suppressed cognitive processes and relaxed physiology (Bonny & Pahnke, 2002). Data sets of brain waves related to musically induced ASC are limited in quantity as subjects experiencing musically induced ASC are often dancing, which would not be conducive to the confined nature of an MRI machine (Becker, 2004).

Alpha patterns have also been documented on EEG scans in conjunction with the subject's subjective report of a feeling of relaxation (Bonny & Pahnke, 2002). Alpha brain wave patterns, as indicated by EEG scans, easily entrain with other physiological processes, such as cardiac rhythms (Edwards, 2014). This ability for alpha brain waves to entrain with other physiological processes is an interesting similarity with entrainment that could benefit from further research to investigate this relationship. It has been documented that music has the capability to affect brain wave patterns in coma patients (Fachner, 2011). This impact on coma patients highlights the physiological elements of music in the absence of an active social conditioning environment; this lends credence to the physiological implications of musically induced ASC.

ANS arousal. ANS arousal is another physiological process that has been documented in conjunction with musically induced ASC (Becker, 2004; Herbert, 2011; McCraty, Atkinson, Rein, & Watkins, 1996a). ANS arousal creates involuntary physiological reactions, such as changes in skin temperature, tears, or changes in breathing and heart rate, which can be

indications of emotional arousal (Becker, 2004). It is not specifically noted whether this ANS arousal is primarily sympathetic or parasympathetic arousal. The term “arousal” and description of heightened emotion would lead one towards an understanding of sympathetic activity, as this part of the nervous system allows the body to respond in an alert manner (Edward & Kosslyn, 2011). The transcendental perspective that occurs after musically induced ASC could be related to parasympathetic activity, the counterbalance part of the nervous system that calms the body down (Becker, 2004). Perhaps Becker did not specify between the two parts of the ANS as a way to indicate that both the sympathetic and parasympathetic nervous systems are involved in musically induced ASC.

Becker (2004) speculated that musically induced ASC could be purposefully induced by learning to control ANS arousal, which is typically an involuntary process. Becker theorized that people who purposefully enter ASC allow themselves to experience an emotional concept of self that is created by ANS arousal (Jankowsky, 2007). Music can be considered a conduit for emotional expression (Becker, 2004; Fachner, 2011; Rouget, 1985). Biswas (2011) described music as “deeply rooted in the irrational processes of the body. It moves beyond intellectual, conceptual, discursive thinking towards an emotional, sensual realm” (p. 108). This quote reveals the visceral elements of music. This emotional concept of self allows typical boundaries to diminish as the music “weaves together, soaks through, and connects which might otherwise be sharply demarcated as Self and Other” (Biswas, 2011, p. 104).

Psychological Perceptions Associated with Musically Induced ASC

Investigating reports of psychological perceptions at EDM events can provide insights in musically induced ASC. Participants at EDM events have cited music as an important catalyst for their perceptions (Hutson, 2000; Rill, 2010). Rill (2010, p. 144) stated, “it is a combination

of the music, the people, and the mood that create the particular vibe of an [EDM] area. This unifying energy binds participants into a collective experience.” This collective experience is one of the defining aspects of musically induced ASC, especially at EDM events.

Some of the perceptions that have been associated with musically induced ASC include a focus on group identity, diminished cognitive processes, and increased sensorial awareness. These perceptions are slightly more difficult to empirically measure than the physiological processes discussed above. As Becker (2004) put it,

The brain can be considered objectively, given names for its parts and physically dissected. The mind, mental life, as a process is harder to study scientifically. Although techniques for scientific mind-study are developing, mind as full inner experience can only be fully known by the one who has one; mind is a first-person, phenomenological experience. (p. 9)

Despite the difficulty in measuring psychological experiences compared to physiological processes, it is crucial to discuss the psychological perceptions encompassed by musically induced ASC. Physiology is an important component in the discussion of consciousness, especially in the form of ASC (Becker, 2004; Herbert, 2011; McNeill, 1995) In order to conceptualize the reports of musically induced ASC at EDM events, it is important to consider these psychological experiences.

Focus on group identity. Musically induced ASC is often characterized by a focus on group identity. Music and dance creates neural connections that encourage an atmosphere of trust and social bonding (Benzon, 2001). Benzon (2001) stated, “Music... is a group activity in which the interactions between individuals are as precisely timed and orchestrated as those within a single brain. The individuals are physically separate but temporally integrated” (p. 164). This

group identity is very strong among EDM participants. People who attend EDM events or raves have reported an emergence of collective identity as the group begins to interpret events from a unified perspective (Rill, 2010). EDM is specifically linked with a group mentality (Butler, 2003). Social barriers are broken down as people interact in the EDM environment (Becker-Blease, 2004) characterized by playful imagination and free dance (Rill, 2010). Individual identities become less important (Hutson, 2000) as ego diminishes (Becker, 2004; Rill, 2010) and emotional expression prevails (Becker, 2004; Fachner, 2011; Horesh, 2006; Jankowsky, 2007; McGuinness & Overy, 2011; Pilch, 2006; Rill, 2010).

Diminished cognitive processes. People who have experienced musically induced ASC, such as at EDM events, described it as “getting out of your head” or a decrease in mental dialogue (Becker, 2004; Herbert, 2011; Karim, 2011; Rill, 2010). Ludwig (1966) categorizes musically induced ASC as having “Decreased Alertness or Relaxation of Critical Faculties” (p. 227). Benzon (2001) states, “it is perhaps not so strange that an altered state of one's own body parallels the cessation of inner speech” (p. 154). This decrease in mental dialogue has been described by an EDM participant as the potential “to see themselves without the crushing ego, to know the possibilities of the self” (Hutson, 2000, p. 39).

This transcendental experience (Becker, 2004; Karim, 2011) has been described by some participants as akin to a spiritual experience (Becker-Blease, 2004; Hutson, 2000; Rill, 2010). This is not to suggest that spiritual experiences are characterized by diminished cognitive processes. Rather, this terminology highlights the all encompassing nature of musically induced ASC which exceeds pedestrian, rational explanations. This diminishing of traditional mental boundaries is an important aspect of musically induced ASC. This diminishing of mental boundaries allows for emotional arousal to be more pronounced.

Emotional arousal. Emotional arousal is an important aspect of musically induced ASC (Becker, 2004; Fachner, 2011; Freeman, 2000; Horesh, 2006; Jankowsky, 2007; McGuiness & Overy, 2011; Pilch, 2006; Rill, 2010; Rouget, 1985; Sacks, 2006). Emotional arousal, specifically the expression of joy, has been documented in response to musically induced ASC in individuals as young as eighteen months old (Pilch, 2006). Becker proposes that individuals that more easily experience musically induced ASC typically hold a more emotional sense of self with less boundaries than the typical Western philosophy of Self (Jankowsky, 2007). Concerning those individuals who were able to experience musically induced ASC (trancers or “deep listeners”), Becker (2004) wrote the following: “Musical immersion stimulates emotion and facilitates their special attentiveness, their special consciousness” (p.1). This emotional arousal is often induced through sensorial overload (Becker, 2004); sensorial overload is especially characteristic of EDM events (Becker- Blease, 2004; Butler, 2006; Fachner, 2011; Hutson, 2000; Pilch, 2006; Rill, 2010). Like the other psychological perceptions examined in this chapter, emotional arousal facilitates the diminishing of boundaries between people. The sensorial overload contributing to the emotional arousal and the cessation of inner dialogue “can contribute to a sense of transcendence, a sense of being played by the music, or a sense that the boundaries of the self have dissolved into the surroundings” (Margulis, 2014, p. 68). These sensorial and emotional experiences are an important part of musically induced ASC.

Summary

The physiological processes (entrainment, alpha brain waves, and ANS arousal) and psychological perceptions (focus on group identity, diminished cognitive processes, and increased sensorial awareness) discussed in this chapter will be crucial elements in the theory of MB which will be proposed in chapter three of this thesis. Although MB could theoretically be

expounded to include other instances of musically induced ASC, these principles have been designed to represent reported experiences at EDM events. This demographic was chosen because it is one of few musically induced ASC group experiences in the Western world. This chapter examined Rouget's (1985) theory regarding musically induced ASC; Rouget highly emphasized the importance of the social conditioning environment in creating a unified group response to music. Becker's (2004) theory examined physiological processes associated with musically induced ASC. The following chapter of this thesis will propose a theory for how the physiological processes and psychological perceptions associated with musically induced ASC may facilitate a group bonding experience through the dissolving of traditional boundaries.

Chapter Three: Theory of Musical Bonding

This chapter will propose a theory of musically induced ASC that will be referred to as Musical Bonding (MB). This theory proposes that within a specific social conditioning environment, music facilitates correlated physiological processes and psychological perceptions which create a group bonding experience due to the diminishing of normal boundaries between self and others. The correlated physiological processes and psychological perceptions are as follows: entrainment with a focus on group identity, alpha brain wave patterns with a decrease in cognitive processes, and ANS arousal with emotional arousal. This theory builds upon McNeill's (1995) theory of muscular bonding which examines the euphoric feeling induced by participating in group experiences of coordinated movement, such as dancing or marching. This chapter will explore the manner in which MB elicits a group identity through a similar process to the theory of muscular bonding by facilitating the dissipation of traditional boundaries between individuals. The previous chapter of this thesis explored three physiological and three psychological elements that have been observed in conjunction with musically induced ASC. The three physiological processes that were discussed were entrainment, increase in alpha brain waves, and ANS arousal; the three psychological perceptions that were discussed were a focus on group identity, diminished thought processes, and emotional arousal. These physiological processes and psychological perceptions will be linked together as characteristics of MB. The concept of systems theory will be used to describe the relationship between those links. This concept is important to consider when designing empirical research to investigate MB.

McNeill's Theory of Muscular Bonding

McNeill (1995)'s theory observed the unified, exhilarated feeling that is created by engaging in group movement. This group movement can be seen, for example, in military

marching formations or dancing. McNeill identified this as muscular bonding. He theorized that muscular bonding is characterized by a joyful, community-minded focus that is universally experienced by members of a group engaging in rhythmic movements for an extended period of time. McNeill explained that dancing has the “distinctive capability of enhancing group solidarity probably depends on keeping time together for a prolonged period, thus translating individual discharge of anxiety into collective catharsis” (p. 17), which highlights the group aspect of this event.

McNeill (1995) explores this concept of muscular bonding through a multitude of contexts that range from various religious ceremonies, to war processions, to village festivals, to evolutionary concepts of societal formations. This theory continually emphasizes the group mentality of muscular bonding as a way to unify individuals through a euphoric process. Although many of these ceremonies involve music or rhythmic drumming of some sort, McNeill focused on the social implications and historical relevance of muscular bonding rather than musical aspects of this concept. This thesis will further explore the implications of music on this bonding experience.

