

## **“Music: A Deeper Understanding of the Effects of Your Favorite Song”**

By Alivia Laird

Music is something enjoyed by almost everyone, but deeply understood by few. The very first recorded music dates back to 800 BCE, written in cuneiform as a religious hymn (Hollis). Music is also mentioned multiple times throughout the bible, one of the most well-known cases being when David played the harp to cure King Saul’s depression (Gutheil 400). This art form has played a key role in history, showing expression of a wide range of cultures and time periods. It is commonly known that people around the world use music for different things: distractions, motivation, and even to comprehend one’s emotions (Heshmat).

These instances display the side of music that is understood and comprehended by most of the general public. What is not so easily understood is how can music do these things to the human brain? Why does music make us feel happy, sad, or excited? What about music triggers the general urge to get up and dance? Lastly, why can music help us express our own, deeply misunderstood emotions? The purpose of this essay is to dive deep into the many varying opinions formed by scientists who have conducted studies and research on the way the brain processes our favorite tunes. Gaining knowledge on these brain functions not only helps an individual better understand the workings of their own mind, but also encourages deeper thinking into the emotions triggered by certain songs. The simple act of listening to music can trigger a multitude of emotional and physical responses due to the chemical and electrical responses within the human brain.

Before one can decipher why music triggers emotional responses, it is necessary to first have an understanding of some basic brain functions. According to UPMC, the human brain is incredibly complex and unique; it communicates with itself by transmitting chemicals from one neuron to another and these transmissions play a large role in the different feeling and actions associated with everyday life. These chemicals, also called neurotransmitters, can either stimulate brain activity (excitatory), or hold a calming affect (inhibitory). The four main neurotransmitters in the human brain are Serotonin, Dopamine, Glutamate, and Norepinephrine. Serotonin is commonly known for being connected to sleep and depression, but it is also involved in functions such as appetite, arousal, and mood. Dopamine is associated with multiple positive reactions within the brain such as pleasure or reward along with controlling the function of behavior, emotions, and cognition. On the negative side, Dopamine is also linked to addiction of substances such as drugs and alcohol. Glutamine is important in functions like early brain development, memory, and learning. Norepinephrine works alongside adrenaline to trigger the response to stress known as “Fight or flight” (UPMC).

Another important factor in understanding the psychological and emotional effects of music is to first be able to comprehend music itself and the different components it holds. In volume 99 of *The American Journal of Insanity*, author Howard Hanson introduces himself as a musician and theorist but acknowledges having no special degree of knowledge in music therapeutics. He instead aims to discuss terms and phrases often loosely used in the topic, to allow more concrete definitions to be put in place, decreasing the sometimes misunderstood aspects of music and psychology. He explains that though music is a very subtle art form, it holds great emotional connotations, such as being invigorating or soothing. Music can be boiled down to three main relationships between tones: tones sounded simultaneously, tones sounded

consecutively, and the relation to time of tones sounded. If tones are sounded simultaneously it means there are multiple tones being established at the same time, and this is referred to as a harmony. A melody consists of tones that are being sounded consecutively, meaning they are sounded one after another without break. Finally, the relationship between tones and time can be defined as rhythm; the precise time at which specific tones are sounded creates the rhythm of a musical work. From these basic relationships, many more complex ones arise, creating the intricate sounds and songs we hear every day. Being able to research and come to understand the complexities of music's emotional effects is only possible after comprehending the inner workings of the art (Hanson 317).

The ability to evoke such a large variety of emotions is a quality that makes music incredibly unique. Dr. Shahram Heshmat, author of the essay "Music, Emotions, and Well-Being," states that music is often used to "diminish undesirable emotional states (e.g. stress and fatigue)." Understanding neurological responses is the key to understanding why music can be used in such a way. Positive feelings generated from listening to music has shown evidence of being connected to the same pleasure center in the brain where other forms of pleasure such as food, sex, and/or drugs stem from. Dopamine systems in the brain that are generally involved in addictive behaviors can be naturally targeted by stimuli such as music. The idea of music being addictive is reinforced in one study in particular in which researchers had participants listen to their favorite song after being given Naltrexone, a drug commonly used to treat addiction. A large number of participants reported that their favorite song no longer gave them feelings of pleasure while listening to it (Heshmat).

