Winter 2011

Music, Mood, and Memory: An In-Depth Look at How Music Can Be Used as a Trigger to Elicit Specific Emotional Responses and Associated Memories

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Winter 2011-2012

Abstract

No matter how humans have evolved over the years, no matter how different the cultures or customs are across seas, every race in the history of humankind has had music. Music and emotions have been intertwined throughout history. While short-term memories are fleeting, it is theorized that music has the potential to become a long-term memory after just one hearing (Eschrich 48).

Music, memories, and emotions have all been proven to intertwine, yet not much research has demonstrated the interrelation of all three. Musicology focuses on the connection between the human psyche and music. The most common use of music is meaning enhancement, which is when listeners play music in order to enhance an event, such as a wedding (Sloboda 90). Music therapists utilize music and the subsequent reactions from their patients to access "emotions, memories, structural behavior, and provide social experiments" (Thaut 820). Music therapy has been used to relax patients, and to assist in controlling different disorders, such as Parkinson's disease, aphasia, and Tourette's syndrome.

Survey questions were created by the researcher to find the personal viewpoints of the participants in regards to how music, memory, and emotions are connected. Forty-six participants, ranging in age from 18 to 60, were surveyed. The first five questions assessed the participants' agreement with general assertions that music can affect the listeners and how music, memories, and emotions connect. The subsequent five questions were created to ascertain whether if or how music personally affected the respondents. They were asked, for example, if they had noticed mood changes in themselves due to music, or if they had ever individually had memories that correlated with specific music. The majority of the participants strongly agreed that music can bring out emotions in the listeners, that certain memories can be attached to

different pieces of music, that slower, classical style music can relax the listener, that playing faster songs in clubs keeps patrons happy and upbeat, and that music is an important part of memory. The results from this survey strongly supported the researcher's thesis.

It is hoped that this thesis could be beneficial to many fields of study. Some specific areas where the findings could be applicable include musicology for music production, psychotherapy for repressed memories and anger management, music therapy for mental and physical disorders, and neuroscience for brain abnormalities.

Acknowledgments

I would like to thank Professor Fein for encouraging me to continue and complete this thesis and Professor Allison Kramer for all the time she put in helping me make this the best it could be. Hilary Kraus was indispensable when finding sources for me to utilize, and Christine Vahlsing and Olivia Morin assisted me in more ways than I can say, and always cheered me on whenever it seemed like too much.

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Chapter One: Introduction

Music is an important part of human life. It affects emotions in a way that neither books, nor art, nor films can. Music communicates love and hate, joy and depression, peace and longing. Since music is independent of physical matter, it cannot be contained by any one person, or in any kind of container. As music is not reliant on sight, it is not confined to a canvas, but can move through space unhindered. Because music depends more on interpretation than any one language, it can be shared across borders. In that way, music is unique from other types of art. No matter how humans have evolved over the years, no matter how different the cultures or customs are across seas, every race in the history of humankind has had music. The instruments may change, the languages may differ, and the sounds may sound like noise to the previous generation, but there has always been music. There are songs of the past and future, what-could-have-been and what-should-have-been. Music expresses the longing of the human heart, which is part of why music has survived throughout the course of human history.

Music and emotions have been intertwined throughout the history of music. One culture that truly embraced musicology, the study of music, was the Ancient Greeks. They divided music and emotions into two principle functions: *mimesis*, which values music for its representational function, and *catharsis*, the effect music has on the listener (Cook 47). Mimesis was revived in the 1600's with the rise of opera (47). Composers used music to reveal or heighten the emotions expressed in the pieces that the music tried to represent (47). The desired meaning behind the compositions was to have the listeners feel the emotions that the musicians felt while performing (47).

Music is a constant in life, even more so in the current age. When youths are wandering around with iPods constantly, they are adding their own soundtrack to their lives that influences

them more than they know. As each experience is colored by the tempos and notes of music, life encounters are correlated to the type of song that was heard at the time. Echoic memory is memory for sound, which is a very short sensory memory of auditory stimulation (Tulving 396). These types of sensory memories are typically temporary and fade quickly, unless they become part of a larger memory (396). Through echoic memory, sounds are one of the most important parts of forming new recollections. Memories then bring forth the emotions that were felt at the time the event was being recorded in the brain (396).

Music, memories, and emotions have all been proven to intertwine, yet not much research has been completed showing all three combined, as previously only two have been connected at one time. There are books and journals devoted to the ways in which music and emotions are intertwined, what parts of the brain react when they combine, and on why memories and emotions are so closely interlaced. Not a lot of research, however, has linked music to memories to emotions. Instead, existing research tends to only focus on part of the equation.

The tri-connection between music, memories, and emotions seems like such an important and necessary topic that it is surprising that there is not more research done connecting the three. This paper will present how each of the three parts can be used as a trigger to elicit responses from the other parts. Music will trigger memories and emotions, emotions will trigger a person to think of a song or a memory, and a memory will be formed using music and emotions as a base.

The motivation for this thesis project is, and always has been, fascination with the brain. That a part of the human body that weighs in at just around three pounds is responsible for the actions, thoughts, and responses of a person is improbable, and yet undeniable. This thesis will present research on the connections between music and emotions and also emotions and memories, both on a biological level, such as electrical impulses and chemical reactions, and also

on a subjective emotional level, describing how these biological responses activate different moods. Chapter Two, the literature review, explores current findings on the connections among the parts of the brain connecting musical interpretation, memories, and emotions. Once a synthesis of the literature was completed, a questionnaire based on the research was created by the author and distributed to subjects. This research is described in Chapter Three. Survey results were analyzed using descriptive statistical analysis and are presented in Chapter Four. Finally, shortcomings of the research, suggestions for improvement, and practical applications are presented in Chapter Five.

Chapter Two: Literature Review

Sound is the cornerstone of this thesis: specifically, sound as the perception of, and the consequent reactions to, music. Hearing is what allows sound to be perceived by the brain. In order to be stimulated, any receptor in the human body must first be directly acted upon by an energy change (Carlson 537). The ear is a distance receptor. It can be affected by energy that is initiated apart from the body (537). Each distance receptor is affected by a different type of energy (537). For ears, this energy is sound waves. Sound waves are periodic compressions of air, water, or some other stimuli (537). Sound waves have two parts, frequency and amplitude (Kalat 234). Frequency is the number of compressions per second, and is measured in Hertz (Hz cycles per second) (234). The higher frequency, the higher the pitch is (234). Amplitude correlates with intensity (234). The more intense the amplitude, the louder the sound is perceived to be (234).

The ears consist of three parts; the outer, middle, and inner ear (Kalat 256). The external ear is known as the auricle, and it is made of cartilage and resides on the outside of the head (256). The auricle leads the sound waves into the ear canal (256). This focuses the sound waves towards the eardrum located in the middle ear (256). Once the sound waves travel down the ear canal, they hit the eardrum, which causes the eardrum to vibrate at the same frequency as the sound wave (235). The inner ear is the part that contains the cochlea, a small, snail-shaped organ that is the only part concerned with hearing (Carlson 555). The cochlea houses the membranous cochlear duct (559). The organ of Corti is the hearing sense organ that resides on the length of the cochlear duct (559).