Physiology of muscular bonding is another area that McNeill (1995) briefly touched on but left open for further research. McNeill cited a significant dearth of research regarding physiological reactions to rhythmic music or rhythmic dancing. McNeill stated that physiological reactions to rhythmic movement are created by ANS arousal, both the sympathetic and parasympathetic nervous systems. He believed that it would be quite difficult to measure this process in real time because there was no way to adequately measure this ANS arousal while allowing the freedom of movement necessary for muscular bonding. As a result, he suggested that the same processes that enable steady physiological cycles, such as cardiac and pulmonary

rates, could also be responsible for creating muscular bonding. To support this theory, he cited studies that showed brain waves adjusting to mirror the rhythmic auditory stimulation. Although McNeill never explicitly refers to these processes as entrainment, it is clear that entrainment is a key element in the physiological aspects of his theory.

Musical Bonding

MB will build on McNeill's (1995) theory of muscular bonding while encompassing the additional aspects of musically induced ASC discussed in the previous chapter of this thesis. MB is characterized by the physiological processes of entrainment, an increase in alpha brain waves, and ANS arousal; MB is also characterized by the psychological perceptions of focus on group identity, diminished thought processes, and emotional arousal. While these elements have been documented separately in musically induced ASC research, MB is unique in that it synthesizes these elements into a single theory. MB is built on the premise that this experience of engaging with music initiates a group mentality by dissolving boundaries. While MB does not deny McNeill's theory concerning the power of rhythmic movement in creating a community identity, MB focuses on music as the facilitator of the group identity. MB occurs in a group environment.

Experiencing music in a group environment builds a sense of community through the dissolution of boundaries (Benzon, 2001; Freeman, 2000; Rill, 2010). Experiencing deep emotions in reaction to music creates trust that builds a sense of community (Freeman, 2000). Along with emotional arousal, the physiological process of entrainment contributes to the sense of community; people are united into a group when they experience similar physical reactions to the same music (Benzon, 2001). Anthropologists believe that music could have developed as a way to bind people together emotionally and peacefully resolve conflict (Jourdain, 1997). As Sacks (2008) stated,

Rhythm and its entrainment of movement (and often emotion), its power to "move" people, in both senses of the word, may well have had a crucial cultural and economic function in human evolution, bringing people together, producing a sense of collectivity and community. (p. 268)

Freeman (2000), in particular, cited neurological evidence that music plays a role in resolving conflict and bonding individuals together in community. Benzon (2001) summarized Freeman's findings in the following manner:

Neuroscientist Walter Freeman has argued that ritual music and dance trigger brain mechanisms that foster social bonding and so have been essential to creating the trust upon which all social interaction depends. ... By attending to one another through musicking, performers attune their nervous systems to one another, restructuring their representations of others. This results in more harmonious interactions within the group. (pp. 29, 81-82)

Freeman wrote that the releasing of the neurochemical oxytocin appears to alter synaptic connections. This creates an environment ripe for new encoding of information; oxytocin is often released in experiences that culminate with an increased feeling of trust, such as sexual activities and childbirth. This neurochemical process appears to function in a similar way when experiencing music in a group, producing an increased feeling of trust. Freeman believed that this neurochemical process was central to inducing ASC, which allowed for an environment capable of encoding new information, such as the bonding experience within a community. Freeman stated that the physiological processes of music combined with the social conditioning aspects of experiencing music in a group context can create this bonding experience. Ringo Starr gives anecdotal evidence of this bonding experience in the context of musical performance:

It feels great; [it is] just a knowing. [It is] magic actually; it is pure magic. Everyone who is playing at that time knows where everybody's going. We all feel like one; wherever you go, everyone feels that's where we should go. I would know if Paul was going to do something, or if George was going to raise it up a bit, or John would double, or we'd bring it down. I usually play with my eyes closed, so you would know when things like that were happening... you've got to trust each other. (Benzon, 2001, p. 147)

This thesis proposes that the theory of MB could be applied to the context of EDM events.

MB at EDM Events

EDM events create a sense of community among the participants (Hutson, 2000; Rill, 2010). In fact, this sense of community is a foundational element of EDM events (Hutson, 2000). The community mindset and focus on feelings swells as individual thought processes diminish (Rill, 2010). "The 'we' at a rave is a collective sensual experience. While each individual has autonomous space and personalized experience, they are simultaneously aware that they are part of the collective body" (Rill, 2010, p. 155). This quote highlights the dissipation of traditional boundaries around individuals as a focus on a group identity begins to emerge.

"The thematic boundaries that normally delineate our edges [of self] are destabilized."

The transformative power of these moments lies in the capacity for trancing to reshape the experience of the world. These somatic interactions are mapped into our neural structures as new "images" of our world interactions. These new images then alter the dialogue that gives rise to core consciousness, in turn engendering novel ways of being embodied. (Rill, 2010, p. 152)

These new experiences at EDM events can alter participants' view of consciousness. This new view of consciousness is primarily a sensorial consciousness as opposed to an intellectual consciousness (Rill, 2010).

EDM participants have asserted that these experiences are induced by music (Hutson, 2000). Often these musical experiences are interpreted as transcendental; as ego diminishes, a sense of becoming unified with the music and with individuals in the environment prevails (Rill, 2010; Hutson, 2000; Karim, 2011). Rill (2010) wrote, "the participants are individuals in their style and flavor, but together they are a liquid sea of bodies, all synchronized to the beats around and within them" (p. 141). The synchronization is heightened as the participants are on the nocturnal cycle (EDM events often last throughout the night), experience the same music, and share the same drug culture (Hutson, 2000). This highlights the community element, encompassed in the theory of MB, present at EDM events.

A valid concern in investigating MB in the context of EDM events is the prevalence of drugs, such as Ecstasy (Fachner, 2011; Horesh, 2006; Hutson, 2000; Rill, 2010). Drug usage can mirror MB (Bonny & Pahnke, 2002; Fachner, 2011; Horesh, 2006; Jourdain, 1997). However, the comorbidity of drug usage and MB does not negate the legitimacy of MB. Further investigation, such as the study proposed in the next chapter of this thesis, is needed to study the effects of MB without the variable of drug usage.

In a similar manner to the way in which drugs affect physiology and psychological perceptions, MB can create strong physiological and psychological effects (Bonny & Pahnke, 2002; Fachner, 2011; Horesh, 2006; Jourdain, 1997). Drug addicts often view music in a similar manner as the substances they abuse: "Addicts are used to turning to external factors to manipulate their mood and emotional state, using drugs and music for this purpose

interchangeably” (Horesh, 2006, p. 134). Naloxone, a substance that blocks opiate receptors in the Central Nervous System (CNS), is known to decrease the perception of pleasure caused by opiates; Naloxone has also been shown to decrease the perception of pleasure induced by music (Jourdain, 1997). Benzon (2001) wrote, “musical ecstasy certainly is not just extreme joy or delight while making music; it is a separate experience- or perhaps a family of experiences- with a particular feel, a particular phenomenology” (p.16). Music pulsates through the human body, transforming mundane moments into an ecstatic experience (Jourdain, 1997). The physiological processes and psychological perceptions of MB, discussed in the previous chapter of this thesis, will be linked together in order to better understand this powerful impact of MB.

Linking Physiological and Psychological Elements

Physiological processes and psychological perceptions are closely linked. Following Freeman’s (2000) line of reasoning, this thesis will consider the psychological perceptions that could be linked with physiological processes that are potentially facilitated by music. It is likely that some of the physiological processes associated with musically induced ASC could be occurring in unison with the psychological perceptions also characteristic of this state. Becker (2004) stated that this investigation of the linking of physiological and psychological elements is crucial for understanding musically induced ASC: “Deep listening and trancing, as processes, are simultaneously physical and psychological, somatic and cognitive” (p. 29). For the purposes of this thesis, each physiological process will be linked with a psychological perception.

Extant research suggests that the following physiological processes and psychological perceptions are correlated: entrainment with a focus on group identity (Becker, 2004; Benzon, 2001; Freeman, 2000; McNeill, 1995; Sacks, 2008), alpha brain waves with diminished cognitive processing (Bonny & Pahnke, 2002; Clayton et al., 2005; Fachner, 2011), and ANS arousal with

emotional arousal (Becker, 2004; Herbert, 2011; Jankowsky, 2007). These pairs are not firm divisions, impenetrable by other elements. Rather, these elements co-exist simultaneously and can influence each other, in a manner reflective of general systems theory that will be discussed below. Although this thesis will propose a model for one type of empirical study needed to further investigate this theory, this theory will require many additional empirical studies in the future to investigate whether the relationships between the pairs are causal or merely casual.

General System Theory

The theory of MB has been conceptualized to reflect principles found in general systems theory (Brown & Christensen, 1999; Murrar, Sommers-Flanagan, & Sommers-Flanagan, 2012; Van Dyke et al., 2011; Yarhouse & Sells, 2008). General system theory was created by von Bertalanffy (1968) to describe the manner in which elements in a system interact in an independent yet inter-dependent manner. This creates a system that has the capacity to function efficiently for both the individual parts and the system as a whole.

Von Bertalanffy did not believe that a system's individual components could be evaluated as independent entities, or the individual components assembled in a linear fashion to encompass the totality of the system. He proposed the definition of a system as characterized by the interactions of its parts and the nonlinearity of their interactions.

Concepts of wholeness and recursion were privileged over reductionism and linear causal models. (Van Dyke et al., 2011, p. 349)

In other words, general systems theory states that a system cannot be fully understood by investigating each element individually. Each individual element influences the other elements. A change to one aspect of the system will cause a ripple effect to the other aspects (Brown &

Christensen, 1999; Murry et al., 2012; Van Dyke et al., 2011; von Bertalanffy (1968); Yarhouse & Sells, 2008).

Human systems aren't closed; they're open and have fluid boundaries that accept and give influence. ... Living systems don't function in closed loops where "A" always leads to "B" and eventually "C." General systems theory recognizes that all parts of a system can impact the others, leaving room for many possible outcomes. (Murray et al., 2012, pp. 409-410)

Another element of systems theory, specifically cybernetic systems theory, is the concept of a feedback loop, which is where response from outside of the system generates a reaction within the system in an attempt to maintain homeostasis. The classic example of this self-monitoring system is a thermostat which adjusts temperature based on the input from the room. There are two types of feedback loops: positive feedback loops, which prompt a change, or negative feedback loops, which prompt a return to stability. These changes occur as the system attempts to maintain a stable environment, or homeostasis (Brown & Christensen, 1999; Van Dyke et al., 2011; Yarhouse & Sells, 2008).

In many ways, each of the below links is part of a circular feedback loop that re-enforces the theory of MB. Although it is still a provisional, untested theory, the theory of MB could potentially highlight the following use of general systems theory. Entrainment/group identity is heavily influenced by the two other links while simultaneously influencing them. Entrainment creates a focus on group identity. This focus on group identity occurs as egocentric thought processes diminish. As thought processes diminish, emotional reactions become more prominent. The emotional connection re-enforces the bonding experience, which in turn perpetuates the entrainment. MB could potentially continue as long as the facilitating elements of music and

community remain in place, or until a suppressing force, such as a need for higher level cognitive processes, circumvents the current feedback loop. In order to have a more robust understanding of the nature of this system, it is important to discuss each physiological process/psychological perception link encompassed by the theory of MB.

