

Effects of Music on Emotional Processing and Memory Function in the Human Brain: A Narrative Review

Arvin Kodali¹

Received September 30, 2025

Accepted March 20, 2026

Electronic access April 15, 2026

Music is a ubiquitous part of life, from forms of expression to the enhancement of well-being and function. Building on a large body of existing research, the goal of this narrative review is to address the complex relationships between music and our cognitive function and emotional processing. By examining prior work in this space, this review underscores how music has these wide-ranging behavioral effects by engaging complex regions, including the amygdala, the limbic system, and reward pathways. Additionally, this review explores how music can be used to improve academic performance and as a therapeutic tool by lessening anxiety, improving memory, and slowing down the cognitive impact of neurodegenerative diseases. The paper demonstrates how music dependably engages emotion- and memory-related neural systems, which can support both cognitive and therapeutic performance and outcomes. Finally, it examines individual and cultural differences in music perception, showing how idiosyncratic factors can contribute to differing emotional and cognitive responses.

Keywords: Music and the brain, Emotional processing, Memory function, Dementia and Alzheimer's disease, Neural pathways of emotion.

Introduction

The interdependence between music and the brain is a compelling subject that has caught the attention of researchers across disciplines, including neuroscientists and psychologists. Besides being a form of expression, music plays an outstanding role in engaging both cognitive and emotional functions^{1,2}. Specifically, music is able to change an individual's emotional state and has key bidirectional roles in both forming new memories and resurrecting past memories²⁻⁴. For instance, think of when you hear your favorite song and can't help but smile. There have already been multiple works and large bodies of research establishing deep connections between music, emotional processing, and memory across behavioral, clinical, and neuroimaging studies^{3,5}.

However, results across these bodies of literature are spread over many areas and methodologies, making it difficult to connect neural activity to real-world cognitive and therapeutic effects. This narrative review aims to collect and synthesize various pieces of information on music and the multitude of effects on emotion and memory. Accordingly, this paper seeks to explore the primary question: how does music affect emotional processing and memory function in the human brain? By examining how neural systems involved in emotion and memory management engage when hearing or playing music, this paper aims to highlight the cognitive and psychological

impacts. To do so, this review will explore the critical brain structures involved and use empirical and case studies, as well as real-world examples, to discuss the relationships between music and core cognitive and affective functions. The final part of the paper highlights limitations and open questions, such as the role of cultural and individual differences in music perception, contradictions in research, and areas for future study. By consolidating information from various sources, this review highlights the contemporary neurological and psychological processes of music-related emotion and memory.

How the Brain Processes Music

There are multiple regions that support music processing, including both low-level sensory regions (i.e., auditory cortex) and higher-level multimodal processing regions related to emotion, memory, and attention^{1,6}. The brain processes music hierarchically, meaning that it goes through multiple stages of processing involving both bottom-up and top-down processing until the meaning of the music comes to be understood. Bottom-up processing relates to the flow of sensory information from lower to higher brain regions, while top-down does the opposite⁷. Bottom-up processing is communicated using raw sensory data, while top-down processing uses prior knowledge, goals, or expectations to shape the interpretation of incoming sensory input⁷.

To be specific, bottom-up music processing starts with

¹ Eastlake High School, Washington, USA

sound signals that are caught by the ear and are sent to the cochlea, which converts the sounds into neural signals (see Figure 1 for a schematic of the ear)⁶. The auditory nerves then carry the neural signals to the brainstem and thalamus for processing⁶. After processing, the thalamus relays the information to the auditory cortex, where continued cortical processing supports the analysis and recognition of complex sounds⁶. To provide more detail, following the auditory cortex's basic processing, the secondary auditory areas, such as the belt regions and Wernicke's area, incorporate many other complex musical patterns like harmony and rhythm⁸.

