

Music and Emotions: Why Do Certain Musical Pieces Evoke Strong Emotional Responses?

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ABSTRACT

Music is applied in many places in the modern world, relying on a hidden reaction to achieve an important goal, namely, emotions. These responses are used for a variety of things, from getting the attention of people at airports to therapy and art. While responses to music are common, not every piece manages to evoke emotion. This leads to the natural question - why do certain musical pieces evoke strong emotional responses? This literature review explores the posed question through assessing multiple studies that are focused on emotional reactions to music and their causes. Specific elements of musical pieces such as tempo, rhythm, and genres that trigger the emotional responses are analyzed. The connection between the music and the listener is discussed. The neuroscience aspects of music-emotion interplay provide evidence for at least six different mechanisms within the human brain, including activation of the hedonic and eudaimonic brain regions, which are responsible for inducing reactions to music. Emotional responses to musical pieces increase in both frequency and magnitude in adolescence. Summarizing, certain musical elements elicit stronger emotional responses than others due to the activation of particular brain mechanisms and creation of personal connections to aspects of the listener's life.

Keywords: *evoked emotions, music elements, psychological responses to music, neuroscience of musical reactions, music tempo, listener-music connections, music and adolescence, brain stem reflex, hedonic and eudaimonic brain routes.*

In our world, there are many things that can cause emotional reactions, and one of the most prominent is music. While responses to music are common, not all of them involve emotions. This leads to the natural question: Why do certain musical pieces evoke strong emotional responses?

Although the relationship between music and emotions may seem simple, there is a complexity fed by personal reaction. Music is used everywhere, including therapy, art, and even things like announcements. To understand its universality, one must first understand what it is about music that evokes strong emotions. What do musical pieces that elicit significant emotional responses all have in common?

This work breaks down the question above into three sections, each dedicated to a separate theme. The first section explores specific parts of the musical pieces that evoke emotional responses, aiming at elucidation of what elements trigger them. The next section discusses the connection between the music and the listener. Understanding this linkage would help to comprehend the effect that factors have on personal reactions to music. For example, why one person is laughing while another is crying over the same piece of music. The final section investigates the neuroscience aspects of music-emotion connections, focusing on explaining what parts of the brain are responsible for the activation of strong emotions within a human.

EMOTION-EVOKING MUSICAL DETAILS

Most people have some emotional response when listening to music. According to a 2017 study published in *Psychology Today*, 89.8% of people report that they have cried while listening to music. However, different types of music evoke various feelings in

unexpected ways. Scherer, et al. (2017), claims that music produces emotional reactions in the listener, which go beyond the cognitive inference that the music intends to express. This suggests that the intellectual and emotional elements of a musical piece evoke strong responses independent of intention. For instance, when a person listens to a song that his or her parents used to sing to them at bedtime, not only do they respond to the song itself, but they also react to the memory of their parents. This can trigger nostalgia, happiness, or sadness. It depends on the emotional triggers they have attached to the memory.

This statement was further supported by the study of Fricke et al. (2016), which concluded that preferences for specific music pieces have a complex three-dimensional structure. One of these dimensions is the intellectual and emotional depth in music. For instance, when a child listens to their parents sing, he or she attaches feelings of safety and comfort to that music. As a result, a later occasion of exposure to that song will elicit similar feelings. Lyrics such as, "Don't be afraid," can become a comforting thought for the child while the musical phrasing creates a soothing environment. Such an attachment colors everything related to the song. This embraces the point that Fricke, et al. (2016), made: there is significant depth in the music features to which people link meaning.