Entrainment and group identity. The simplified definition of entrainment as the synchronization of rhythmic patterns between two independent entities does not adequately describe the variety of entrainment types. Entrainment can occur as an individual person's physiology synchronizes in response to musical stimuli (Benzon, 2001; Clayton et al., 2005; Nozaradan et al., 2012). Another type of entrainment can occur within the context of a social conditioning environment in which individuals mirror each other's responses. Research suggests that both of these types of entrainment are involved in the formation of group identity correlated with the entrainment process ASC (Becker, 2004; Benzon, 2001; Clayton et al., 2005; Herbert, 2011; Sacks, 2008). Sacks (2008) wrote,

We have to go to a concert, or a church, or a musical festival to re-experience music as a social activity, to recapture the collective excitement and bonding of music. In such a situation, music is a communal experience, and there seems to be, in some sense, an actual binding or "marriage" of nervous systems. ... Rhythm and its entrainment of movement (and often emotion), its power to "move" people, in both senses of the word, may well have had a crucial cultural and economic function in human evolution, bringing people together, producing a sense of collectivity and community. ... Just as rapid neuronal oscillations bind together different functional parts within the brain and nervous system, so rhythm binds together the individual nervous systems of a human community. (pp. 266-269)

Sacks' linkage of physiological entrainment and psychological perception of a group identity is also shared by a number of researchers (Becker, 2004; Benzon, 2001; Freeman, 2000; McNeill, 1995). Benzon (2001) wrote, "much of social interaction is about achieving coherence among the neurally distributed components of a single identity" (p. 62). Music, particularly the element of rhythm, appears to be uniquely equipped to facilitate this focus on group identity through the process of entrainment (Becker, 2004; Benzon, 2001; Freeman, 2000; McNeill, 1995; Sacks, 2008).

In the context of EDM events, multiple instances of entrainment and the focus on group identity suggest the occurrence of MB. Rill (2010) discussed how the music facilitates an energetic group identity, which he referred to as a "vibe." The feeling of unity is a key element at these types of events, further emphasized by engaging in the same behaviors at the same time (Hutson, 2000). Ravers, a term for a subset of EDM participants, have a doctrine of "Peace Love Unity Respect (PLUR)" (Hutson, 2000); this highlights the emphasis on the unified group identity. One participant said, "The goal of the techno journey is for people to see themselves without the crushing ego, to know the possibilities of the self" (Hutson, 2000, p. 39). As this quote alludes to, the focus on group identity often occurs in conjunction with a diminished focus on the ego. This dissipation of boundaries between individuals in the formation of a group identity is facilitated by this diminished focus on the ego. This diminishing of thought processes is another aspect of MB.

Alpha brain waves and diminished thought processes. Before exploring the psychological perception of diminished thought processes, it is important to further explore the physiological process of alpha brain waves. EEG scans have revealed an increase of alpha brain wave (8-10 Hz) patterns in musically induced ASC (Fachner, 2011). This is also characteristic of

other examples of ASC induced through activities such as meditation or using psychedelic drugs (Fachner, 2011). These alpha brain waves are associated with a state of relaxation (Bonny & Pahnke, 2002; Clayton et al., 2005). However, the confining nature of this type of brain scanning equipment makes it difficult to accurately assess MB, especially if it occurs in conjunction with dancing; exploring MB in a laboratory environment, isolated from social conditioning, could potentially decrease the potency of MB (Becker, 2004). More research is needed to strengthen the link between alpha brain waves and musically induced MB that Fachner (2011) mentioned. However, the frequency of alpha brain waves associated with other types of ASC (Bonny & Pahnke, 2002; Clayton et al., 2005) strengthens Fachner (2011)'s assertion that it is also present in musically induced ASC. For this reason, an increase in alpha brain waves is considered a characteristic of MB.

A frequently reported psychological perception associated with musically induced ASC is a diminished focus on thought processes (Becker, 2004; Becker- Blease, 2004; Herbert, 2011; Rill, 2010). There is a decrease both in the focus on the Freudian ego and analytical thought processes (Becker, 2004; Bonny & Pahnke, 2002; Hutson, 2000; Rill, 2010). A decrease in analytical thought processes could be linked with the results of an increase in alpha brain waves (Bonny & Pahnke, 2002; Clayton et al., 2005; Fachner, 2011). The decrease in analytical thought processes could be considered “flow,” where meta-cognitive processes are temporarily suspended in order to focus on the present moment (Fachner, 2011). Flow allows for a greater focus on emotional awareness, which will be further discussed below. Flow could also be related to “groove”, an experience where musicians feel that the music flows effortlessly, time is suspended, and analytical thought processes are minimized, perhaps evocative of Ringo Starr's description of musical performance given above (Benzon, 2001; Butler, 2003; Margulis, 2014).

With respect to musically induced ASC, Benzon (2001) wrote, “it is perhaps not so strange that an altered sense of one’s own body parallels the cessation of inner speech” (p. 154). This quieting of inner dialogue is often interpreted as a transcendental perspective (Becker, 2004; Hutson, 2000; Karim, 2011; Rill, 2010). Boundaries between one’s identity and others begin to diminish (Benzon, 2001; Jankowsky, 2007; McNeill, 1995), which could play into the previously discussed concept of a focus on group identity. Hutson (2000) stated this diminishing of boundaries, non-differentiation, is a crucial part of the EDM event experience. Examples of this aspect of MB in the EDM environment is often referred to as being “in-the-moment” or “getting out of your head” (Rill, 2010). It often creates a transcendental perspective (Becker, 2004; Karim, 2011) or spiritual experience (Becker- Blease, 2004; Hutson, 2000; Rill, 2010). This emotional experience could be related to the next element of MB.

ANS arousal and emotional arousal. The transcendental perspective highlights the emotional aspects of the next link. The physiological process of this final link in MB is Autonomic Nervous System (ANS) arousal. ANS arousal has been documented in association with emotional reactions to music (Becker, 2004; Herbert, 2011; McCraty et al., 1996a; McNeill, 1995). Becker (2004) postulated that musically induced ASC is dependent on both social conditioning and ANS arousal. McNeill (1995) suggested that ANS arousal in the form of the parasympathetic nervous system could be an attempt to balance overstimulation; he also acknowledged several other factors that could be facilitating that reaction including ANS arousal in the form of sympathetic nervous system arousal. McNeill’s idea involves both the sympathetic and parasympathetic nervous systems, which aligns with extant research (Becker, 2004; Herbert, 2011; Jankowsky, 2007; McCraty et al., 1996a). Jankowsky (2007) summarized Becker’s theory that entrainment facilitates ANS arousal. Becker explained that ANS arousal manifests as

physiological processes, such as tears or changes in heart rate, which are indications of emotional reactions.

The emotional reactions interpreted from the ANS arousal (Becker, 2004; Jankowsky, 2007) could explain the emotional arousal that is encompassed by the theory of MB. Music has the capacity to facilitate emotional responses (Benzon, 2001; Pilch, 2006; Sacks, 2008). Emotional arousal has been associated with musically induced ASC (Becker, 2004; Fachner, 2011; Freeman, 2000; Horesh, 2006; Jankowsky, 2007; McGuiness & Overy, 2011; Pilch, 2006; Rill, 2010; Rouget, 1985; Sacks, 2006). Concerning musically induced ASC, Becker (2004) wrote, “Musical immersion stimulates emotion and facilitates their special attentiveness, their special consciousness” (p. 1). This musical immersion can facilitate strong physiological responses that are often interpreted as complex emotions, as the following testimony demonstrates:

In certain [musical] passages, it evokes sobs and I feel totally crushed- my listening is fully concentrated, the rest of the world disappears in a way, and I become merged into the music or the music in me, it fills me completely. I also get physical reactions... wet eyes, a breathing that gets sobbing in certain passages, a feeling of crying in my throat and chest. Trying to find words for the emotions themselves I would like to use words as: crushed, shaken, tragedy, maybe death, absorption, but also tenderness, longing, desire (vain), a will to live, prayer. (Becker, 2004, p. 55)

Music can facilitate a variety of intense emotional reactions. A frequent experience is the feeling of joy; this type emotional response to music has been documented in people as young as eighteen months old (Pilch, 2006). The joyful reaction can be expressed emotionally and physically. The following testimony alludes to this visceral reaction to the music: “I was filled by

a feeling that the music started to take command of my body. ... I was dancing, whirling, giving myself up to the music and the rhythms, overjoyed, laughing” (Becker, 2004, p. 54). These emotive reactions to music could be an indication that the traditional boundaries of self have diminished.

If ... we think of our emotional life as being grounded in the neural regulation of body state, then it follows that spontaneous eruptions of feeling reflect the activity of those parts of the brain concerned with monitoring our bodily state *and* with communicating that state to others. The latter is crucial. We are social creatures, we depend on our fellows. When we express emotion we are signaling something about our interior milieu. We assume that others will pick up the signal and respond accordingly. Similarly, when we pick up on the emotions of another, our nervous system will bring about changes in our interior milieu. Our heart rate will increase or decrease, as will our respiration rate, and various hormones will be dispatched in the bloodstream to perform various tasks. Thus emotional communication is a means for mutual regulation of body states. (Benzon, 2001, pp. 96-97)

In other words, the physiological processes and psychological perceptions associated with emotional arousal can facilitate a uniting of individuals through shared emotions. Traditional views of self in the Western world discourage unbridled emotional expression or total impetuosity in favor of sensorial experiences (Pilch, 2006). This sensorial, emotional expression of dissipating boundaries has been observed at EDM events (Hutson, 2000; Rill, 2010).

The emotional arousal aspect of MB is present in these testimonies from participants at EDM events: “Feeling this is what life is all about” (as quoted in Rill, 2010, p. 146), “After every rave, I walk out having seen my soul and its place in eternity,” (Hutson, 2000, p. 38), “Music has

has taught me to fly using wings I never knew I had. It is through music and dance that my soul is free to soar among the heavens” (Hutson, 2000, p. 39), and “[the experience at EDM events] melds into one cosmic soup and everything is one and you can’t separate the music or the moves or which came first” (Hutson, 2000, p. 42). This feeling of being united with the music is an emotional experience that is frequently reported at EDM events (Becker, 2004; Butler, 2003; Hutson, 2000; Rill, 2010). The emotionally charged interactions facilitated by EDM further emphasize the group identity (Butler, 2003), which is a crucial aspect of MB.

Investigation

The suggested links between the physiological processes and psychological perceptions of MB discussed above – entrainment/focus on group identity; alpha brain waves/diminished thought processes; ANS arousal/emotional arousal – function through an interrelated and interactional process. These elements are labeled separately to enable effective discussion concerning the various elements. However, these elements are not as definitively separated in the practical application of MB as they are for the purposes of this thesis, as discussed earlier in the general systems theory section.