Other explanations as to why humans feel what they do while listening to music relate to the actions of different types of neurons within the brain. According to Jennings, Mirror neurons

are cells within the brain that are responsible for emulating the feelings perceived from the outside world. This specific type of cell contributes greatly to a person's ability to empathize with others in negative situations or feel joy for others in positive situations. Listeners' understanding of the emotional context of the music triggers mirror neurons to emulate those feelings, which is a possible reason for the feelings that accompany hearing one's favorite song. Life experiences could also play a large role in the emotions associated with different kinds of music. For example, a lullaby is something typically heard while being put to sleep by one's mother at a young age; therefore, the brain associates similar sounds or songs with a calm or peaceful feeling. Similarly, a favorite song of an ex-boyfriend/girlfriend could be associated with negative feelings such as anger or sadness. Following the same principles of songs and sounds being connected to life experiences, the brain could also associate specific songs with the environment in which they are heard. For example, if a song is heard at a concert or dance, the song from then on might evoke feelings of joy and happiness, whereas if a song is played at a funeral it would evoke feelings of sadness (Jennings).

Human beings are in a constant state of trying to predict what will happen next, and this includes while listening to music. The human brain subconsciously takes the information based on what it has previously heard and general experience with music to attempt to figure out what might happen next in the song. According to Jennings, research has shown that a visible spike in electrical brain activity can be seen the moment one realizes the meaning behind the music they are hearing. The majority of these interactions take place in either the auditory cortex or frontal lobes of the brain. Both areas are deeply connected to the limbic system, which plays a large role in the processing of music and the addition of emotions to our thoughts on the piece. This system connects back to the previously mentioned dopamine systems of the brain. A correct prediction

or unexpected but pleasurable section of sound can become a small release or large burst of Dopamine, respectively. Bursts of this neurotransmitter can then activate the autonomic nervous system, creating a physical response (Jennings).

Sometimes listening to music can not only cause emotional effects, but physical ones connected to certain reaction in the brain. When listening to music, individuals often get what are known as “goosebumps.” The process of goosebumps forming and the hair on human skin rising, also known as piloerection, is a process that has been carried along through human evolution (Richardson and Beverly). Early humans developed much more hair than is common today. This excess amount of hair was designed to help protect the body from the harsh elements, being that there were fewer forms of shelter, as well as to ward off predators. The formation of goosebumps occurs when small muscles near the hair follicles under the skin become stimulated by the sympathetic nervous system, causing the hair to stand upright. This portion of our brain is needed to mobilize energy within the body to properly react to stressful situations. This bodily response is no longer needed, but it still occurs in certain situations, such as hearing unexpected changes in sound during music. This could be quick changes in the tempo or notes being used. Though the body reacts to these changes as if it is facing a harmful environment, the brain quickly processes the situation and realizes there is no danger present. Finally, instead of producing the chemicals that cause anxiety and stress, the brain releases Dopamine, the chemical known to be attributed to feelings of pleasure (Richardson and Beverly).

The reward or pleasure center in the human brain can be triggered by multiple different things, one being coordinated movement. A neurologist at Columbia University, John Krakaur, used this example: “Consider the thrill some get from watching a choreographed fight or car

chase scenes in action movies. What about the enjoyment spectators get when watching sports or actually riding on a roller coaster or in a fast car?" Scientists remain unsure as to why humans generally enjoy these types of movement, but there is no doubt they do, and plenty of evidence suggests the brain finds joy in it. Being that dance is a form of coordinated movement, and it has already been established that listening to music can evoke pleasure, some believe that dancing to music is double dose of happiness (Krakauer).

Researchers have come up with three possible reasons as to why the coordinated movements found in dance are pleasurable. According to Krakauer, the first reason is some sections of the reward center in the human brain are also connected to motor areas, or areas that control movement. Secondly is the idea that music was originally created through rhythmic movements such as clapping hands, tapping feet, or snapping fingers in a steady repetitive manner (beat). Finally, humans are sensitive and attentive to the movements of others around us, and this possible explanation holds the greatest amount of supporting evidence (Krakauer).

The evidence supporting this claim relate back to a type of neuron in the brain that has also been found to be involved in the processing of music: mirror neurons. As Krakauer explains, mirror neurons are activated when people perform an action that is the same as one they are watching. Evidence has also led scientists to believe that sensory experiences are incredibly similar to motor experiences. Taking these two concepts it is easy to see how listening to music and dancing could evoke some of the same emotions as one another. Another aspect on the topic of finding dancing pleasurable comes from simply watching. Witnessing a professional dancer showcase their skills causes the human brain to subconsciously attempt to predict their next movement. When the brain is unable to do this correctly it is thought that the negative prediction

and consequent surprise of seeing the actual movement that was performed can lead to feelings of pleasure (Krakauer).