In his 2013 study, Schubert asserts that changes in musical features such as the pace of the piece influence perceived and felt emotions. This introduces the idea that the tempo is also one of the main factors that evokes strong emotional responses. The claim was further supported by the research of Arjmand et al. (2017), which revealed that unexpected rhythm changes are some of the primary mechanisms through which music induces emotions. Their

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Fall 2025

conclusion underlined that tempo is one of the most dominant emotion-inducing components of music. This is also supported by Juslin et al. (2013), whose study provided an important piece to the evidence of tempo-induced emotional responses. As it was shown, simple acoustic effects – such as a drastic change in tempo – cause what they refer to as a brain stem reflex. This reflex is the process through which the human body adjusts to the external rhythm of the music. As an example, more upbeat songs like “Shake it Off” by Taylor Swift cause a feeling of lightness in the body, making it easier to move around. This prompts the person to be more active, energetic, and more willing to do work. Slower, more melancholic songs, such as the first movement of Beethoven’s Moonlight Sonata, cause the body to seem heavier and more relaxed, inducing the person to become calmer and sleepier.

In the studies discussed above researchers have identified key components, such as unexpected rhythm changes or emotional/intellectual depth, that allow music to evoke strong emotional responses. Tempo was found to be the main factor that evokes the primary, outer reaction of a human. The depth of the reaction, whether emotional or intellectual, influences the inner and longer lasting emotional reaction that humans have towards music. Many times, this is the sole reason why we remember the melody of a song or tune.

MUSIC AND THE LISTENER

The next aspect of evoking emotions is the connection between the listener and music. There are many various genres of music, and since they are so individual, the relationships between them and the listener must also be unique. Consequently, different styles of music naturally evoke varied emotional responses. Schutz et al (2017) focused their study on pitch and timing, two of the most effective cues in

emotional speech. Results revealed that communication in and through music can be achieved with the use of both elements, taking into account their effectiveness in emotional speech. Similarly, when looking at different styles of music, the most obvious differences are also pitch and timing. Such observation leads to the conclusion that the ideas music is attempting to convey within each genre may vary. Just as much as each genre can. This results in differing emotional responses when people listen to various genres of music. Confirming this statement, Yasah Goyal et al. (2024) asserted that such features as extraversion relate to the listening of music genres such as hip-hop, rap, and jazz, while neuroticism corresponds more with calming music.

Besides the idea that different types of music evoke various emotional responses, another hypothesis was introduced: emotional responses to music increase in both frequency and magnitude during adolescence. According to Kudaravalli et al. (2024), adolescence corresponds with an increase in music reward valuation due to the many changes happening in this period, both physically and mentally. These changes often cause increased levels of stress and negative emotions. At the same time, music is a great way for people of all ages to distance themselves from the rest of the world, its problems, and enjoy this relaxation as a reward. In their study, Platz, et al. (2015), discovered that music-evoked autobiographical memories are at their maximum during the adolescent years. This concept adds to the idea of musical rewards, because these memories are often related to positive life events. Due to the heightened stress levels of almost all adolescents, this reward is valued much more by them than by other age groups. Sometimes it may even change their relationship with music or a certain music genre.

These studies clearly showed that the relationship between a music piece and the listener plays a big role in the emotional response to the music with some key factors such as different styles of music or development of a person during their adolescent years. These key factors have a significant impact on how these relationships are formed and changed, thus emphasizing the importance of the exploration of strong emotional responses to music.

THE NEUROSCIENCE OF EMOTIONAL REACTIONS

Although the aesthetic ways music evokes strong emotions is quite important to look at, it is also necessary to consider the scientific explanation of why these responses happen – more specifically, the neuroscience involved.

The primary idea is that the brain uses several mechanisms to induce emotional responses, particularly to music. While conventional assumptions lean towards music triggering a single general mechanism in the brain, multiple studies have discovered that there are several pathways that respond to different aspects of music. In their research, Juslin and Västfjäll (2008) disproved the single-mechanism theory. They demonstrated that there are at least six different mechanisms within the human brain that are responsible for inducing emotion in responses to music. When each mechanism is activated, the brain works on comprehending all parts of the music. This theory contends that while listening to music, our brain takes the song apart, processes each element, and puts everything back together with emotional connections linked within. This hypothesis was further supported by the study of Schaefer (2017), where he described the imaging of the brain while a person is listening to music: the psychological processing of music demonstrates

multiple mechanisms within the brain activated during the experiment.