These complexities create challenges for empirical research regarding MB. Anthropological research can be done to create observational data of MB in EDM contexts, in the vein of Rouget’s (1985) research, to nurture a deeper understanding of the process by which these elements interact to facilitate the state of MB. However, empirical data collection in a controlled study would need to focus on only one or two variables at a time in order to create a normative baseline for future studies. This inherently postpones the systemic investigation of MB until normative baselines are gathered for isolated variables.

Chapter Four will propose a preliminary study to investigate physiological processes encompassed by the theory of MB. The broader nature of the proposed study is useful for considering an overarching perspective of the physiological processes encompassed by the theory of MB in the context of EDM. Future studies will need to further isolate the individual variables in order to produce more specified results. These specified results can lead to normative baselines for each variable which can then be incorporated back into future investigation of the general systems structure encompassed by the theory of MB. Although the theory of MB inherently refers the phenomenon occurring in a group setting, normative baselines regarding the physiological processes facilitated by music need to be devised in isolation. Preliminary research should investigate the variable of music without the influence of the group environment. After normative baselines have been established for the physiological processes and psychological perceptions encompassed by the theory of MB, future research can investigate these same elements in a group context in order to evaluate the variable of social conditioning environment.

Chapter Four: Proposed Method Section

This chapter will propose a research study that will lay the foundation for future research of MB. The difficulties in isolating variables in MB will be discussed. EmWave2 technology will be proposed as a potential instrument for conducting MB research. Sampling methods and research design will also be discussed in relation to this study. Finally, the limitations of this study will be examined and areas for future research will be suggested.

Discussion of Variables

As discussed in the previous chapters of this thesis, MB is a provisional, untested theory concerning the physiological processes and psychological perceptions that may occur when experiencing music in a group environment. Because of the untested nature of aspects of this theory, foundational research must be conducted to determine normative baselines of certain variables. The complex nature of MB encompasses many variables. A fundamental principle in the theory of MB is the experience of music in a group environment. Because the level of influence of social conditioning in MB is unknown, it is important to create a normative baseline for the physiological and psychological elements of MB for participants listening to music in isolation. This data could serve as a comparison for future studies regarding the social conditioning influence of MB.

The general systems interaction of the multiple variables encompassed by the theory of MB can present complexities in empirical research. It could be difficult to maintain reliability when testing one variable in isolation. As a hypothetical example, if entrainment is highly dependent on ANS activity, studying entrainment without awareness of ANS activity could produce research results that are inconsistent with MB. However, isolating variables can provide information into individual elements of MB that can later be studied in combination with the

other elements. In particular, the social conditioning element of MB will be removed in preliminary research. While social conditioning in the group experience is a crucial element of MB, preliminary research will seek to find a normative baseline of the physiological processes and psychological perceptions associated with MB when experiencing music in isolation. The results of these studies can produce a foundation for future research regarding these same variables in a group environment.

This study will determine whether there are physiological indications of MB in response to music independent from other variables, such as a social conditioning environment. This will provide insight into the role of music in facilitating MB. As stated earlier in this thesis, the population of interest are 18-30 year olds as this is the typical age demographic for EDM events. This population was chosen because of the frequency of ASC reported in a group environment interacting with music (Becker-Blease, 2004; Hutson, 2000; Rill, 2010). Because of this population, the music will be a sample of EDM genre that would be listened to at this type of event. If EDM genres associated with EDM events can facilitate physiological reactions associated with MB in isolation from the social conditioning environment, it would align with Becker's (2004) theory that music can induce physiological processes associated with ASC. If this music genre does not facilitate these physiological processes in isolation from the social conditioning environment, it would lend credence to Rouget's (1985) theory that ASC is largely a product of the social conditioning environment. In order to minimize bias from previous EDM events, participants will be screened to exclude those who have previously attended an EDM event. However, the music will be representative of genre typically performed at EDM events in order to facilitate similar physiological processes that could occur at EDM events in response to the music.

Trance music is a genre of EDM typically performed at EDM events. Trance music is especially noted for creating a strong relationship within the individual and the group as a whole (Becker-Blease, 2004). Trance music has a characteristic of 130-150 beats per minute which encourages dancing (Verderosa & Mattingly, 2002). Trance music is more melodic than other rhythmically driven genres of EDM frequently performed at EDM events (Butler, 2006; Pérez & Ramírez, 2011). Another genre of EDM is ambient music. Ambient music is slower and is generally listened to alone (Becker-Blease, 2004); this is in contrast to trance music's fast tempo and group experience (Becker-Blease, 2004). In this research study, a selection of ambient music will be used as the control piece and a selection of trance music will be the intervention. This will provide data on physiological reactions for the EDM genre typically experienced in group settings at EDM events, trance music. This will serve as a comparison to an EDM genre generally experienced alone, ambient music. This data will create a baseline of physiological reactions to the music at EDM events. Because this study will be conducted in isolation, social conditioning bias from group entrainment, discussed earlier in this thesis, is minimized. It is important to create a baseline of these variables in individuals prior to conducting similar research in a group environment due to the additional variable of social conditioning bias.

Instrument

This research study will utilize the emWave2 device, which is type of biofeedback machine designed by the Institute of HeartMath (McCarty, Atkinson, Tomasino, & Bradley, 2006). Biofeedback is a training tool designed to assist cognitive assessment of psychological distress as manifested through physiological arousal. When a person is aware of how their body reacts to stress, they can retrain their body to adjust back to a well-functioning state. (Edwards, 2014; Hall, 2012; Thurber, 2006; Whited, Larkin, & Whited, 2014). The emWave2 device

gathers Heart Rate Variability (HRV) data through an ear lobe sensor (McCraty et al., 2006; McCraty et al., 1996a; McCraty, Barrios-Choplin, Atkinson, & Tomasino, 1996b). Research suggests that the HRV patterns are a product of neurocardiac function facilitated by Autonomic Nervous System (ANS) activity; research also suggests that changes in the HRV pattern can be reflective of emotional affect (McCraty et al., 2006). While HRV patterns can be insight into a variety of emotional states, the Institute of HeartMath appears to be most interested in the state of coherence (McCraty et al., 2006). Coherence is defined as a

global shift in psychophysiological functioning, which is marked by a distinct change in the rhythm of heart activity. This global shift generates a state of optimal function, characterized by increased synchronization, harmony, and efficiency in the interactions within and among the physiological, cognitive, and emotional systems. (McCraty et al., 2006, p. 3)

Coherence manifests as a smooth, sine-wave pattern of Heart Rate Variability (HRV) centered around 0.1 Hz (McCraty et al., 2006). A high degree of HRV, a large amount of changes in the pattern of the cardiac rhythms, is an indication of “physiological resilience and emotional flexibility” (Emwave personal stress reliever: Owner's manual, 2006). Coherence is a product of many different physiological processes, including those encompassed by MB. Coherence reflects the entrainment present across many different physiological systems (McCraty et al., 2006; Hall, 2012). Coherence also encompasses alpha brain wave patterns as neurocardiac entrainment reflects a change in HRV (Edwards, 2014; Hall, 2012; McCraty et al., 2006). The HRV, an indication of coherence, is effected by Autonomic Nervous System (ANS) activity, both the sympathetic and parasympathetic branches (McCraty et al., 2006). In summary, coherence is reflected in HRV as a product of neurocardiac entrainment in the alpha zone

facilitated by ANS arousal (McCraty et al., 2006). As these physiological processes are the same elements encompassed by the provisional theory of MB, emWave2 appears to be an effective instrument for investigating MB.

Although this proposed study will be limited to the physiological processes manifesting as coherence in response to a musical intervention, it is interesting to note the commonalities between coherence and the psychological perceptions encompassed by the provisional theory of MB. ANS activity and cortisol levels were considered as being a factors in HRV; the corresponding indications of emotional arousal from the ANS activity and cortisol were considered in conjunction with HRV patterns (McCraty et al., 2006). Coherence is associated with positive emotions such as appreciation and love; this is not to be confused with a state of relaxation, which is a state distinct from coherence (Edwards, 2014; Hall, 2012; McCraty et al., 2006). These positive emotions are very similar to the emotions often expressed in MB (Becker, 2004; Fachner, 2011; Freeman, 2000; Horesh, 2006; Jankowsky, 2007; McGuinness & Overy, 2011; Pilch, 2006; Rill, 2010; Rouget, 1985; Sacks, 2006). As an illustration, the feelings of love towards everything associated with coherence (Edwards, 2014; Hall, 2012; McCraty et al., 2006) appears to be very similar to testimonies from EDM participants who reported increased feelings of love (Rill, 2010). If the state of coherence is extended to a hyper-state atypical in daily life, it tends to manifest as a self-less love with limited focus on ego (McCraty et al., 2006). This appears to be similar to the diminished cognitive processes and diminished focus on ego as boundary dissipation occurs in MB. Additional research is necessary to stabilize this potential link.

Coherence is a broad picture of systemic function depicted in the HRV data (McCraty et al., 2006). This ability to measure multiple physiological processes encompassed by the systemic

nature of MB suggests that coherence could be a viable investigate of the theory of MB. Although each physiological process and correlated psychological perception should be investigated individually to determine normative baselines in the context of MB, coherence can provide a preliminary, systemic overview of the physiological components associated with MB. At the end of the session, low, medium, and high coherence scores are given. These session scores indicate the percentage of time spent in each level of coherence (Emwave personal stress reliever: Owner's manual, 2006). The real-time depiction of these elements as a coherence score makes it a viable instrument for monitoring physiological reactions to the musical intervention. This is especially useful as emWave coherence has already been used to measure physiological reactions to music.

EmWave technology has also been used measure to physiological reactions to music (McCraty et al., 2006; McCraty et al., 1996a; McCraty et al., 1996b; Thurber, 2006) which gives credence to utilizing it for MB research Although this particular study does not include group testing, the portable and noninvasive nature of the emWave2 could be a feasible option for studying the effects of MB in a real life, group settings. The unobtrusive nature of the emWave2 devise does not hinder typical expressions of musically induced ASC, such as dance. Theoretically, the emWave2 could be useful for measuring individual physiological processes through the use of individual emWave2 units in the context of a group experience of MB. This capability is especially valuable in light of the constricting nature of other instruments capable of measuring physiological reactions to music such as an EEG, Event-Related Potentials (ERP), Magnetoencephalography (MEG) or functional Magnetic Resonance Imaging (fMRI) (Smith & Kosslyn, 2011).

Participants

This study will seek participants who are within the age range of eighteen to thirty years old, which is the typical demographic for participants at EDM events (Hutson, 2000; Rill, 2010). In order to minimize social conditioning environment bias for this particular study, this study will exclude participants who have previously attended an EDM event. Because entrainment is a crucial element in both MB and in the coherence score of the emWave2, participants with disorders that interfere with entrainment will also be excluded from this study. Disorders that interfere with entrainment include Parkinson's, autism, epilepsy, and heart arrhythmias (Clayton et al., 2005). Participants with hearing loss will also be excluded from this study because of the musical intervention utilized in this study. The participants will be recruited through flyers at local colleges because of the high concentration of the desired demographic. As incentive to join the study, participants will be entered into a drawing for a gift card to a local coffee shop. This incentive falls under the ethical guidelines of avoiding undue inducements (Department of Health, Education, and Welfare, 1979). A previous emWave study involving music (McCraty et al., 1996a) utilized 10 participants in 5 separate evaluations for a total of 50 observations. In a similar manner, this study will seek 50 participants who will randomly selected to the control group or testing group.