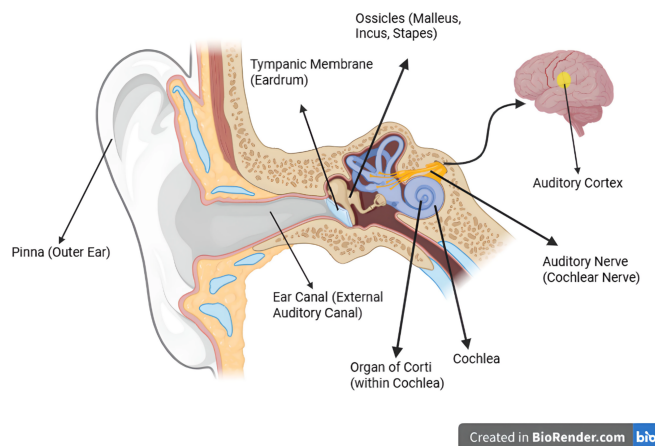


Fig. 1 Sound transduction from the ear to the cortex. This figure shows a clear schematic of the human ear as well as the auditory pathway used to process sound. Sound enters via the pinna (outer ear) and travels down the ear canal (external auditory canal) and vibrates the tympanic membrane (eardrum). The vibrations from the tympanic membrane are transmitted through the ossicles (malleus, incus, stapes) and to the cochlea, where the sound is converted into neural signals with the help of the organ of Corti. These signals travel via the auditory nerve to their final destination, the auditory cortex, for higher-level processing (adapted from BioRender, 2025)

Music processing in higher-order regions supports more intricate experiences, including preferences, memory, and reward. For instance, the basal ganglia, a group of small structures that control voluntary movements and reward-related processing, are engaged in interpreting rhythm, which in turn helps the brain in pattern recognition, interpreting regularities in information⁹. Other related regions canonically referred to as the “reward pathway,” specifically the ventral tegmental area, are engaged when we listen to gratifying music¹⁰. Furthermore, regions of the limbic system, like the amygdala and hippocampus, contribute largely to our emotional experience when listening to music^{2,11}.

The next sections will provide further detail on the role of neurotransmitters (chemical messengers) in supporting reward function before discussing the broader relationships between

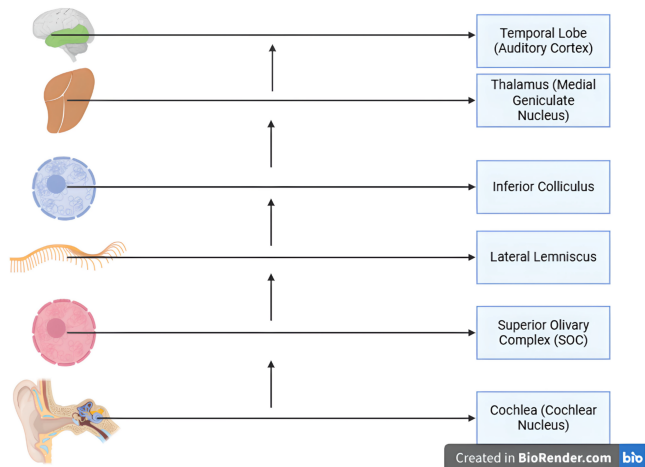


Fig. 2 Sound transduction pathway. Sound enters the cochlea, where it is later relayed to the brainstem (Superior Olivary Cortex). It travels through the midbrain (inferior colliculus, medial geniculate nucleus) to the thalamus (above the midbrain) before finally reaching the auditory cortex for higher-level processing (adapted from BioRender, 2025)

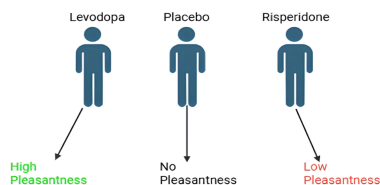
music, emotion, and memory and their neural correlates.

The Role of Neurotransmitters in Invoking Reward Responses to Music

All of the activity in these large brain regions is mediated by chemical messengers (“neurotransmitters”) that allow neurons to communicate with each other and with other cells throughout the body¹². Neurotransmitters hold a key role in sending signals across synapses, binding to specific receptors, and generating both inhibitory and excitatory effects throughout the nervous system¹². They allow for both basic functions needed for survival, such as digestion and sleep, as well as more complex functions, like movement, emotion, and cognition¹².