The following idea introduced the activation of the hedonic and eudaimonic brain regions, which are sections of the human brain that also activate emotional responses. The hedonic region includes brain areas like the ventral striatum, orbitofrontal cortex, medial prefrontal cortex, and is focused on feelings such as pleasure and enjoyment. The eudaimonic brain region consists of the precuneus, medial prefrontal cortex, posterior cingulate cortex, and is focused on factors such as personal growth, and contributing to something larger than oneself. According to the research of Lamont, published in 2021, listening and performing music provides the potential to receive various feelings like pleasure, engagement, and meaning – almost like a reward for the person for listening to music. The feeling of pleasure connects back to the abovementioned area of research, which showed that such emotions are evoked due to the music's relationship to past positive events in life. This, in turn, is linked to adolescents, whose increased magnitude, sharpness, and frequency of emotional responses to music allows them to experience these emotions more often. Therefore, causing these routes to be activated more regularly. Fasano, et al. (2022), highlighted the involvement of a brain's subsystem associated with the hedonic and eudaimonic routes in the brain. Specifically, they examined the processing of these two routes when a person is listening to music during their earlier adolescent years. These findings emphasize not only the fact that the emotional responses happen due to the activity of the hedonic and eudaimonic routes within the brain, but that they are also increased in activity during the adolescent years.

Summarizing, the neuroscience of the induction of emotional responses to music can be broken down into two main parts. Namely, in

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Fall 2025

order to process music, the hedonic and eudaimonic routes of the brain are activated when a person is listening to music. Moreover, emotional responses are induced by the work of multiple mechanisms within the brain, not a single one. Once the music is heard, the routes activated process it, like a computer processing a given problem. The specific mechanisms then become activated in order to induce the proper emotional responses to the music after it has been processed; similar to how a modern computer shows the answer on its display.

FURTHER DIRECTIONS

This research provides evidence that certain musical elements evoke stronger responses by activating several mechanisms within the brain that trigger connections to personal aspects of the life of the listener. A clear view of the physical responses of the brain to certain music pieces can aid in the understanding of other components of its activity as well as how connections are created in the first place. Each aspect of this research project comes together to form an answer to how and why people can have such emotional responses to music.

Despite scientists already having achieved a large amount of knowledge in this field, there are still many questions that need to be answered for better understanding. These include but are not limited by: (i) the role that mechanisms and routes within the brain have played in human evolution, (ii) why certain changes in music cause bigger vacillations in emotional responses, and (iii) what effects does the increased amount and magnitude of emotional responses to music have on adolescent development and how it impacts their further living as adults. These questions leave room for future research and indicate a large field available for study.

For further investigation, there are a few areas of inquiry that could be helpful to explore and research. Some of these topics include works on the role of mechanisms that evoke emotional responses to music and the impact they have on human brain development. In addition, researchers could investigate why certain changes in music cause bigger emotional response changes than others or study the effects of emotional musical reactions. This kind of information may help answer the key questions on the relationship between music and emotions with more detail and allow for the possibility of making new discoveries either about music, the human body, or both.

There is also a great potential for interdisciplinary research, when scientists from different, sometimes very different, areas of science apply their joint efforts to shed light on deeper roots of the effects observed. For instance, the connection of mathematics and music is well established. Construction of working mathematical models for above mentioned relationships will definitely help to look inside the process and find patterns, previously unobserved or overseen. Hypothetically, there might be an even deeper connection with the modern and highly popular direction in physics, the so-called string theory. The latter assumes the whole physical world consists of tiny strings and that all properties are simply their vibrations. So, there is a chance that the holy grail of physics – the unified theory of everything – is *just* music.

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