Music and Memory

On a biological level, the auditory sensation is a direct result from the ears, auditory nerves and the auditory areas of the temporal lobes of the brain (Anthony 256). Neurons, which are "the structural and functional unit of the nervous system, consisting of the nerve cell body and all its processes, including an axon and one or more dendrites," are vital to hearing (Agnes 969). The axons extend from the cochlear nerve into the temporal lobe of the brain, which then produces the sensation of hearing (Carlson 559). The axons connect directly to one of twelve cranial nerves. These nerves connect directly into the brain, rather than to the spinal cord, like the spinal nerves are (Parker 82). Cranial nerves are named by the part of the body they are connected to, as well as identified by Roman numerals (82). The vestibulocochlear nerve is labeled a sensory nerve, and is VIII out of XII (82). This nerve contains two branches, the vestibular and the cochlear (82). The vestibular branch deals solely with orientation and balance from the inner ear; the cochlear branch relays signals concerning sound and hearing from the ears (82).

Memory is not contained in a single section of the brain. Many different aspects of consciousness combine from all areas of the brain to form memories (Parker 86). One area of the brain involved in memory is the cortex, which is "the outer layer of grey matter over most of the brain" (Agnes 327). The cortex is divided into sections, each of which receives information from a specific sense. The parts most important for this thesis are the primary auditory cortex, which analyzes the hearing from the ears; and the auditory association cortex, which takes all the auditory information from the primary auditory cortex and integrates it with memory and emotions, as well as with the other senses (Parker 86).

Along with the cortex, three other important memory–related areas of the brain linked to this study are the thalamus, which screens and relays sensory data; the amygdala, which stores the emotional parts of memory, especially the powerful feelings; and the hippocampus, which transfers sensory information to long- and short-term memory storage (Parker 86). Memories are thought to be formed when neurons (nerve cells) create new axons and connections (Grossberg 369). All incoming information is scanned by the thalamus and cortex for significance. The amygdala and hippocampus are also involved when processing information that would be an initial part of a memory (Parker 86).

The neurons in these areas, collectively known as the limbic system, form links, which then create an engram, or a memory trace (Parker 86). Once a memory is initially formed, the more activity and information related to the memory, as well as recalling it, will lead the memory circuit to be absorbed into the surrounding neuron web, creating a single memory (86). In order to become a long-term memory, there are three stages based on the "durational" (time) process. Once the senses relay information, such as a bird chirping, it is classified as a "sensory memory" and is normally stored for half a second at most (87). Once attention is paid to the chirping, it becomes a short-term memory which lasts for a few minutes. In order for a short-term memory to transfer into a long-term memory, consolidation must occur. Consolidation "requires attention, repetition, and associative ideas," and how the memory was consolidated determines how easily the memory can be recalled (87).

Music is everywhere, and many people choose to listen to music because of the soundtrack it adds to their lives. This musical accompaniment is used on some level for the emotions that are distinguished during the experience (Eschrich 48). This is a possible factor in why music is so easily recalled years after the first hearing – there is a strong emotional

connection (48). Songs are long, and cannot happen instantaneously, but instead are spread out over (conceivably) several minutes, if not longer (48). In order for the brain to process the song, it is immediately stored as a long-term memory, as short-term memories are fleeting (48).

Due to the shared neural pathways that connect memory and music, it is a common occurrence to have a piece of music "stuck" in one's head (Sacks 41). The repetition of a piece of music – or of a piece of a piece of music – can remain inside the brain for days on end (41). Since the selection can be trivial or even music that the listener does not enjoy, this phenomenon suggests that the music has entered part of the brain that forces it to replay repeatedly and independently (41). This type of event usually occurs with theme music or from a commercial – which is unsurprising, as the composers of these pieces attempt to create music that will "hook" the listeners and have the music stick in their minds (Levitin 151). This can also occur with music that has meaning or emotion connected to them – such as thinking of church elicits emotional sensations that brings with it memories of church songs (151). This phenomenon has become more frequent in recent years with the invention of personal music players. Before this creation, people did not have such easy access to music, and as such, the possibility to have music "stick" in one's head was slimmer (151).

Memory and Mood

Memories can be classified into two categories: emotional memories, where the emotions are implicit and not accessible by the conscious mind, and memories about emotions, when the emotions are explicit and accessible by the mind (LeDoux 153). These two processing systems are useful in different ways. Implicit memory is applied when a rapid response to stimuli, for example, assessing if a situation is a reward or punishment, is required, or if there is a sudden influx of incoming information which requires an immediate reaction (Rolls 177). The explicit

memory system is more rational, and is more valuable for long-term planning (177). These two systems balance each other while often being in conflict. The implicit takes control if there is too much information for the explicit to process in a timely manner, and the explicit overpowers when long-term plans are preferred over immediate rewards (177). This is how complex animals choose between immediate gratification and long-term satisfaction (177). Emotional, unconscious decisions may have the rational, conscious system fabricate an explanation for the illogical actions after they have been completed (177). Research has been completed trying to connect emotions and memories on a neural level. Most of this research has been focused on negative emotions, such as fear. Fear memories – whether created by human or non-human entities – mainly fall into the "implicit" category. There is not a conscious recalling of memories when fear is experienced (LeDoux 153).

It has been observed that what is experienced in one emotional state – happy or sad, scared or excited – can sometimes be more easily recalled when one is again in that emotional state. This phenomenon is called state-dependent memory (Myers 374). Similarly, another aspect of memories is that they are somewhat mood-congruent, meaning that recollections are associated with the specific emotion experienced at the time of the event (374). These emotions are considered retrieval cues, for the emotions serve as cues to recall other memories associated with that emotion (374). These memories then help sustain the current mood (374). For example, suicidal patients have been known to focus their attention on the negative parts of everyday life that correspond to the negative encounters they have already experienced. This tendency leads their recent memories to be encoded with a focus on the negative (374). Then these negative memories are easily recalled when they are in the depressed state, leading the process to circle

back onto itself (Schacter 211). This phenomenon is part of the cognitive psychological explanation for the "vicious cycle" of depression (211).

It has been hypothesized that the reason why memories and emotions are so closely intertwined is because emotions are used as "contextual information linked to the to-be-remembered item," meaning that the given emotion is built into the memory (Eschrich 49). This theory would explain why some memories are so emotionally-ridden: the emotion is a cornerstone for the memory, so it is practically impossible to access the memory without experiencing the emotion as well (49). This process works the other way as well. When an intense emotion is felt, it floods the brain with that specific chemical, which in turn activates all of those specific emotions' neurons in the brain (49). As the emotional neurons are accessed, those neurons with an associated memory retrieve the memory and bring it to the forefront of the mind. This is why stimuli that provoke emotions are remembered more clearly than emotional-lacking stimulus (49).

The amygdala, an almond-shaped cluster of neurons located deep inside the temporal lobe on each side of the brain, is one of the most important parts associated with emotional memories (Myers 72).). This structure assesses incoming information for potential flight-or-fight scenarios. It is able to do this because the amygdala has access to the primitive sensory information from the early perceptual processing stations, the parts of the brain that first gather and analyze data from each of the different senses (Damasio 131). As well as having a connection to the primitive sensory information, the information initially gathered by the early perceptual processing stations, it also collaborates with the later processing stages, which has more refined and elaborate information (131). Since the amygdala can access both types of information, it can evaluate the importance of the simple information by comparing it to the

refined information, and thus determine if the incoming information is of low or high significance (Myers 72). When that is determined, it enables the brain to select the appropriate behavior response, and retains the emotional event. Thus, the amygdala can influence or control memories for emotional events (72).