Research Study

This study will follow the model of previous emWave2 research regarding physiological reactions to musical interventions (McCraty et al., 1996a; McCraty et al., 1996b; Thurber, 2006). This study will follow these same protocols as these previous studies in that a fifteen minute interval of pre-test baseline measurements of the coherence score will be gathered; this fifteen minute interval will be silence. This will be followed by a fifteen minute interval of musical

intervention. Participants will be randomly assigned to either the control group, which will receive the intervention of ambient music, or the test group, which will receive the intervention of trance music. All participants would be given informed consent documentation which explains Institutional Review Board (IRB) policies before consenting to the study. Risk for this study is minimal as the music will be played at a volume similar to exposure levels experienced in daily life. Other than the brief overview listed in the informed consent documentation, participants will not be informed during the test what is being measured in order to prevent bias. For the same reason, the emWave device will be utilized in the silence mode and stealth mode (no indicator lights) and the participant will not be able to watch the computer screen. Each participant will wear the emWave2 ear lobe sensory for a total of thirty minutes. This interval allows for the fifteen minute pretest of silence and the fifteen minute intervention of music, ambient music for the control group and trance music for the testing group. The ambient music will be a fifteen minute loop of selections from Brian Eno's *Music for Airports* "1/2", as suggested by Verderosa & Mattingly (2002, p. 35). The trance music will be a fifteen loop of selections from Paragliders "Paraglide", as suggested by Butler (2006, p. 10).¹

The emWave software creates ratios of low, medium, and high coherence levels for each testing interval. These ratios indicate the amount of time spent in each coherence level during the testing interval. These ratios will be recorded for both the pre-test interval of silence and the intervention interval of music for both the control group (ambient music) and the test group (trance music). The change in ratios between the pre-test interval and the testing interval could suggest a psychological change facilitated by the music manifested by a change in coherence. The means of both the control group's coherence score ratios and the test group's coherence

¹The few seconds of vocal repetition will be edited out for the purposes of this study in order to prevent semantic prompting.

score ratios will be calculated for both the pre-test interval (silence) and the intervention interval (music). This will highlight any changes in the ratios of coherence scores between the pre-test and intervention intervals, as well as the differences in ratios between the control group and the testing group. A larger percentage of high coherence scores in the trance music group (testing group) than in the ambient music (control group) would suggest that trance music facilitates higher levels of coherence scores than ambient music.

This data will be important to create a baseline of coherence scores for trance music. This data will provide empirical insights on physiological responses to trance music, when compared to the similar EDM genre of ambient music. This is an important foundation study that should be conducted prior to researching trance music in a group environment, such as at an EDM event. The data gathered from this study can also help to highlight the social conditioning influences on MB at EDM events. If this study reveals no significant difference between the ambient music group and the trance music group, it could be hypothesized that the reported experiential difference between the two subgenres (Becker-Blease, 2004) is related to the social conditioning aspect of MB (Becker, 2004; Benzon, 2001; Fachner, 2011; Jankowsky, 2007; Rill, 2010) found at EDM events (Hutson, 2000; Rill, 2010). The implications of the potential results will be discussed in the next chapter of this thesis.

Limitations

This study is quite limited in scope. This study only looks at the coherence levels of participants who listened to trance music when compared to participants who listened to ambient music. This study does not address the social conditioning elements associated with MB. Although the coherence score serves as a coalescence of entrainment, alpha brain waves, and ANS activity, this study does not individually examine the elements related to the physiological

processes of MB. This study does not evaluate the psychological perceptions of MB. It is possible that the results of this study may not be directly generalizable to the entire EDM population due the prevalence of drug use at these events (Rill, 2010; Hutson, 2000; Fachner, 2011). However, this limitation is unavoidable as it would be unethical to randomly assign participants to studies that would utilize typical EDM drugs, such as Ecstasy (Department of Health, Education, and Welfare, 1979).

Extension of the Research

This foundational research study will provide a baseline of coherence levels for participants listening to trance music. Future studies related to MB at EDM events could function as an extension of this current study administered in a group setting. The portable nature of the emWave2 would allow for the administration of the test to a number of individuals at once, limited only by the number of emWave2 devices available. This study could be conducted in a laboratory environment to create a baseline of normative coherence scores when listening to trance music in a group. This data could then provide insight into future studies that would gather coherence scores of participants at actual EDM events. Normative baselines of coherence scores in response to the intervention of trance music in individual participants who have not been influenced by social conditioning environment bias of prior EDM events will provide valuable insight for future studies. This same study could be re-administered in a group, laboratory setting with participants without the social conditioning environment bias to determine normative baselines for coherence scores for participants listening to trance music in a group setting. Next, these baselines could be used to expand the study into an actual EDM event to explore the social conditioning environment bias variable in comparison to the normative baselines for participants without the social conditioning environment bias. A discussion of

potential results from this proposed study can be found in the next chapter of this thesis.

Extensive empirical research is needed to examine the theoretical principles of MB. Each physiological process and psychological perception requires examination in individuals prior to conducting MB research in a group environment. These variables must be isolated in order to gather empirical data on each element of MB which will create the foundation for more complex MB research. As discussed earlier in this thesis, the systems theory element of MB creates feedback loops. The process of these feedback loops will require extensive research after the foundational research of isolated variables has been completed. The untested nature of MB presents many opportunities for future research

Chapter Five: Summary and Areas for Future Research

This final chapter will provide a brief summarization of the previous chapters in order to provide contextualization for potential results that the method proposed in chapter four could produce. The results of this proposed research study would provide insight into the impact of the social conditioning environment on physiological processes encompassed by the theory of MB. Previous research from Rouget (1985) and Becker (2004) diverge on the expected impact of this variable on the facilitating process of musically induced ASC.

This thesis focused on physiological processes and psychological perceptions associated with musically induced ASC. In the context of a social conditioning environment and group community, the theory of MB proposes that these physiological processes and psychological perceptions can interact to facilitate the dissipation of traditional boundaries between people. Although this theory was designed in the context of EDM events, aspects of this theory can be investigated through a variety of approaches. Further research on the neurochemical aspects of MB could provide additional insight into this complex phenomenon. Many areas of research in the field of music cognition touch on issues adjacent to aspects of MB that could provide a more robust understanding of MB. Finally, aspects of the theory of MB could be expanded towards other demographics, provided that certain ethical considerations of the potential power of MB are observed.

Literature Review. This thesis examined current literature regarding musically induced ASC. It was noted that ASC has been viewed with skepticism in the Western World (Becker, 2004; Jankowsky, 2007). ASC is often facilitated by music (Becker, 2004; Benzon, 2001; Bonny & Pahnke, 2002; Herbert, 2011; Pilch, 2006; Rouget, 1985). Rouget (1985) proposed that musically induced ASC was a product of social conditioning. Becker (2004) expounded on

Rouget's theory to suggest that musically induced ASC is associated with physiological processes in response to the music. This thesis took the position that both social conditioning physiological processes are associated with musically induced ASC.

Some of the physiological processes that are encompassed by musically induced ASC include the following: entrainment (Becker, 2004; Benzon, 2001; Clayton et al., 2005; Jankowsky, 2007; Levitin, 2006; Nozaradan et al., 2012; Sacks, 2008), increase in alpha brain waves (Bonny & Pahnke, 2002; Fachner, 2011), and ANS arousal (Becker, 2004; Herbert, 2011; McCraty et al., 1996a; McNeill, 1995). Psychological processes that have been documented in conjunction with musically induced ASC include the following: a focus on group identity (Becker- Blease, 2004; Benzon, 2001; Butler, 2006; Hutson, 2000; Rill, 2010), diminished cognitive processes (Becker, 2004; Becker-Blease, 2004; Herbert, 2011; Karim, 2011; Rill, 2010), and emotional arousal (Becker, 2004; Fachner, 2011; Freeman, 2000; Horesh, 2006; Jankowsky, 2007; McGuinness & Overy, 2011; Pilch, 2006; Rill, 2010; Rouget, 1985; Sacks, 2006). This thesis focused on the population at EDM events. This population was chosen because of the frequency of ASC reported in a group environment interacting with music in a Western culture (Becker-Blease, 2004; Hutson, 2000; Rill, 2010).

Theory of Musical Bonding. As stated in this thesis, the theory of MB proposes that music facilitates linked physiological processes and psychological perceptions which create a group bonding experience as normal boundaries between self and others dissolve. This thesis incorporates these physiological processes and psychological perceptions that have been noted in diverse accounts of musically induced ASC into one entity that is labeled MB. The following physiological processes and psychological perceptions are correlated: entrainment with focus on group identity (Becker, 2004; Benzon, 2001; Freeman, 2000; McNeill, 1995; Sacks, 2008),

increase in alpha brain waves with diminished cognitive processes (Bonny & Pahnke, 2002; Clayton et al., 2005; Fachner, 2011), and ANS arousal with emotional arousal (Becker, 2004; Jankowsky, 2007). Although these related elements have been noted in other musically induced ASC research, this thesis integrates these elements into one system, MB. In the manner of general systems theory (Brown & Christensen, 1999; Van Dyke et al., 2011; Yarhouse & Sells, 2008), the theory of MB proposed in this thesis suggests that each pair influences the entire system as long as the facilitating element- music- remains in place or until a suppressing force, such as the need for higher level cognitive process, circumvents the loop.

These physiological processes and psychological perceptions encompassed by MB create a unifying experience as normal boundaries between self and others dissolve. This same phenomenon of a heightened sense of community of MB is noted in McNeill (1995)'s theory of Muscular Bonding. McNeill's theory states that a unifying experience occurs when a group engages in coordinated movements, such as marching or dancing; this unifying experience occurs when boundaries between self and others dissolve. In a similar way, MB states that a bonding experience occurs as boundaries between self and others dissolve when a group engages in a shared experience of music (Benzon, 2001; Jankowsky, 2007; McNeill, 1995). Boundaries are dissolved as people experience the physiological process of entrainment, which is linked with a focus on group identity (Becker, 2004; Benzon, 2001; Freeman, 2000; McNeill, 1995; Sacks, 2008). The diminished cognitive processes, linked with an increase in alpha brain waves, allows boundaries to be dissolved as the analytical focus on self diminishes (Becker, 2004; Becker-Blease, 2004; Hutson, 2000; Karim, 2011; Rill, 2010). Emotional arousal, linked with ANS arousal, is also associated with the loss of boundaries between self and others when shared emotional experience creates a bonding experience (Benzon, 2001; Butler, 2006; Freeman, 2000;

McNeill, 1995). In summary, the theory of MB states that music facilitates these linked physiological processes and psychological perceptions which creates a bonding experience by dissolving boundaries between self and others.