This paper focuses primarily on the role of a particular neurotransmitter in generating feelings of anticipation in reward, pleasure, and satisfaction when listening to music¹³. These feelings are mediated by dopamine’s release in reward pathways: music listening engages the mesocorticolimbic pathway, which originates in the ventral tegmental area and includes the basal ganglia¹⁰. This is where the ventral tegmental area projects dopamine to key structures, including the nucleus accumbens¹⁰. The interaction between these regions is the neural basis for both reward processing and the generation of positive emotions in relation to music. Generally, the release of dopamine correlates with the emotional arousal, anticipation of joy, and happiness one feels in the moment¹⁰. This extends to music; dopamine is the principal contributor to

the noticeable change in feelings experienced while listening to music¹⁴. Key evidence comes from a study in which participants were given a dopamine precursor (levodopa), which increased dopamine levels, or a dopamine antagonist (risperidone), which decreased dopamine levels; as seen in Figure 3, levodopa, compared to a placebo, increased the pleasurable experience associated with music, while risperidone had the opposite effect¹³.



Created in BioRender.com bito

Fig. 3 Pleasurable responses to music are influenced by dopamine levels. This figure demonstrates that feelings of pleasure are higher when dopamine levels are higher. Levodopa is a dopamine precursor (increases dopamine levels), and risperidone is a dopamine antagonist (decreases dopamine levels). Adapted from Ferreri et al. (2019), BioRender (2025).

The role of dopamine in “feeling music” is further highlighted in clinical settings. Notably, those with Parkinson’s disease (a deteriorating movement disorder, primarily caused by the loss of dopamine neurons in the substantia nigra pars and other regions) possess less of this dopaminergic response, therefore reducing their response to music¹⁵. Music therapy, a type of therapy that uses music to improve quality of life, reduce stress, and help accomplish goals, is thought to increase the dopaminergic reaction through external rhythmic cues, modulating dopamine activity, and compensating for the lack of stimulation, improving outcomes for those with diseases like Parkinson’s as well as dementia, or Alzheimer’s^{16,17}.

Music’s pleasurable effects stem not only from the release of dopamine in these reward pathways, but also from broader whole-brain changes. For instance, whole-brain oscillations show synchrony between our predictions of the music we are listening to and the motor responses it evokes⁹. The next section will focus on emotional responses to music more broadly.

Basic Science of Music, Emotion, and Memory

As noted, music possesses the great ability to spark and regulate human emotions, engaging many complex neural structures and psychological processes. Many people across the

world have emotional reactions to music; however, these reactions are often associated with individual connections and personal experiences^{18,19}. Evidence comes from the case study of patient Harry S. Following a brain aneurysm and the passing of his wife, Harry S. had lost much of his emotional and intellectual capabilities²⁰. However, when he performed his songs, he strongly reacted in an emotional manner, demonstrating music’s ability to evoke emotions, even when other functions were impaired²⁰. The neural structures engaged in music effluence include the amygdala, prefrontal cortex, and dopaminergic reward system discussed previously²¹.

Research has shown that intensely pleasurable experiences to music, such as chills, named ‘musical chills’, are related to increased activity in the reward and emotion-related regions, namely the ventral striatum, amygdala, and prefrontal cortex (see Figure 4 for the location of these regions)^{14,21}. Interestingly, these areas similarly respond to other pleasurable experiences like eating or social bonding, exemplifying that music taps into neural processes related to rapture or motivation^{2,14}.

However, there are some atypicalities where individuals seemingly have normal reward systems but do not respond to music in the way others do²². One example of this is called ‘music anhedonia’. People who experience music anhedonia can still decipher the harmonic pattern of music; however, there is no emotional response elicited²³. On the other end of the scale is musicophilia, where people experience an extreme sense of pleasure or other emotions when listening to music²⁴. These differences might be due to a mix of genetic, environmental, or cultural factors¹⁹. For instance, some proposed causes include that individuals with such atypicalities may have less neural sensitivity to the reward signals induced by music or that, due to cultural or environmental differences, they do not develop a rewarding connection with music^{24,25}. There also seems to be some evidence that these unique conditions—musicophilia and music anhedonia—may also be induced by brain damage: Fletcher found that those with dementia that had more degeneration of their left posterior hippocampus but less degeneration of certain prefrontal and orbitofrontal regions had higher changes of musicophilia, while Martinez-Molina identified that those with musical anhedonia had reduced responses in their reward pathways^{22,24}. This provides further evidence for the role of these reward regions in normative musical processing.

Nevertheless, this connection between music and the brain’s reward pathways helps to explain why music generally induces idiosyncratic emotional responses across people¹⁸. We know that different musical genres and tempos, types of music, and how fast the beat of the music is can elicit different emotional states^{26,27}. For example, faster, more upbeat music typically induces feelings of arousal and happiness, while more melodic passages of the piece, such as the vibrato of a cello, evoke feelings of sadness, calmness, or nostalgia^{26,28}.