Also located within the temporal lobe is the primary auditory cortex. The auditory information that enters through the ears (sound) travels from one ear to the auditory receiving area above the opposite ear (Myers 79). Because both the amygdala and the auditory cortex are located in the same lobe, there are a higher number of neural pathways connecting the two parts due to their proximity (79). Since there are so many interconnected neural pathways, memory, music, and emotions all work with each other to create detailed, layered memories. Thus, the cerebral areas responsible for music comprehension, emotional response, and memory formation are all neurologically linked, making music a natural retrieval cue for emotional memories (82).

A stimulus related to a memory – such as a song – works as a retrieval cue, triggering the remembrance of scenes and facts, but can also bring forth the emotional meanings attached to the specific memory (LeDoux 165) Brain plasticity– the ability for the brain to reorganize itself and create new neural connections, especially after injury or illness in the brain – specifically in the amygdala, has suggested that with reactivated memories (remembering events after they occurred) the emotion of the reactivated memory may be strengthened (165). Why this occurs is still unknown, but it has been validated.

Mood and Music

Neuroscience is quite possibly the most reliable way to determine if music can actually elicit emotions from the listeners. It has been suggested through empirical psychomusicological research that both children and adults can distinguish between musical emotions (Trainor 310).

However, some music portrays emotions more precisely than others. There is a clear distinction between sad music (piano, legato, slow) and happy music (staccato, high-pitched, fast), but less of a distinction between tenderness and sadness (311). The variances amid the two are slight, so this furthers the question of how specific emotions relate to certain musical numbers (311).

The emotion-processing parts of the brain discussed earlier create a physiological response throughout the body. This effect happens by two methods: one, there is a release of chemical molecules that are released into the bloodstream and affect various parts of the body, and two, there is an increase in neural activity that spreads to various parts of the brain (Trainor 312).

The electroencephalograph device – known as an EEG – records electrical activities of the brain (Kalat 137). It is attached to the scalp by electrodes. Electrodes are "any terminal that conducts an electric current into or away from various conduction substances in a circuit…" (Agnes 458). This machine enables inquirers to view brain activity in humans and animals without resorting to surgery. At most, eight electrodes are attached to the scalp while the output is recorded (Kalat 137). Using the evoked potential method, scientists can record the brain's electrical activities in response to specific sensory stimuli (137). This process is known as electroencephalography – electric brain-writing (Asimov 178).

EEG research has produced findings related to emotions. One finding revealed patterns in the anterior regions of the brain while emotion was being processed (Trainor 317). Multiple EEG research has shown that frontal lobe activation patterns differ based on the emotion being experienced. The second finding shows frontal EEG activity during a neutral state to observe whether there is a perceivable difference due to personality types (317). It was found that optimistic and outgoing personalities activated the left frontal areas while pessimistic and shy

personalities had stronger right frontal area activity (317). The researcher conducted an experiment to see if music affected the frontal lobe activation. The results supported the theory that music did affect the frontal lobe area corresponding to the emotion the music was meant to portray (317).

As EEG tests were taking place, the researchers noted physiological responses. The changes in heart rate, respiration, blood flow, and skin conductance support the theory that music activates the peripheral parts of the nervous system as well as affecting neural activity (Trainor 320). EEG results reveal that music activates cortical systems in the brain, particularly those concerned with emotion, such as the frontal lobes. However, music does not appear to have any survival function. As such, while it does elicit emotional responses – both neurologically and physiologically – these reactions are not as strong as those resulting from other emotional stimuli, such as aggression or fear (320).

Researchers have also explored how the brain processes music in patients who have a deranged musical function – as compared to normal processing based on psychological testing, functional imaging, positron emission tomography [PET] and functional magnetic resonance imaging [fMRI] (Trainor 185). For example, one composer with a right frontoparietotemporal infarction (an obstruction of blood to that part of the brain, causing the tissue to die) lost his emotional response to music, and could no longer compose music with emotional meaning (Brust 185).

In 2008, six mechanisms through which music could elicit emotions were determined: brain stem reflexes, evaluative conditioning, emotional contagion, episodic memory, and musical expectancy (Sloboda 89). These mechanisms are only used as a baseline to help determine which are in use for different listeners, and should not be confined only to this list (89). Three of

these mechanisms relate to this thesis: evaluative conditioning, emotional contagion, and episodic memory.

One way music may elicit emotions is through *evaluative conditioning* (Juslin 622). This occurs when music induces an emotional response because the stimulus (the song) has previously been paired with either a positive or negative event. Through repetitive pairings, music can come to evoke the given emotion, even without the event reoccurring (622). Evaluative conditioning can also occur even when the participant is unaware – both when the pairing is being established and induced (622). This sort of conditioning is very hard to break, as it can also occur when music is not the main activity. Therefore, it is plausible that evaluative conditioning is the cause of many musical responses in everyday life (622).

Another type of conditioning is *emotional contagion,* where a listener perceives the emotion in a song, then mirrors that emotion. This is speculated to occur due to the voice patterns that are apparent in songs. Humans are able to perceive emotions from others due to their vocal patterns, and as music seeks to emulate that pattern, it is hypothesized that the emotions expressed in song can be detected by the listeners, just as they would be in normal conversation. These perceived emotions can act as a stimulus to elicit personal memories associated with those emotions (Juslin 622).

Episodic memory relates the most to this thesis. This occurs when an emotion is elicited from a listener because the music evokes a personal memory of a specific event that occurred in the listeners' life (Juslin 623). When the song plays, the memory is evoked, and so is the emotion associated with that specific memory. It has been hypothesized that these musical memories can be so intense due to the fact that the "physiological response patterns to the original events are stored in memory along with the experiential contents" (623).

Music has been used to remind listeners of past cherished times for centuries. As music plays such a strong role in adolescent development, even more so with the invention of personal music players, it is understandable that musical emotions can be more emotionally vivid during young adulthood, as this is the time when most develop their perception of self-identity (Juslin 623). As such, studies have shown that musical emotions are elicited from these types of emotional mechanisms (623).

Musicology

Musicology focuses on the connection between the human psyche and music. It seeks answers "for whether when, how, and why [people] experience music as expressive of emotions" (Sloboda 73). There are two types of explanations: *causal*, discovering unexplained behaviors and seeking reasons why the action occurs, and *organismic*, which focuses on the internal factors that affect the organism (73). As such, musicology attempts to understand what happens between a person hearing music, and experiencing or detecting an emotion based on the piece (73).

There is a distinction between perceived emotions – ones that are recognized from the music – and evoked emotions – emotions the listener actually feels (Sloboda 83). These two viewpoints have been separated into two perspectives. The *cognitive* position is the belief that music cannot evoke emotions and can only express emotions (83). Conversely, the *emotivist* viewpoint argues that music can elicit emotional responses from the listeners (83).

Originally, the only way to determine what the listeners were feeling was to simply ask them. That method was flawed, as the participants themselves could not differentiate between perceived or evoked emotions. However, this fault was eliminated when physiological changes were noted. Perceived emotions have no discernible effect on human physiology, but evoked emotions alter heart rate and skin conductance. This theory was explored in 2004, when it was

concluded that music can express and evoke emotions (Sloboda 83). Interestingly, only about fifty-five to sixty-five percent of music experiences elicited emotional arousal. Why this is, and what factors contribute to an evoked emotion are still unknown (84).