Methods Section. MB is a complex, provisional theory that will require years of investigation. Because MB utilizes systems theory, each element influences the whole. Experimenting with any variable will create potential repercussions with other variables. Preliminary research must be done on each variable in isolation to create normative baselines prior to researching the systemic function. As stated in the literature review, social conditioning is a significant factor in researching these issues. Because of this, preliminary research should be done in isolation from group environments in order to create normative baselines of physiological processes and psychological perceptions encompassed by MB prior to including the additional variable of social conditioning.

For these reasons, the proposed research study in this thesis would seek participants within the typical EDM event demographic, ages 18-30 (Rill, 2010), that have not previously been to an EDM event. Participants would wear an EmWave2 ear lobe sensor during a fifteen-minute pre-test interval of silence, followed by a fifteen-minute interval of EDM music. The EmWave2 measures coherence (McCraty et al., 1996a; McCraty et al., 1996b; McCraty, et al., 2006), which functions as an overall indicator of the previously mentioned physiological processes encompassed within MB. This study will measure the change in coherence in participants listening to trance music, an EDM genre usually experienced at EDM group events (Becker-Blease, 2004). This change in coherence will be measured against a randomly assigned control group of participants listening to ambient music, an EDM genre usually experienced alone.

Discussion of Possible Results

No significant difference between the two groups could suggest that the music itself does not facilitate the MB observed at EDM events; this would suggest that MB is largely a product of social conditioning. This result would be in line with Rouget's (1985) theory that musically induced ASC is primarily due to social conditioning influences, rather than a physiological process facilitated by the music. Although Rouget certainly does not deny that physiological processes are involved in musically induced ASC, he does deny that music inherently induces trance (Pilch, 2006). In regards to this proposed research study, no significant difference between the ambient music group and the trance music group could suggest that there is not something that creates an inherently different physiological reaction to the trance music compared to the ambient music. If there was a significant difference in coherence levels for the participants experiencing trance music at an EDM event in comparison to participants experiencing trance music in a laboratory setting, those findings would further strengthen the impact of the social conditioning environment. This could instigate additional studies exploring the elements of an EDM event that facilitate MB.

A significant difference between the two groups would suggest that the MB at EDM events is facilitated by specific musical elements in the EDM genre. This would be congruent with Becker's (2004) theory that both social conditioning and physiological processes are elements in musically induced ASC. Becker (2004) explains her philosophy regarding trance (ASC) as the following:

Whereas the sciences of biology and neuroscience are central to explaining the phenomenon of trancing, trance as inner experience cannot be understood entirely within a scientific framework. My object is to make trancing comprehensible within a secular

humanistic framework, within a biological orientation while simultaneously acknowledging the special gnosis of trancing that cannot and need not be explained. (p. 1-2)

Becker did not discount the importance of the social conditioning environment variable but did emphasize physiological processes more than Rouget did. Relating to the proposed study in Chapter Four, a significant difference between the two groups would show that trance music as a genre facilitated a different physiological process than the ambient music did. This result would not state that social conditioning environment is an unimportant variable; rather, this difference between the ambient music group and the trance music group would imply that the physiological processes associated with MB are not solely a reaction to the social conditioning environment. A significant difference between the ambient music group and the trance music group would indicate a difference in physiological reactions between the genres even when experienced in isolation from the social conditioning environment. Residual suggestibility from past experience with the social conditioning environment would be diminished because participants who had previously attended an EDM event would be excluded from this study. A significant difference between the ambient music group and the trance music group would suggest that future research regarding MB should continue to investigate physiological processes facilitated by music both in the context of, as well as removed from, the social conditioning environment in order to continue further investigation. This finding could be elaborated upon by repeating the study with other EDM genres in comparison to the control group of ambient music.

While preliminary research regarding the variables of physiological processes and psychological perceptions need to be conducted in isolation in order to create normative baselines, this research will not be truly addressing the theory of MB until it is implemented in a

group setting. The bonding of individuals through the process of boundary dissipation is crucial to the entire concept of MB. As such, foundational studies, such as the one outlined in chapter four of the thesis, should be re-administered in a group setting to gather the same data during a potential MB state. Subjective as well as objective ways of determining when boundary dissipation occurs in MB would also be important in developing empirical research towards the existence of MB.

Areas for Future Research

The subjects raised in this thesis could lead into a number of different avenues for future research. The interdisciplinary nature of this thesis could provide a beginning point of discussion for a variety of subjects. Some of these subjects that will be briefly discussed include the following: neurochemical aspects related to MB, music cognition aspects related to MB, other potential social conditioning environments that could support MB, as well as ethical issues related to MB.

Neurochemical aspects of MB. Freeman (2000) investigated the role of oxytocin in bonding aspects of musical contexts. Oxytocin facilitates a neurological environment conducive to forming new memories. Freeman postulates that the role of oxytocin is active during group bonding experiences associated with music. This role of oxytocin could be a vital aspect of facilitating MB. As such, future research concerning the facilitating agents of MB, such as music and group environment, should also consider the role of oxytocin. The investigation of ANS arousal in MB could benefit from a more detailed exploration, specifically in the area of neurochemical involvement. For example, a crucial area of future exploration in the emotional arousal encompassed by MB is the activity of the hypothalamus and the amygdala (Levitin,

2006; McNeill, 1995).² Because these structures are associated with ANS arousal and emotional processing (Smith & Kosslyn, 2011), hypothalamus and amygdala activity could also be another facilitator of MB. Following the principles set forth in Chapter Four, normative baselines of these functions in reaction to music in isolation should be determined. This preliminary study should be conducted prior to investigating these functions in the group context of MB. Although the confining nature of brain-imaging could make group testing difficult, the role of the hypothalamus and amygdala in facilitating MB deserves additional investigation.

MB in other contexts. Although the theory of MB was designed to reflect the specific social conditioning environment of EDM events, it is plausible that this theory could be expanded to incorporate other demographics. In expanding this theory, it could be enlightening to examine other group experiences of ASC. Possession states are an often cited example of musically induced ASC in a group context (Becker, 2004; Benzon, 2001; Jankowsky, 2007; Rouget, 1985); it is plausible that the theory of MB could be useful in exploring this phenomenon. Another potential area for MB research could be charismatic worship services (Becker- Blease, 2004; Becker, 2004; Freeman, 2000; Hutson, 2000).³ MB is specifically designed to explain the group bonding effect of musically induced ASC. However, it is possible that some of the principles of MB could serve useful in describing other types of musically induced ASC occurring in solitude. For example, emerging research suggests that musically induced ASC may occur when listening to music on long road trips (Brodsky, 2015; Herbert, 2011). Although this would not be an example of MB due to the lack of a group context,

²This area for potential research was highlighted by Dr. Misti Poulos via thesis draft comments on March 19, 2015.

³This area for potential research was highlighted by Dr. David Henderson via thesis draft comments on March 27, 2015.

physiological or psychological elements present in MB could still manifest in these instances where musically induced ASC occurs in isolation.

Ethical issues related to MB. As one considers other social conditioning environments that could support the state of MB, it is important to consider the ethical implications of purposefully creating that type of environment. Following Freeman's (2000) theory that oxytocin is involved in dissolving the boundaries between self and others in musically induced ASC, this same process present in MB could create a state that would render participants more suggestible to ideologies not previously held. This process of oxytocin is similar to some aspects of brainwashing. More investigation is needed to determine whether rational judgment is impaired in the state of MB. Therefore, prudent awareness of the implications of MB should be present when music is utilized in a group setting. Future research should investigate the ethical limits of utilizing MB as well as implications on conscious volition for participants experiencing the state of MB.

Conclusion

The provisional theory of MB proposed in this thesis will require many years of empirical testing to investigate these complex variables involved in this phenomenon. Building on the music and trance research by Rouget (1985) and Becker (2004), this thesis investigates instances of musically induced ASC at EDM events (Becker-Blease, 2004; Hutson, 2000; Rill, 2010). The theory of MB highlights the group bonding resulting from the diminishing of traditional boundaries between individuals. This theory proposes that this state is accomplished through the correlated physiological processes and psychological perceptions associated with musically induced ASC. MB suggests that these elements interact in a manner reminiscent of general systems theory. This system could theoretically allow a community of individuals from the same

social conditioning environment to experience a diminishing of traditional boundaries between self and others, which can manifest as a bonding experience.

The complex nature of this theory requires preliminary empirical investigation of isolated variables prior to initiating studies focusing on the general systems nature of the theory of MB. The proposed method in Chapter Four for determining normative baselines for aspects of the physiological processes encompassed by the theory of MB is designed to be applicable to future EDM research. Although the theory of MB explicitly refers to a group context, normative baselines are important to determine before introducing additional variables. Future studies can then address the influence of the social conditioning environment. The results of the proposed study in Chapter Four will shed light on the influence of music on facilitating ASC. Chapter Four proposes a study to investigate if trance music, an EDM genre generally experienced in group contexts, is able to facilitate physiological processes when isolated from the EDM social conditioning environment. If trance music facilitates the physiological processes encompassed by the theory of MB when isolated from the EDM event, it would give more credence to Becker's (2004) theory; Becker's theory encompasses the idea that music has the capacity to facilitate physiological processes. If trance music does not facilitate those same processes when isolated from the EDM social conditioning environment, it would bolster Rouget's (1985) claim that musically induced ASC is a direct result of the environment; thus, the music is not able to facilitate the processes encompassed by MB in isolation from the social conditioning environment.

The complex nature of this theory can serve as the ideological impetus for a variety of empirical research studies investigating the validity of this theory. Much of the research used to create the theory of MB was from a largely anthropological perspective (Becker, 2004; Becker-

Blease, 2004; Benzon, 2001; Hutson, 2000; Jankowsky, 2007; Rill, 2010; Rouget, 1985).

Empirical studies, such as the one proposed in this thesis, would provide quantifiable data to strengthen the qualitative research regarding elements used to devise the theory of MB.

Empirical studies could provide verification of the existence of the state of MB as well as provide more focused insight into the various facilitating elements of this state. Future research will continue to investigate this powerful capacity of music to facilitate the bonding of individuals.

References

- A state of trance*. (2014). Retrieved October 4, 2014, from <http://www.astateoftrance.com/about/>
- Becker- Blease, K. A. (2004). Dissociative states through new age and electronic trance music. *Journal of Trauma & Dissociation*, 5 (2), 89-100.
- Becker, J. (2004). *Deep listeners: Music, emotion, and trancing*. Bloomington: Indiana University.
- Benzon, W. (2001). *Beethoven's anvil: Music in mind and culture*. New York: Basic Books.
- Biswas, A. (2011). The Music of what happens: mind, meditation, and music as movement. In D. Clarke, & E. Clarke, *Music and consciousness: Philosophical, psychological, and cultural perspectives*. New York: Oxford University.
- Bonny, H. L., & Pahnke, W. (2002). Music and consciousness. In L. Summer (Ed.), *Music and consciousness: The evolution of guided imagery and music* (pp. 72-92). Gilsum, NH: Barcelona Publishers.
- Brodsky, W. (2015). *Driving with music: Cognitive-behavioural implications*. Ashgate.
- Butler, M. J. (2006). *Unlocking the groove: Rhythm, meter and musical design in electronic dance music*. Bloomington: Indiana University Press.
- Clayton, Martin; Sager, Rebecca and Will, Udo (2005). In time with the music: the concept of entrainment and its significance for ethnomusicology. *European Meetings in Ethnomusicology*, 11, pp. 3–142.
- Department of Health, Education, and Welfare. (1979). *The Belmont Report*. Washington, D.C.: U.S. Department of Health & Human Services.
- Diagnostic and statistical manual of mental disorders: DSM-5*. (2013). Washington, D.C: American Psychiatric Association.