However, music can be quite idiosyncratic, resulting from individual or cultural factors¹⁸. The psychological state of the listener, such as their mood, as well as episodic memories, may modulate the emotions and effects of music on the brain, leading to individual differences^{3,29}.

The multitude of effects that music has on an individual is often related to the memories that the music evokes^{4,30}. Music has a unique ability to trigger autobiographical memories: memories of specific personal experiences or events³. Studies show that recognizable music elicits more vivid memories than other sensory cues, such as words or sounds⁴. This is because repeated patterns such as words or melodies act as mnemonic devices, allowing the brain to link these memorable parts of the song to stored memories for retrieval³¹.

However, the effects of memory are much more specific than just recognizable music. In an experimental setting, music that evoked a positive connection rather than a negative one was recognized better, indicating that the emotional valence of the music directly correlates with an individual's memory retention³¹. Further, this sensory and emotional engagement has been shown to strengthen the recall and encoding of memories, especially when the music holds emotional meaning, evoking vivid mental imagery in an individual's mind, but more research and work are needed to fully understand it^{3,4}.

When it comes to memory itself, regions like the amygdala, prefrontal cortex, and hippocampus are all highly involved (see Figure 4 for a schematic)^{32,33}. Located deep inside the temporal lobe, the hippocampus is necessary to form and recall episodic memories³². For instance, neuroimaging studies done by Janata show that listening to familiar (as opposed to unfamiliar) music activates the medial prefrontal cortex (mPFC), an area associated with a larger network of regions ("default mode network") thought to engage the storage and retrieval of autobiographical memories³. This is thought to occur because familiar music creates mental imagery in our minds⁴. Adding to these neural findings, Belfi conducted a study where participants listened to 30 songs and viewed 30 faces, and noted their evoked memories. The researchers discovered that 'music-evoked autobiographical memories' (MEAM) were much more graphic than the memories evoked from the faces, demonstrating that MEAMs are a stronger cue than others⁴. Moreover, music also evokes feelings of nostalgia, allowing individuals to remember and reconnect with positive or sorrowful episodic events³⁰.

Music and Brain Network Interactions

Although the paper focuses on the individual brain regions and their sole relationship to music responsiveness, it is also important to highlight the nature of interconnected brain networks in musical processing and coordinated neural activity². For one, music perception starts in the auditory cortex after be-

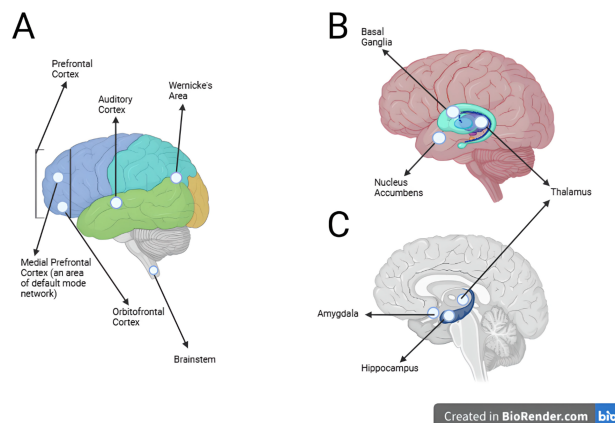


Fig. 4 Regions that support complex music functions. This figure shows a simplified schematic of the brain, highlighting important regions involved in music processing, emotional regulation, reward, and memory formation. The figure includes auditory processing centers (auditory cortex), the thalamus, emotional and memory structures (amygdala, hippocampus), autobiographical and cognitive regions (prefrontal cortex, medial prefrontal cortex), reward regions (basal ganglia, ventral striatum, ventral tegmental area, nucleus accumbens), the motor cortico-striatal circuit (rhythm and movement timing), and the default mode network. Panel A shows a surface view (figure adapted from PikPNG). Panels B and C show medial views highlighting the basal ganglia and hippocampus/amygdala circuitry, respectively. Figures are adapted from BioRender (2025).

ing passed through ear mechanisms, processing several acoustic elements such as timbre, pitch, and rhythm¹⁰. However, the experience of music goes beyond exclusively auditory perception, engaging different brain regions responsible for emotion, memory, and reward processing. These regions communicate through fundamental neural networks that allow sensory interpretation to be tied to emotional interpretation and memory retrieval².