A study was done having participants listen to six different excerpts of classical music that were previously considered as expressing emotions (Mithen 95). When these pieces were heard, the participants experienced physiological changes congruent to the emotion the piece was thought to represent. Music embodying fear brought changes in the pulse rate and amplitude, while respiratory patterns altered when happy music was played (95). There are three commonly accepted mechanisms from which these physiological responses occur from (95). Music may be subconsciously appraised in the same method as visual stimuli, which then unconsciously provokes an emotional response, or the music may recall memories of a past emotional event (95). Lastly, as the audience unconsciously mimics the mental movements of the performer, it can result in a similar physiological state (95).

Klaus Scherer and Marcel Zenter from the University of Geneva argued that there are four factors that influence the degree an emotional state will be elicited from music listening (Mithen 95). The qualities of the piece itself play a factor, which refers to the tempo, rhythm, and melody (Sloboda 497). Second was the manner in which it is performed – how the performer expressed the piece (497). Third was the listeners' state – especially their mood before the music began to play (497). Finally, how the music is heard, whether it is performed inside or outside, in a formal or informal setting, or any other such factors that could affect the experience (497).

Musicologists identify three different types of emotion-eliciting categories. *Index* refers to the association between music and an event or object; *icon* is a response between a similarity

in music and on emotion-bearing signal; and *symbol* is a relationship within the music itself (Sloboda 89).

Some reasons listeners purposely choose certain music is for distraction (letting them focus on only the music, and to alleviate boredom), and for energy (used to maintain focus on a certain task). The most relevant use for this thesis the *meaning enhancement* (Sloboda 90). This is when listeners use music to enhance a certain events' emotional processing, such as the songs played during a wedding (90). It is also in use when music is played to aid in reminiscing on cherished memories, or to in order to reduce stress (90). This works in some situations because the listeners are actively trying to alter their mood by playing music, but their emotions can also be altered unconsciously while listening to music (90).

Music Therapy

German Romantic writer Novalis once wrote, "Every disease is a musical problem; every cure is a musical solution" (Sacks 250). While music has been part of the human experience for millennia, and music and healing intertwined for almost as long, the concept of formal music therapy has only been active since the twentieth century (250). Doctors and nurses noticed that the wounded soldiers in veterans hospitals "pain and misery and even, seemingly, some of their physiological responses (pulse rates, blood pressure, and so on) could be improved by music" (251). As such, the staff of various hospitals began inviting musicians to play for the injured men. Soon though, they noticed that professional training would benefit patients more (251). Michigan State University began the first formal music therapy program in 1944 – one year before the end of WWII – and the National Association of Music Therapy was formed in 1950. Even with these programs however, music therapy remained mostly unrecognized for the next twenty-five years (251). Music therapists utilize music and the subsequent reactions from their

patients to access “emotions, memories, structural behavior, and provide social experiments” (Thaut 820). Music therapy can be either active, meaning the client actively does something with the music, or receptive, implying that the client is just receiving the music, most commonly in the form of listening (820).

One significant and worldwide use for music therapy is to relax patients preparing for, undergoing, or recovering from surgery (Mithen 95). Doctors use “sedative music” (slow steady tempos, gentle rhythms, and predictable changes) in order to reduce anesthetics and pain medication, while noticing that patients exposed to music throughout the process tend to have shorter recovery periods (95). Conversely, another music therapy application is to stimulate the participants. This is utilized for mental disorders such as autism, obsessive-compulsive disorder, and attention-deficit disorder (95). This type of therapy has been shown to “foster cooperation, promote body awareness and self-awareness, facilitate self-expression, and reinforce structure learning” (95).

Parkinson’s disease, classified as a “movement disorder,” is one condition in which music therapy has been particularly helpful (Sacks 252). One of the aspects of Parkinson’s is that the perception of time for the patient can be skewed – moving too fast or too slow. The patient rarely notices the difference unless they see a clock and realize how much actual time has passed (254). When music is present, however, the tempo and speed of the piece can temporarily overpower the Parkinsonism and releases the patient to their own rate of movement, what was natural for them, as long as the music plays (253). Since recorded music resists all attempts to hurry or slow it down, it provides a stead beat for the patients (254). Parkinson’s disease can sometimes progress to the point that patients get “stuck” in time. They are unable to initiate any sort of voluntary movement without outside stimulus. One example is patients who can catch and

return a thrown ball, but once the exchange is completed, they "freeze" again (255). Music has been shown to create a longer release from that frozen state.

Another condition music therapy has been found to be very effective for is aphasia (Brust 183). Aphasia is classified as the loss of ability to understand or produce speech, due to brain damage (Sacks 219). It has been found that music therapy can succeed in situations by having the patients experience language that is embedded in music. This type of music therapy is most effective for Parkinson's disease as well, for the therapist-patient relationship depends on "musical and vocal interaction, [but also] physical contact, gesture[s], imitation of movements, and prosody (linguistics)" (219). It has been hypothesized that the reason this type of therapy is successful is due to the plasticity of the brain, the ability to adapt to change when one part of the brain is unable to fulfill its intended role. The left hemisphere is normally associated with linguistic potential, but through this type of music therapy, it has been considered that the right hemisphere contains within it linguistic potential as well (219). Combining this potential with the right hemisphere's musical skills provides an explanation for why this music therapy is successful (221). Research has shown that the basic linguistic capacity that the right hemisphere holds can be transformed "into a reasonably efficient linguistic organ with less than three months of training – and that music is the key to this transformation" (223).

Music therapy has also been shown to be effective with Tourette's syndrome. There are many different degrees of this syndrome, the basic being confined to the production of simple tics or repetitive motions, but can also advance to "mimicry, antics, playfulness, inventions, and unexpected and often surreal associations," and it is those who suffer from this rarer phantasmagoric (surreal) form that shows more complex reactions to music therapy (Sacks 227). When a patient reacts to certain piece of music, they are often representing the music. It appears

to be a personal expression of the patients' reaction to the piece, but accentuated and altered by "Tourettic exaggeration, parody, and impulsiveness" (227). There is an extreme reaction on a mental level as well, for when a musician with Tourette's plays, there is known to be a total immersion into the song and its emotions (227). Jazz and rock are two musical genres that seem to attract Tourettic musicians, for the "heavy beat and its freedom to improvise" ensures that if a convulsive tic overpowers them, it would be in place with the music (228).

Conversely, there are many Tourettic musicians who are drawn to the strict structure and rigid rules of classical music (Sacks 229). One type of music therapy commonly utilized within the Tourette's community is drum circles. Often the participants are in constant ticking movements, and everyone is ticking in their own rhythm. Once the drumming begins however, all the irrelevant movement ceases, and the players synchronized into a group, focusing all of their energy into the music (229). It has been observed that in these drum circles music acts twofold – firstly, to calm and focus those who were often distracted in everyday life by uncontrollable tics due to reconfigured brain activity, and secondly, to bond the players together both musically and socially, connecting those who feel isolated in the outside world by their condition (229). Music therapy is effective for Tourette's because it helps the patients focus all the energy into producing sound, and also satisfies the craving for touch that many patients have (229). One composer with Tourette's, Tobias Picker, said, "I live my life controlled by Tourette's but I use music to control it. I have harnessed its energy – I play with it, manipulate it, trick it, mimic it, taunt it, explore it, exploit it, in every possible way" (231).