- Edwards, S. D. (2014). Evaluation of heart rhythm coherence feedback training on physiological and psychological variables. *South African Journal of Psychology*, 44 (1), 73-82.
- Emwave personal stress reliever: Owner's manual*. (2006). Boulder Creek: HeartMath.
- Fachner, J. (2011). Drugs, altered states, and musical consciousness: reframing time and space. In D. Clarke, & E. Clarke (Eds.), *Music and consciousness: Philosophical, psychological, and cultural perspectives*. New York: Oxford University Press.
- Freeman, W. (2000). A neurobiological role of music in social bonding. *The origins of music* (pp. 411-424). Cambridge: MIT Press.
- Hall, K. N. (2012). *The effects of heartmath emwave heart rate variability coherence training on stress reduction for parents of children with autism* (Ph.D. dissertation ed.). Eagan, MN: Argosy University Twin Cities.
- Herbert, R. (2011). Reconsidering music and trance: cross-cultural differences and cross-disciplinary perspectives. *Ethnomusicology Forum*, 20 (2), 201-227.
- Horesh, T. (2006). Dangerous music: working with the destructive and healing powers of popular music in the treatment of substance abusers. In D. Aldridge, & J. Fachner (Eds.), *Music and altered states: Consciousness, transcendence, therapy, and addictions* (pp. 125-139). London: Jessica Kingsley Publishers.
- Hutson, S. R. (2000). The rave: spiritual healing in modern western subcultures. *Anthropological Quarterly*, 73 (1), 35-49.
- Jankowsky, R. J. (2007). Music, spirit possession and the in-between: ethnomusicological inquiry and the challenge of trance. *Ethnomusicology Forum*, 16 (2), 185-208.
- Jourdain, R. (1997). *Music, the brain, and ecstasy*. New York: HarperCollins Publishers.

- Kandler, K., & Katz, L. C. (1995). Neuronal coupling and uncoupling in the developing nervous system. *Current Opinion in Neurobiology*, 5, 98-105.
- Karim, J. (2011, September 27). *Trance music and altered states of consciousness: An analysis of trance & house music as a transcendental force (a summary)*. Retrieved October 9, 2014, from Music and Brain Blog at University of Toronto:
<http://musicbrainerblogger.blogspot.com/2011/09/trance-music-and-altered-states-of.html>
- Levitin, D. (2006). *This is your brain on music: The science of a human obsession*. New York: Dutton.
- Ludwig, A. M. (1966). Altered states of consciousness. *Archives of General Psychiatry*, 15, 225-234.
- Margulis, E. H. (2014). *On repeat: How music plays the mind*. New York: Oxford University Press.
- McCraty, R., Atkinson, M., Rein, G., & Watkins, A. (1996a). Music enhances the effect of positive emotional states on salivary IgA. *Stress Medicine*, 12 (3), 167-175.
- McCraty, R., Atkinson, M., Tomasino, D., & Bradley, R. T. (2006). *The coherent heart: Heart-brain interactions, psychophysiological coherence, and the emergence of system-wide order*. Boulder Creek: Institute of HeartMath.
- McCraty, R., Barrios-Choplin, B., Atkinson, M., & Tomasino, D. (1996b). The effects of different types of music on mood, tension, and mental clarity. *Alternative Therapies in Health and Medicine*, 2, 52-65.
- McGuiness, A., & Overy, K. (2011.). Music, consciousness, and the brain: music as shared experience of an embodied present. In D. Clarke, & E. Clarke (Eds.), *Music and*

- consciousness: Philosophical, psychological, and cultural perspectives*. New York: Oxford University Press.
- McNeill, W. H. (1995). *Keeping together in time: Dance and drill in human history*. Cambridge, MA: Harvard University Press.
- Murray, K. W., Sommers-Flanagan, J., & Sommers-Flanagan, R. (2012). Family systems theory and therapy. In J. Sommers-Flanagan, & R. Sommers-Flanagan, *Counseling and psychotherapy theories in context and practice: Skills, strategies, and techniques* (pp. 405-440). Hoboken: John Wiley & Sons, Inc.
- Music cognition at Eastman School of Music/University of Rochester*. (n.d.). Retrieved April 2014, 4, from Eastman School of Music: <http://www.theory.esm.rochester.edu/music-cognition/>
- Nozaradan, S., Isabelle, P., & Mouraux, A. (2012). Selective neuronal entrainment to the beat and meter embedded in a musical rhythm. *Journal of Neuroscience*, 32 (49), 17572-17581.
- Pérez, F. O., & Ramírez, F. A. (2011). Armin: automatic trance music composition using answer set programming. *Fundamenta Informaticae*(81), 79-96.
- Pilch, J. J. (2006). Music and trance. In D. Aldridge, & J. Fachner (Eds.), *Music and altered states: consciousness, transcendence, therapy, and addictions* (pp. 28-50). London: Jessica Kingsley Publishers.
- Rill, B. (2010). Identity discourses on the dance floor. *Anthropology of consciousness*, 21 (2), 139-162.
- Rouget, G. (1985). *Music and Trance* (Revised ed.). (B. Biebuyck, Trans.) Chicago: University of Chicago Press.

- Sacks, O. (2006). The power of music. *Brain*, 129 (10), 2528-2532.
- Sacks, O. (2008). *Musicophilia*. New York: Vintage Books.
- Smith, E. E., & Kosslyn, S. M. (2011). How the brain gives rise to the mind. In D. J. Levitin, *Foundations of cognitive psychology: core readings* (pp. 656-683). Boston: Allyn & Bacon.
- Thurber, M. R. (2006). *Effects of heart-rate variability biofeedback training and emotional regulation on music performance anxiety in university students* (Ph.D. dissertation ed.). Denton, TX: University of North Texas.
- Van Dyke, D., Jones, S. L., & Butman, R. E. (2011). Family systems theory and therapy. In J. & Butman, *Modern psychotherapies: A comprehensive christian appraisal* (pp. 346-397). Downers Grove: InterVarsity Press.
- Verderosa, T., & Mattingly, R. (2002). *The techno primer: The essential reference for loop-based music styles*. Milwaukee: Hal Leonard.

Appendix

MUSICAL BONDING

A Thesis Proposal

Presented to

The Faculty of

Criswell College

In Partial Fulfillment

Of the Requirements for RES 603

by

Hannah Margaret Percival

February 8, 2015

Proposed Table of Contents

Chapter 1: Introduction

Chapter II: Literature Review

Chapter III: Operationalization of Constructs

Chapter: IV: Proposed Method Section

Chapter V: Summary

Abstract

Participants in group music experiences such as Electronic Dance Music (EDM) events often report a diminished focus on cognition, an increase in sensorial awareness, and a focus on the group identity rather than the individual. This thesis will label this experience as “musical bonding” because the purpose is to prime individuals for a community mentality. Becker postulates that musically-induced altered states can be created by rhythmic entrainment, which is the process by which two separate entities begin to vibrate at the same rate. Rhythmic entrainment can occur within the human body in reaction to music as well as a physiological reaction between two people; musical bonding encompasses both of these concepts of entrainment simultaneously. Due to the compounding variables of social conditioning, it is difficult to assess the implications of musical bonding at group events. In order to isolate the intrapersonal aspects of entrainment, this thesis proposes a study for observing the entrainment effects of music genres generally listened to at musical bonding events, such as EDM, in isolation from the group influence. This will provide a normative baseline for intrapersonal entrainment effects of EDM. When the entrainment effects from EDM are known, research can be further extended to measure the entrainment effects of EDM within the socially conditioned environment of musical bonding.

Literature Review

Participants in group music environments often report feelings of altered consciousness that include diminished cognitive processes, increased sensorial experiences, and a dissolution of ego as focus moves towards a group mentality (Hutson, 2000; McGuinness and Overy, 2011; Rill 2010; Becker, 2004; Benzon, 2001; Butler, 2003). One group music event where these perceptions have been reported is an Electronic Dance Music (EDM) event, which is a more recent evolution of rave culture. Participants in these events are bombarded with a variety of sensorial experiences such as illicit drug use, lighting effects, and pulsating music. Despite the variety of stimuli, participants and scholars emphasize the influence of the music in inducing an altered state (Rill, 2010; Hutson, 2000; Becker, 2004; McGuinness and Overy, 2011).

Entrainment

Becker cites neurological research, which suggests that physiological and sociological elements react to music to induce an altered state (Becker, 2004). One of the key components of Becker's theory is entrainment. Entrainment is the process by which two entities with individual rhythmic patterns interact in such a way that their patterns adjust to be in synchronization with each other. This process has been observed in entities as varied as pendulums, fireflies, breathing and heart rates, and human sociological processes such as speech patterns and mirroring non-verbal gestures (Will & Berg, 2007).

Rhythmic entrainment can occur when humans interact with music (Will & Berg, 2007). For the purposes of this thesis, rhythmic entrainment exhibited in a person in reaction to music will be labeled intrapersonal musical entrainment. Entrainment can also occur between individuals as they interact (Will & Berg, 2007). This type of social entrainment is important in understanding intrapersonal musical entrainment because intrapersonal musical entrainment is

set up through expectation. This expectation is created through exposure to music of this genre and observing other people's reaction to the music. In a live music event such as an EDM concert, dancing in response to the beat provides a fertile environment for entrainment as the visual and physical stimulus of dancing in a crowd can encourage entrainment. This entrainment between two humans listening to music in a social environment will be labeled interpersonal musical entrainment.

Interpersonal musical entrainment forms the basis of Rouget's (1985) theory which states that altered states of consciousness induced by music is created solely from social expectations rather than from anything specific in the music. He believes that there is nothing inherent in music itself that could induce altered states because these altered states are socially constructed (Rouget, 1985). Without dismissing the importance of interpersonal musical entrainment, this thesis concurs with Becker's (2004) assertion that physiological reactions such as intrapersonal musical entrainment also play an important role in the altered state of consciousness found at group music environments.

Musical Bonding

Following in Becker's philosophy, this thesis will take the position that both intrapersonal and interpersonal musical entrainment aid in creating altered states of consciousness at group music events; this thesis will label this concept as "musical bonding." This terminology is based on McNeill's (1995) concept of muscular bonding, which describes interpersonal entrainment found in dancing or military marching drills. Although altered states of consciousness can be created through other stimuli that are often found at group music events such as drug usage or overstimulation, music bonding specifically references music as the

catalyst. Music bonding as a state of mind is characterized by a diminished focus on cognition, an increase in sensorial awareness, and a focus on the group identity rather than the individual.