One pivotal interaction involves communication between the auditory cortex and a few key regions of the limbic system, specifically the amygdala. The amygdala gauges the emotionality of the incoming stimuli, allowing music to generate different responses such as excitement, nostalgia, or happiness². This interaction between the amygdala and the auditory cortex, as well as the interaction between the amygdala and the hippocampus, allows for the formation and retrieval of memories in relation to musical experiences³. Communication between networks helps explain why some pieces of music are capable of provoking stronger memories than others³.

These interactions illustrate how emotional and memory-related processes interact during listening. In addition, the brain's reward network, including the nucleus accumbens

and the ventral tegmental area, contributes to the pleasurable aspects of musical experience through the release of dopamine¹⁰. Together, these structures demonstrate how auditory perception, emotional understanding, memory retrieval, and reward processing function as coordinated neural networks rather than isolated regions². This interconnected activity also explains why music can evoke strong mental reactions while also strengthening memory formation^{2,10}. Because music engages multiple neural systems involved in emotion, memory, and reward processing, understanding these network interactions is important for seeing how music may be applied in clinical and therapeutic settings³⁴.

Clinical Impact of Music

Music's capability to activate autobiographical memories and regulate emotional states validates its usage in clinical settings^{4,30}. It has been shown to help individuals cope with mental pain and improve their overall well-being, as well as in helping anxiety-related conditions like stress⁵. One way that music is used to help people combat anxiety is through music therapy.

As noted previously, music therapy is used to manage conditions and improve the quality of life¹⁶. There are two main types of music therapy. The first one, active interventions, is when an individual takes on the role of making music with their therapist, exemplified by singing or playing an instrument^{17,35}. The second one—receptive interventions—is when an individual listens to music and discusses it with their therapist^{17,35}. These two types of music therapy demonstrate that music is a powerful tool that many people use to alleviate symptoms of anxiety-related conditions.

Case studies and clinical research also consistently demonstrate the effects of music on memory and well-being in those who have dementia, a disease that causes memory loss and cognitive disability, as well as Alzheimer's disease, a form of dementia^{16,36}. People with dementia experience a multitude of symptoms, including sleep loss, stress, and poor quality of life^{37,38}. To investigate the consistency between music and memory improvement, an experiment was conducted to determine the effects of this correlation on an individual with dementia. This was a woman who was given an '8-week music-with-movement intervention'³⁹. The treatment appeared to be a success as the woman noted that it improved sleep quality, reduced depressive symptoms, and increased communication between her and her husband³⁹.

Broader analysis and case studies confirm that specific music-based interventions are associated with improvements in episodic memory recall, well-being, and anxiety in patients with Alzheimer's disease^{16,36}. Self-selected or emotionally meaningful music most effectively supplements recall in individuals with Alzheimer's, making their memories more vivid

and emotionally charged than other memory cues like words or sounds³⁶. These results arise from studies with different methodologies, like verbal fluency assessments (measures how quickly and accurately a person can produce words based on categories), episodic memory tests (evaluating the ability to remember specific personal events), and more, indicating their generalizability^{16,37}.

The musical memory appears to not only support cognition, but also enhance social interactions and improve well-being for people living with Alzheimer's or dementia, providing further support to the previous study¹⁶.

Academics

Music not only brings back prior memories, but it also has an active role in how we form memories. An example of a widely discussed real-world application dealing with the correlation between music and memory occurs in academics. Research surrounding the topic focuses on how music impacts learning, concentration, and information retention, especially in contexts like studying or classroom environments⁴⁰. From a research perspective, the connection between music and memory is complex and individualized⁴¹.

The research is mixed in suggesting whether music elevates concentration or not, and it all depends on the type of music played and other factors⁴². One factor that determines music's effectiveness on concentration is the presence (or lack) of lyrics⁴³. Experimental studies suggest that lyrical background music can be seen as distracting⁴³. This is thought to be because lyrical distractions may interfere with recall and comprehension, especially while learning through tasks that involve verbal information⁴³. On the other hand, instrumental background music has the same or slightly better effects for individuals, promoting concentration and focus, with many stating that music is therapeutic and helpful for absorbing information⁴².