One reason music therapy is so successful is because music, and the emotions it elicits, is not dependent on a certain memory; thus the music does not have to be familiar in order to elicit emotions from the listeners (Sacks 346). The emotional response to music is spread throughout

the mind, in multiple parts of the brain. Further, a formal education in music is not necessary to enjoy and respond to songs (347). Finally, music is accessible. Music has been part of the human experience for centuries, and has evolved and been revered in every culture. In recent years, music has come to be a constant in life, being heard almost constantly on iPods or in stores and other public venues, and yet underappreciated by so many. For those with conditions like those discussed above, music becomes a necessity, a constant through which they can experience life in a fuller and more meaningful way (347).

Chapter Three: Methodology

The method used to gather data for this research was the survey method. A survey is described as "a technique for ascertaining the self-reporting attitudes or behaviors of people, usually by questioning a representative, random sample of them" (Myers 27). In other words, a survey is a system used to determine the perception of the participants' own attitudes or behaviors by asking them certain questions.

The most important part in creating a survey is the wording of the questions. How a question is asked may affect the given answers. This method, like every research method, has its advantages and disadvantages. For example, while this method does have the added benefit of gathering information from a large number of people, it is dependent on the members providing accurate self-information (Myers 30).

The method of subject selection for this survey research was purposeful sampling, meaning the participants were not chosen randomly out of the mass populace to take part. Rather, the method used in selecting participants for this study was nonprobability, convenience sampling. The participants were chosen mainly for convenience in that they were all people that the researcher saw in a typical week. As such, the members were mostly traditional college-age students, as that is where the researcher spent most of her time. The genders of the participants were almost evenly divided, with a twenty-four/twenty-two male/female split. Forty-four of the forty-six members fell into the eighteen-twenty-four age bracket, and the remaining two were in the older categories. All of the participants had at least some college experience, which is understandable because the survey was handed out on the Johnson & Wales University campus, and sixteen of them had a college degree, with two having graduate degrees.

A thirteen-item survey instrument was developed by the researcher and administered to forty-six participants attending Johnson and Wales University in Providence, RI, during the winter of 2010. A copy of this survey is included in Appendix A. The purpose of this survey was to gather self-reflective data concerning how the participants viewed in what way music, memory, and emotions are intertwined. Five of the ten questions were posed on a Likert-type scale ranging from "Strongly Disagree" to "Strongly Agree." The remaining five were presented as Yes/No questions. At the end of the survey, basic demographic questions were asked regarding age, gender, and level of education.

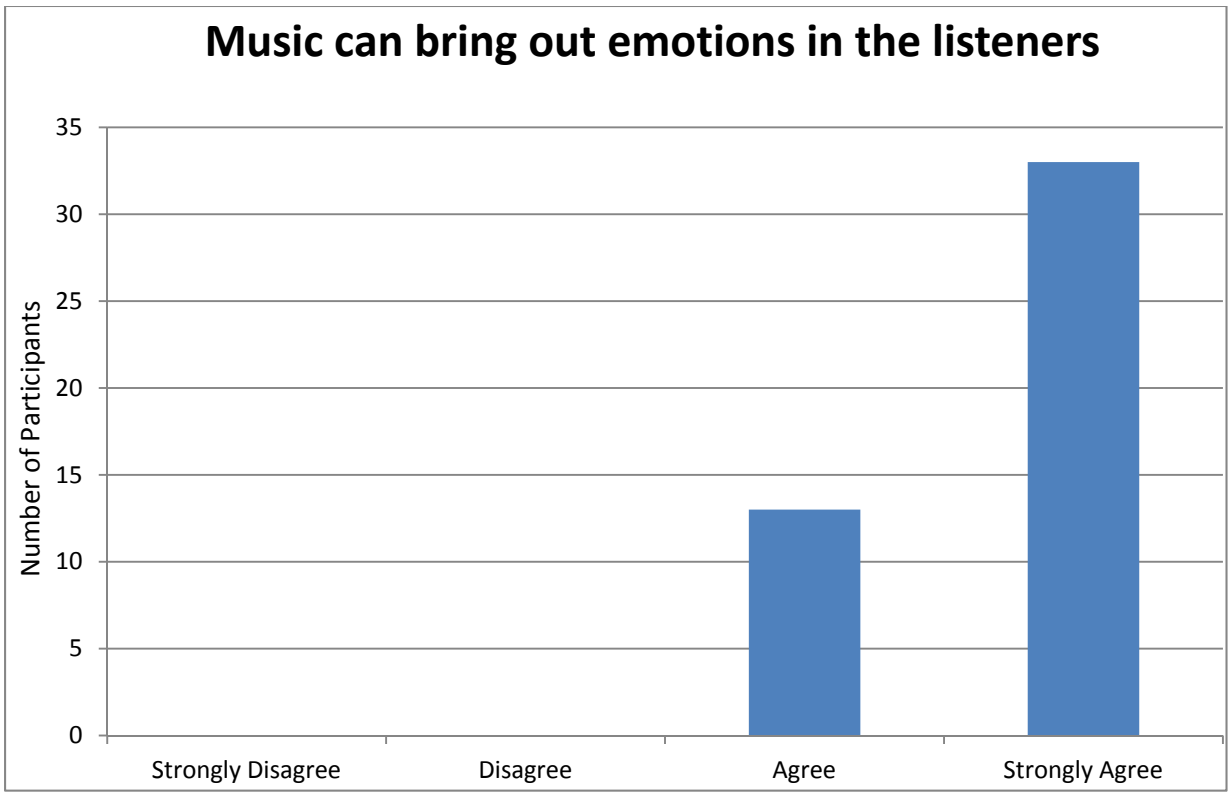
The survey questions were created by the researcher to find the personal viewpoints of the participants in regards to how music, memory, and emotions are interconnected. The first five questions were written in a statement form, to see how the participants felt about general assertions that music can affect the listeners and how music, memories, and emotions connect. The subsequent five questions were created to have the participants answer if or how music affected them personally, such as asking if they had noticed mood changes in themselves due to music, or if they had ever individually had memories that correlated with specific music. The results from these two types of questions strongly supported the researcher's thesis, and as such, are beneficial for this study. Specific results and statistical analyses of the survey results are described in Chapter 4.

Chapter Four: Results

In the first section of this survey research, five questions were posed to the participants requiring Likert-type scale responses ranging from “Strongly Disagree” to “Strongly Agree.” The questions were to determine the respondents’ level of agreement regarding general assertions that music can affect listeners, and how music, memories, and emotions connect. Responses were then complied from the gathered surveys and placed into table format for comprehension.