The diminished focus on cognition found in music bonding has been described by EDM participants as “getting out of your head” (Rill, *Identity Discourses on the Dance floor*, 2010, p. 144). It consists of embracing life-in-the-moment (Hutson, 2000). Normal perception of time may be altered (Rill, *Identity Discourses on the Dance floor*, 2010) because time becomes less relevant when experiencing the moment is prevalent. The diminished focus on cognition is treated with some skepticism in the Western world, which highly values Cartesian concept of the mind controlling experiences through reason (Jankowsky, 2007; Benzon, 2001). The diminished focus on cognition allows for a larger focus on sensorial experience. Music bonding incorporates the concept of sensorial experience that is typical at EDM events. One aspect of the increase in sensorial awareness is an increased awareness of music. Many EDM participants report feeling unified with the music (Rill, *Identity Discourses on the Dance floor*, 2010). This feeling could be created by Autonomic Nervous System (ANS) arousal, which has been documented in response to music (Becker, 2004; Herbert, 2011). ANS arousal could explain the heightened awareness of sensorial input with minimal cognitive processing that is characteristic of music bonding. This involuntary flood of emotions from the ANS arousal (Becker, 2004) can create the feeling of being unified with the music that is prevalent among EDM participants. This feeling of being unified with the music may also be a very literal perception of intrapersonal music entrainment as the bodily systems begin to vibrate at the same rates as the music. This feeling of being “one with the music” occurs as normal boundaries of self are re-defined when egocentricity dissolves. (Rill, 2010; Hutson, 2000; Karim, 2011; Margulis, 2014). This lack of egocentricity allows individuals to focus on reacting to the group environment.

Musical bonding primes an individual for community. The need for community is a key reason that people attend group music events, such as EDM concerts (Hutson, 2000; Benzon, 2001). It is difficult to sort out the complexities of the correlation between interpersonal musical entrainment and the need for community in creating musical bonding. Interpersonal musical entrainment by definition occurs in community because it involves entrainment between people. However, entrainment also creates feelings of unity and community (Will & Berg, 2007). Benzon (2001, p. 157) writes, “the music is a vehicle for a collective intentionality, one that slips beneath the barriers of individuality and the imperatives of autonomous selves. ... In music deeply shared, my rhythms and your rhythms are the same. And thus we are the one.” It is clear that there is a direct relationship between interpersonal entrainment and community in musical bonding but more research is needed to investigate if one of the elements causes the other.

Significance

Although this interpersonal musical entrainment is an important aspect of musical bonding, this thesis proposes a method for studying the effects of intrapersonal musical entrainment. Building upon the philosophy of Rouget, much of musical bonding is created by social expectations and interpersonal entrainment. However, before these complex variables can be explored, empirical norms of intrapersonal entrainment need to be established. The intrapersonal musical entrainment data will be gathered on the physiological reactions to music, in line with Becker’s (2004) philosophy. This data will be collected in isolation from the traditional group music environment in order to control for interpersonal musical entrainment. If data on intrapersonal musical entrainment in relation to musical bonding is not well documented, it will be extremely difficult to interpret interpersonal musical entrainment data. This is due to the enormous amount of variables created in a continually evolving environment at group music

experiences replete with additional stimuli and social expectations. The following study is proposed to gather empirical data in correlation with previously published qualitative data in order to examine musical bonding.

Research Design

Hypothesis

Entrainment can create musical bonding at group music experiences such as EDM events.

Participant Sampling

While musical bonding could occur in a variety of settings, this study will focus on the population that generally attends EDM events because of the qualitative research supporting the existence of musical bonding at EDM events. The demographic for EDM events is generally people ages 18-30 years old (Hutson, 2000; Rill, 2010). The population for this study will consist of this same demographic in order to maintain similar physiological conditions for intrapersonal entrainment that could occur in musical bonding at EDM events. In order to examine intrapersonal musical entrainment without the social conditioning of interpersonal musical entrainment, participants in this study will be screened to exclude participants that have previously attended an EDM. In order to get a normative baseline for intrapersonal musical entrainment, participants who have disorders that interfere with entrainment will also be excluded from this study. These disorders include Parkinson's, autism, epilepsy, and heart arrhythmias (Will & Berg, 2007). Participants with hearing loss will also be screened out because of the music aspect of this study. These participants will be recruited to the study through fliers posted at local colleges because of the high concentration of the desired demographic. Due to the musical nature of this study, participants will be screened to prevent an abnormally large representation of music majors so that the findings can be extrapolated to the typical EDM population. A target number of eighty participants will be used.

Electronic Dance Music Variable

The label EDM encompasses an enormous amount of distinct genres, each with a myriad of sub-genres. Some of the EDM genres, such as New Age or ambient, are typically listened to in isolation and produce different experiences than what constitutes as musical bonding (Becker-Blease, 2004). Specific types of EDM, like trance, are generally created at live events and are associated with musical bonding (Becker-Blease, 2004). This study will follow McCraty, Atkinson, Rein & Watkins' (1996) example of measuring aspects of entrainment with fifteen minute selections of music. Participants will be randomly assigned to a control group or the experimental group. The control group will listen to a selection of EDM music not usually found at group events, such as New Age. The experimental group will listen to a selection of EDM music typically found at group events, such as trance. Both groups will have a fifteen minute baseline of silence prior to the music in order to gather entrainment data without musical stimuli.

EmWave2

EmWave2 is a portable biofeedback machine that extrapolates data from intrapersonal brain and heart entrainment and ASC activity, among other things, to produce a coherence score (McCraty, Atkinson, Rein, & Watkins, 1996; McCraty, Barrios-Choplin, Atkinson, & Tomasino, 1996; McCraty, Atkinson, Tomasino, & Bradley, 2006). Biofeedback is designed as a training tool to cognitively assess psychological distress as manifested through physiological arousal; when a person is aware of how their body reacts to stress, he can retrain his body to adjust back to a well-functioning state of coherence (Hall, 2012; Edwards, 2014; Thurber, 2006; Whited, Larkin, & Whited, 2014). EmWave technology has also been used measure to physiological reactions to music (McCraty, Atkinson, Rein, & Watkins, 1996; McCraty, Barrios-Choplin, Atkinson, & Tomasino, 1996). EmWave is able to measure real-time entrainment as a

coherence score, which makes it a viable option for measuring entrainment with music. The coherence accumulation graph will be used to take the average of the base-line interval (silence) and the intervention interval (music) to determine the amount of change in coherence with music compared to silence. The scores of the control group (New Age) and the experimental group (trance) will be compared to determine if there is something inherent in the music frequently listened to at musical bonding experiences.

References

- Becker- Blease, K. A. (2004). Dissociative States Through New Age and Electronic Trance Music. *Journal of Trauma & Dissociation*, 5 (2), 89-100.
- Becker, J. (2004). *Deep Listeners: Music, Emotion, and Trancing*. Bloomington: Indiana University.
- Benzon, W. (2001). *Beethoven's Anvil: Music in Mind and Culture*. New York: Basic Books.
- Butler, M. J. (2003). *Unlocking the Groove: Rhythm, Meter, and Musical Design in Electronic Dance Music* (Ph.D. dissertation ed.). Indiana University.
- Edwards, S. D. (2014). Evaluation of heart rhythm coherence feedback training on physiological and psychological variables. *South African Journal of Psychology*, 44 (1), 73-82.
- Hall, K. N. (2012). *The effects of HeartMath emWave Heart Rate Variability Coherence Training on Stress Reduction for Parents of Children with Autism* (Ph.D. dissertation ed.). Eagan, MN: Argosy University Twin Cities.
- Herbert, R. (2011). Reconsidering Music and Trance: Cross-cultural Differences and Cross-disciplinary Perspectives. *Ethnomusicology Forum* , 20 (2), 201-227.
- Hutson, S. R. (2000). The Rave: Spiritual Healing in Modern Western Subcultures. *Anthropological Quarterly*, 73 (1), 35-49.
- Jankowsky, R. J. (2007). Music, Spirit Possession and the In-Between: Ethnomusicological Inquiry and the Challenge of Trance. *Ethnomusicology Forum* , 16 (2), 185-208.

- Karim, J. (2011, September 27). *Trance Music and Altered States of Consciousness: An Analysis of Trance & House Music as a Transcendental Force (A Summary)*. Retrieved October 9, 2014, from Music and Brain Blog at University of Toronto:
<http://musicbrainerblogger.blogspot.com/2011/09/trance-music-and-altered-states-of.html>
- Margulis, E. H. (2014). *On Repeat: How Music Plays the Mind*. New York: Oxford University Press.
- McCraty, R., Atkinson, M., Rein, G., & Watkins, A. (1996). Music Enhances the Effect of Positive Emotional States on Salivary IgA. *Stress Medicine, 12* (3), 167-175.
- McCraty, R., Atkinson, M., Tomasino, D., & Bradley, R. T. (2006). *The Coherent Heart: Heart-Brain Interactions, Psychophysiological Coherence, and the Emergence of System-Wide Order*. Boulder Creek: Institute of HeartMath.
- McCraty, R., Barrios-Choplin, B., Atkinson, M., & Tomasino, D. (1996). The Effects of Different Types of Music on Mood, Tension, and Mental Clarity. *Alternative Therapies in Health and Medicine, 2*, 52-65.
- McGuiness, A., & Overy, K. (2011.). Music, consciousness, and the brain: music as shared experience of an embodied present. In D. Clarke, & E. Clarke (Eds.), *Music and Consciousness: Philosophical, Psychological, and Cultural Perspectives*. New York: Oxford University Press.
- McNeill, W. H. (1995). *Keeping Together in Time: Dance and Drill in Human History*. Cambridge, MA: Harvard University Press.

- Rill, B. (2010). Identity Discourses on the Dance floor. *Anthropology of Consciousness*, 21 (2), 139-1623.
- Rouget, G. (1985). *Music and Trance* (Revised ed.). (B. Biebuyck, Trans.) Chicago: University of Chicago Press.
- St. John, G. (2012). Electronic Dance Music Culture and Religion: An Overview (reprint). In M. J. Butler (Ed.), *Electronica, Dance and Club Music*. Burlington, VT: Ashgate.
- Thurber, M. R. (2006). *Effects of Heart-Rate Variability Biofeedback Training and Emotional Regulation on Music Performance Anxiety in University Students* (Ph.D. dissertation ed.). Denton, TX: University of North Texas.
- Whited, A., Larkin, K. T., & Whited, M. (2014). Effectiveness of emWave Biofeedback in Improving Heart Rate Variability Reactivity to and Recovery from Stress. *Applied Psychophysiology Biofeedback*, 39, 75-88.
- Will, U., & Berg, E. (2007). Brain wave synchronization and entrainment to periodic acoustic stimuli. *Neuroscience Letters*, 424, 55-60.