After answering the question of why music makes us feel certain emotions and why music makes us want to dance, it is only natural to wonder where all this information leads or how it can be useful. Throughout the world, scientists and psychologists are constantly doing research into the inner workings of the human brain and the different things that effect its functions. The goal of some of this research is to find easier and more effective methods of treating mental illnesses and disorders. Recently, it has been discovered that music could be one of these methods. Music therapy can be defined as “the skillful use of music and musical elements by an accredited music therapist to promote, maintain, and restore mental, physical, emotional, and spiritual health” (Shentong and Agius). Despite how it might sound, music therapy does not simply mean the professional plays music to patients, even though this action can be relaxing. The act of using music as a therapeutic involves a much deeper active participation from the patient in order for it to improve on mental health. Therapy in this form can also include elements of the creation of music and conversation. Conversation in the topic of music allows mental access to the nonverbal, emotional qualities of music, which can then help a patient become more self-aware or assist in self-expression. Music has shown to be beneficial for not only individuals, but also to the improvement of social unity. They attribute these reasons to the nature of music, which supports a multitude of human interactions within society. Current research into music therapy involves the therapeutic method in use with specific illnesses/disorders: depression, dementia, schizophrenia, and psychosis (Shentong and Agius).

The effectiveness of music therapy has been most heavily studied in regard to depression. Some suggest that the action of making music allows the patient to create a new aesthetic within themselves along with creating opportunities for different physical and relational experiences. Seventeen studies have shown that, in adults, simply listening to music has reduced symptoms of depression, and this can be any type of music based on the patient's preference. Combining this method with standard procedures for treating depression has also shown to be increasingly effective in treating depression. Singing and joining a choir group has also shown to be a useful method in reducing depressive symptoms in multiple studies (Shentong and Agius). Though this method of therapeutics is relatively new and still being studied, the positive effects it has shown to this point are evidence that the continued research into music's effects on the brain could lead to more effective methods of treating and controlling mental illnesses/disorders.

The idea of using such a widely loved activity like listening to music as a method of therapeutics is inspiring, but it does hold some constraints or limitations. One major limitation is the lack of research into the topic. General research into the effects of music on the brain is very recent, therefore making research as to how music could be useful in therapeutics a new field. The lack of mass amounts of research and studies into these topics opens the door for many articles and texts to generalize or falsely assume information. Though this field of study has been gaining attention, it is important to remember that not everything read online is always factual. In volume 111 of *The American Journal of Psychiatry*, author Emil A. Gutheil discusses the idea of music therapy. Music therapy often revolves around the biblical story of David curing King Saul's depression by playing the harp. There are countless articles and texts that discuss the idea of music therapy, giving promising titles but displaying information that has not been scientifically backed up. Doctors continue to present ideas like, "Physicians throughout the



world are beginning to realize that music is of definite value in keeping the mind healthy...’,” or ““It has found that music lessens the fury of the most violent cases...’.” These writers are generalizing with little to no scientific research to support their ideas (Gutheil 400).

Though many articles on the topic hold these false pretenses, some authors do present information in the proper way considering the circumstances, such as Psychiatrist Altshuler stating, “in the future the musician is destined to play a very important role in the care and treatment of nervous and mental diseases as well as in mental hygiene.” Gutheil concludes that before exploring music as a beneficial form of therapy, professionals and the public must be patient while scientists research music and its psychological effects (Gutheil 400). Despite the generalization and display of false information within this subject, there are still many great examples of scientists and researchers who display the information they or others have found without making generalization on the subject. Volume 1337 of *The Neurosciences and Music* discusses the factors that make music so remarkable, such as the use of sensory/motor skills, its role in society, the place it holds in history, and the unique way it is able to evoke emotions in humans. Understanding the neurological functions involved with processing music is important not only because it can allow doctors to find ways to incorporate it into different forms of therapeutics, but it also gives insight into the overall function of the brain and mind. The authors describe different studies and research projects on the subject, one of which uses positron emission tomography (PET) and MRI machines that have “consistently shown that pleasurable music activates brain regions usually responding to other pleasures and rewards such as the ventral striatum but also the orbitofrontal cortex (OFC) and anterior insula...” (Vuilleumier and Wiebke). Research has shown that music not only evokes motor effects like tapping of hands or feet to the rhythm, but also overlaps in active mental imagery. It is clear that music provides vast

cognitive, sensory, and motor experiences that are still being discovered today, but it is important that until scientists and researchers have a solid understanding of the topic, others do not generalize or falsely present the information that has been gathered to this point (Vuilleumier and Wiebke).

Music is a universal language and has endless uses, from cultural expression to dancing and singing. This art form has many different meanings to each individual person and understanding these meanings play an important role in the scientific understanding of the human brain, psychology, and personal awareness. The different chemical and electrical responses of the brain in reaction to listening to music allow humans to experience different emotional and physical reactions. While emotional reactions such as feeling happy or sad stem from dopamine centers in the brain, physical reactions like goosebumps and dancing stem from our evolutionary fight or flight response and mirror neurons. Understanding these neurological functions allows for the opportunity to explore how music could be helpful in a therapeutic setting, and some studies have already shown positive responses in individuals with depression. Music has existed for almost 3000 years and research into its effects has only just begun. What will the art of music lead us to next?

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