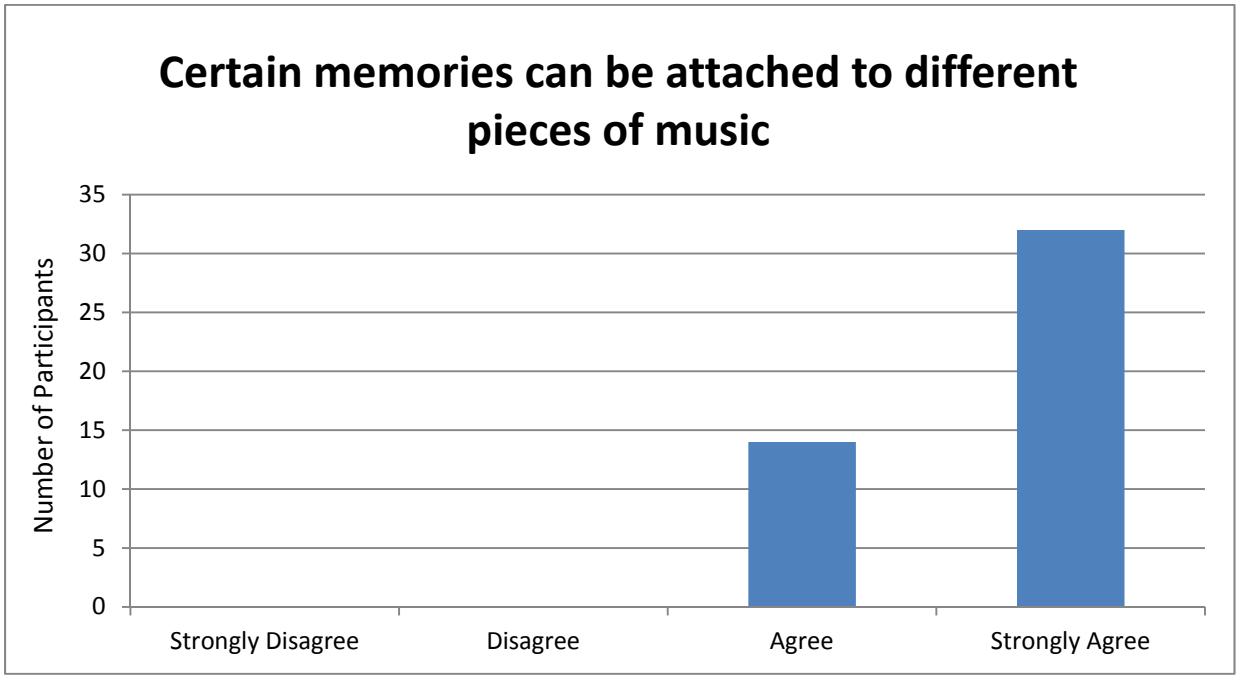
"Music can bring out emotions in the listeners" is a general assertion addressing one core problem explored in this thesis. Out of the forty-six participants surveyed, thirteen agreed, and thirty-three strongly agreed. These results can be seen below in Figure 1. As none of the participants disagreed with the statement, responses indicate the subjects believed not only does music elicit emotions, but that listeners are aware of this phenomenon as it is happening, at least to some degree.

Figure 1



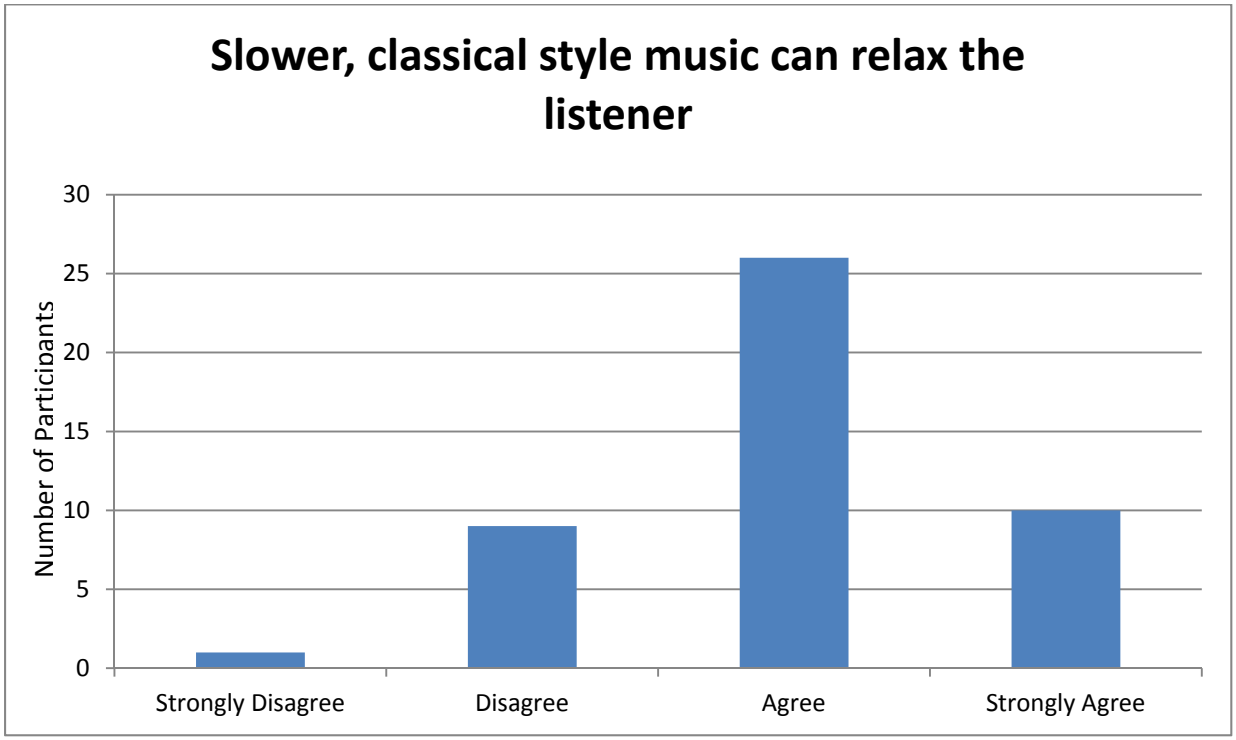
The second part of the thesis, the assertion that music and memories are intertwined, was addressed by the survey item, “Certain memories can be attached to different pieces of music.” Fourteen of the forty-six participants agreed with this statement, and the remaining thirty-two surveyed strongly agreed. The results can be viewed below in Figure 2.

Figure 2



The following two questions pertain to this thesis' assertion that specific types of music can elicit specific emotions from the listener, the statement, "Slower, classical style music can relax the listener" was posed, to which twenty-six respondents agreed and ten strongly agreed; however, nine participants disagreed with the statement, and one strongly disagreed. These results are shown below in Figure 3.

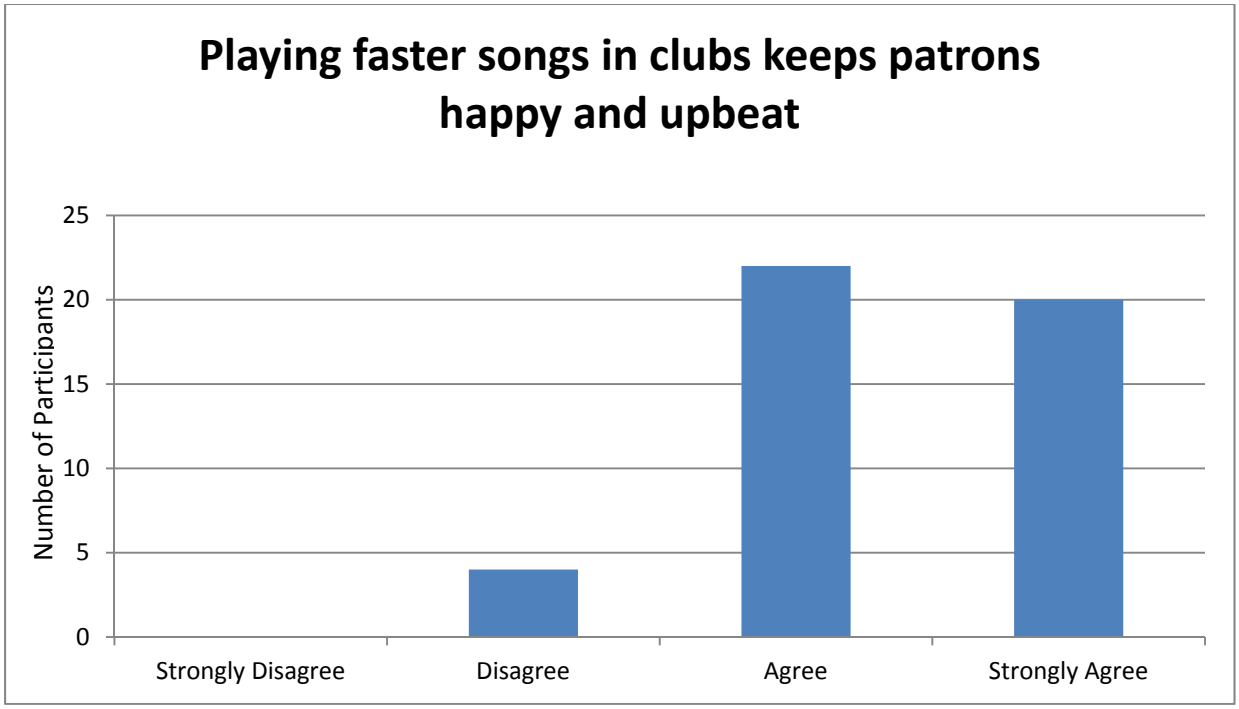
Figure 3



As the purpose of this survey was to gather self-reflecting data from the participants, it was intended that the participants answered in response to how classical music affects them personally. While 78% of the participants agreed with the statement, the remaining 22% revealed that they do not believe classical music can be classified as "relaxing" for them.

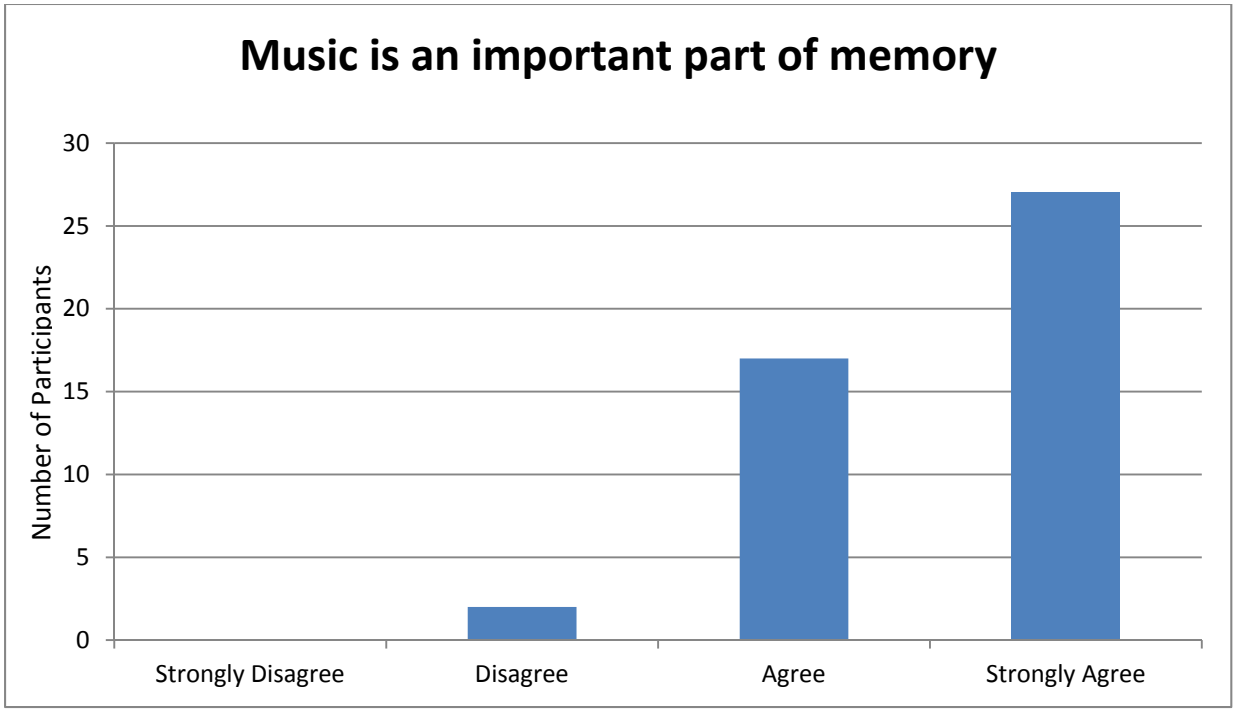
The next item, “Playing faster songs in clubs keeps patrons happy and upbeat,” also questioned the respondents’ general opinions about this thesis’ assertion that specific types of music can be used to elicit specific emotional states. Responses indicated that twenty subjects strongly agreed, twenty-two agreed, four disagreed, and none strongly disagreed. These results are shown below in Figure 4. Once again, the majority of those surveyed agreed, as 91% of respondents believed that faster club music keeps patrons happy and upbeat.

Figure 4



The last item in this section of the survey, "Music is an important part of memory," addresses the final part of the thesis. Figure 2 reported the findings that participants' believe memories could be associated with certain music, and now Figure 5 (below) connects the importance of music to memory. Twenty-seven participants strongly agreed, seventeen agreed, and two disagreed with this statement. Based on the 95% that agreed with the statement, it appears most listeners believe that music is an important part of memory.

Figure 5



The final part of the survey was presented in closed question form, leaving only a "yes" or "no" response available. The participants were asked to consider each question only as it related to them personally. To reinforce this, the phrase "have you" was used repeatedly to ensure self-reflection. "Have you ever started to listen to a piece of music, and then have memories come to mind?" had forty-five of the forty-six surveyed reply in the positive. The second question, "Have you ever thought of a memory, and then wanted to play a song that reminded you of that time?" reverses the process of the first question by beginning with memory, then leading into music. Eighty percent of the surveyed confirmed that they had played a song after thinking of a certain memory, while the remaining twenty percent did not.

The participants were next asked to remember if they had observed someone's mood change in response to music with the question, "Have you ever seen someone's mood be changed when they heard a certain song?" Six stated they had not, while the remaining forty said that they had witnessed such an event. The next question asked, "Has your mood ever been changed from listening to a piece of music?" to see if the participants could remember an occasion when music had altered their own emotional state. Forty-five of the forty-six responses were "yes," they had had their mood changed because of a piece of music. The last question asked, "Have you ever purposely listened to a piece of music in order to change your mood?" Eighty-seven percent confirmed they had tried to adjust their attitude by playing a specific song, while the remaining thirteen percent stated they had not ever tried to modify their emotional state with music.

As a whole, this survey appears to support this thesis' assertions that memories, emotions, and music are interconnected. The vast majority of the participants' answers agreed not only with the idea that music is connected to emotion and memory, but also to the belief that

music can be, and in some contexts, often is, used with the intent to elicit specific emotional states from listeners. It appears then, that even the general public is aware that music has a powerful effect on both mood and memory.

Chapter Five: Discussion

There are several aspects of this thesis that could be improved upon for further research. One suggestion for improvement would be to have a more random sampling of survey subjects with a wider range of ages. Since this survey was conducted on a college campus, the vast majority of the participants were college-aged. Having a larger sample with all age groups more evenly represented could expand on the information that was gathered.

Another suggestion for improvement would be to assess the effects of the wording choice in the survey questions. None of the questions should ever try to lead the participant to the desired answer, but rather allow them to respond based solely on their own thoughts, feelings and experiences. For example, one question that was in the survey was, “Have you ever seen someone’s mood be changed when they heard a certain song?” Based on the way this question was worded, it might lead the participants to take a memory of someone’s mood being changed and falsely conclude the reason for the change was a piece of music. What would be preferable is to have them remember a time when the music was the catalyst of the situation, rather than an uninvolved variable. A suggestion for changing this question would be, “Have you ever noticed when a certain song plays, moods have changed” or “Due to a certain song playing, have you ever noticed someone else’s mood change?”

One more factor that influenced this survey was the length restriction. The survey was restricted to ten questions, and three demographics. While there were meaningful results obtained with these constraints, if there was the possibility to ask more questions, the survey could have gotten more involved, and been able to pose more detailed queries pertaining to the thesis subject matter. Since there was a length requirement, the responses were limited to basic questions. While this restriction is beneficial to participants to reduce the time required to

complete the survey and thus increase the response rate, the research findings might have been more fully informed with more elaborate inquiries.

It is suggested that more research be completed to further the results of this paper and expand upon the connections between music, mood, and memory. The researcher believes that the best way for this exploration to proceed would be to expand upon the research of John A. Sloboda, who has done the most research connecting these three parts together. Specifically, what is distinctive to Sloboda is that in his research, he only attempts to connect two parts at a time (e.g., music and memory, memory and mood, or mood and music), thereby providing a solid and sequential basis for ultimately combining all the parts.

Sloboda uses multiple types of methods to collect his data. He has (with collaborators) determined six different mechanisms through which music could elicit emotions. These mechanisms have helped focus all relevant research to clarify under which conditions music and memory can be connected, thus leading the way to understanding how they are connected. Sloboda has also written about the role of emotions in everyday life: how the soundtrack that is added to commonplace activities can affect which experiences get turned into long-term memories. He writes about how music and emotions intertwine, how music affects the emotional state of the listeners and how certain music can elicit an emotional response from the listener.

There are two kinds of research: descriptive and experimental (Myers 27). Descriptive refers to research in which the participants are an active part of the results gathering process (27). One example of this is the survey process that was utilized for this thesis. The researcher created a questionnaire and the participants described their reactions to the questions through the criteria that the researcher laid out. Thus, the answers that the participants gave are most likely confined to certain responses that were pre-determined by the researchers.

Experimental research is when a physical experiment is undertaken (Myers 27). In this type of research, the researchers know what exactly they are looking for, whether it is a physiological or mental reaction, or both. With this method, the participants normally do not report the results to the researchers, but rather the data is collected from them before, during, and after the experiment (27). This means that the data collected is ostensibly free of human error and bias on the gathering side, as the participants are not reporting the data.

It is the researcher's opinion that the best way to gather data relating to connecting music, mood, and memory would be a blend of both styles, known as a mixed-methods approach (Myers 27). As there is no one scientific rationale for how music elicits emotions, it is up to the participants to help further this line of questioning.

It is hoped this thesis could be beneficial to many fields of study. Since music is such a vital part of the human experience, this line of study could only benefit and expand upon knowing how and why the brain works. For example, music producers could use the survey instrument and others like it that are based on musicological research when attempting to determine what type of songs their targeted market base wants to listen to. Since some of the bases of music, whether it is eliciting emotions or accessing memories, are the tempo, rhythm, and melody, then comprehending what certain aspects makes a song fall into different categories could only help. If there could be set musical guidelines pertaining to each emotion, the producers could further specialize the songs that they want to produce to gear them towards their customer base.

This study could also be useful to psychologists, especially when counseling clients with either repressed memories or anger management issues. For repressed memories, if the psychologist could determine what type of music the client listened to during the time period that

they could not remember and select songs from those categories, the psychologist could use the music as a trigger to bring forth memories to help the subject recover the lost time. In relation to anger management cases, psychologists can determine what type of music the client listens to, and then direct the client to different types of music that trigger happy or calm emotions. The psychologist could also attempt to redirect the client's musical choices in relation to memories that they would rather focus on. If during therapy the psychologist and client can connect specific songs with calming memories, then those songs can be used by the client as a trigger to calm themselves if they ever feel as though their anger is becoming unmanageable.

Along with music therapy for emotional problems, music therapy has been used to treat different sorts of mental and physical disorders. While music therapy has evolved throughout time to where it is presently, it could always be improved upon. For example, while there has been experiment and research done to improve and understand how music therapy affects different types of disorders, there is still a definite lack of knowledge in this field. If more research were done connecting music and emotions, along with recording the physiological changes that those emotions elicit, this research might be able to further the field of music therapy to a place where more disorders are able to be treated with music.

Yet another field that this study could benefit is neuroscience. Neuroscientists can study the brain's electrical patterns when a subject hears music she or he likes, and these patterns could be compared and contrasted with patterns the subject experiences in relation to brain abnormality or dysfunction. As this type of experimental research has only been rudimentarily explored, it is possible that the survey research in this thesis would be able to add to the quality of the experiments, and give different perspectives on the ending results.

There are only benefits that can come from furthering research in analyzing how music, mood, and memory are connected. Music has seeped into every part of modern life, altering and affecting how the world is viewed. Since people are consciously playing music to add another level to emotional events (such as weddings or graduations), it is easy to understand why hearing "the wedding march," or "pomp and circumstance" played outside of one of these situations can elicit emotions and memories of when listeners were at one of these types of emotional events before.

As much as science has discovered about the human brain over the years, there is still much that is unknown. While there are explanations for many biological questions of "how" that has been answered, one that still eludes scientists is how music has an emotional effect on the human mind. Memory and emotions are innate qualities that are part of how humans function. Music, on the other hand, is a creation of man that has existed for millennia. It has never been questioned *if* music affects humans; only questions of *how* and *why* remain to be answered. That music has existed for so long and that there are still questions about its impact on the human psyche only proves how complex and meaningful to the human experience music actually is.

Appendix A

Music used as a Trigger to Elicit Specific Emotions which then Recall Memories Associated with those Emotions

- The following survey is being conducted for RSCH 3001 as a partial fulfillment for the Honors Thesis requirement at Johnson & Wales University in Providence, RI.
- This thesis is attempting to prove that music can be used to bring forth emotions from the listeners, which then remind the listener of a memory to which the specific song is connected.

CIRCLE the correlating abbreviation below each question as it relates to you

Strongly Disagree ... Disagree ... Agree ... Strongly Agree

1)	Music can bring out emotions in the listeners	SD	D	A	SA
2)	Certain memories can be attached to different pieces of music	SD	D	A	SA
3)	Slower, classical style music can relax the listener	SD	D	A	SA
4)	Playing faster songs in clubs keeps patrons happy and upbeat	SD	D	A	SA
5)	Music is an important part of memory	SD	D	A	SA

CIRCLE the correlating 'Yes' or 'No' below each question as it relates to you

6)	Have you ever started to listen to a piece of music, and then have memories come to mind?	No	Yes
7)	Have you ever thought of a memory, and then wanted to play a song that reminded you of that time?	No	Yes
8)	Have you ever seen someone's mood be changed when they heard a certain song?	No	Yes
9)	Has your mood ever been changed from listening to a piece of music?	No	Yes
10)	Have you ever purposely listened to a piece of music in order to change your mood?	No	Yes

CIRCLE the answer that best relates to you

Gender: Male Female

Age: under 18 18-24 25-35 36-49 50-65 over 65

Education Level: High School Some College College Degree

Graduate Degree

THANK YOU FOR PARTICIPATING IN THIS SURVEY.

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