It is also said that instrumental music has no lyrics and is therefore less distracting⁴³. Further, individuals who listen to music report high grade-point averages (GPA), a greater happiness for learning, and improved memorization⁴¹. An empirical article done by Christopher and Shelton shows that general background music was found to be distracting; however, those with a better 'working-memory capacity' were less affected compared to others⁴¹. This shows that personal cognitive abilities also play a role in the correlation between music and academics⁴¹.

These findings highlight that while music is a powerful tool for memory about academic performance, it ultimately depends on the type of music, the type of task, and individualization.

Table 1 Summary of Key Studies on the Effects of Music on Emotional Processing and Memory Function in the Human Brain

Study	Design/Method	Sample/Population	Key Findings	Notes/Context
Brain correlates of music-evoked emotions	Koelsch (2014) Review of neuroimaging studies examining music-evoked emotions	Adults (from multiple neuroimaging studies)	Music activates auditory, emotional, memory, and reward networks; interactions between such networks demonstrate the emotional and cognitive responses to music.	Basic Neuroscience/review of multiple neuroimaging and lesion studies
The neural architecture of music-evoked autobiographical memories	Janata (2009) fMRI study examining music-evoked autobiographical memories	13 adults	Familiar music triggers activation in the hippocampus and medial prefrontal cortex supporting autobiographical memory retrieval	Basic Neuroscience, Memory/Emotion Interaction
Emotional responses to music: The need to consider underlying mechanisms	Juslin and Västfjäll (2008) Theoretical review proposing a multi-mechanism framework for how music affects emotion	N/A (review of psychological mechanisms and empirical evidence across several studies)	Musical emotions come from the automatic usage of several underlying mechanisms (brain stem reflexes, emotional contagion, episodic memory, etc.). Emotion induction depends on deep underlying processes.	Important theoretical framework for understanding mechanisms of emotional responses to music
Anatomically distinct dopamine release during anticipation and experience of peak emotion to music	Salimpoor et al., (2011) fMRI and PET scan study measuring dopamine release during music listening	10 adults	Specific dopamine release in the caudate during anticipation and nucleus accumbens during peak emotional pleasure; links reward system with music-evoked emotional responses	Brain-reward circuitry, music-evoked pleasure
Music evokes vivid autobiographical memories	Belfi et al., (2016) Behavioral study / survey examining music-evoked autobiographical memory recall	Adults (exact number not reported)	Music-evoked autobiographical memories (MEAMs) were more vivid than face-evoked autobiographical memories. MEAMs contained more internal and perceptual details; women retrieved more vivid memories than men	Clinical and cognitive memory application. Links music, emotion, and memory recall.
Dopamine modulates the reward experiences elicited by music	Ferreri et al., (2019) Double-blind, within-subject pharmacological manipulation with levodopa (dopamine precursor), risperidone (dopamine antagonist), and placebo while participants listened to music, measuring music-evoked pleasure and motivation	27 healthy adults who participated in all three pharmacological conditions (levodopa vs. risperidone vs. placebo) while listening to music	Increasing dopaminergic transmission with levodopa increased musical pleasure and motivation. Reducing dopamine with risperidone reduced both pleasure and motivation. Provides causal evidence that dopamine modulates reward experiences evoked by music.	Shows dopamine's causal role in emotional response to music

Methodology

Literature concerning the review was identified using PubMed and general correspondence to information presented in the paper, mainly examining the effects of music on emotion and memory. Search terms included combinations of music, emotion, memory, cognition, and Alzheimer's/Dementia. Only published peer-reviewed articles in English were used.

As previously stated, studies were considered based on their relevance to the topics mentioned in the review, with more focus on papers published in credible academic journals. Both review and empirical studies and articles involving human participants were included.

Important information concentrated from each study included authorship, general methodology, and significant findings related to music, emotion, and memory. The literature was consolidated using a narrative process, organized by cognitive focus and effects.

To be consistent with the narrativity of the review, no formal quality scoring system was applied to the studies used.

Limitations and Open Questions

While research further validates music's association with emotion and cognition, it promotes important contradictions requiring closer analysis. Cultural differences contribute to the individuality of music perception, shaping how people from different regions around the world hear musical attributions, including pitch, rhythm, and emotionality or aesthetic⁴⁴. A study comparing Western listeners from America with members of the Tsimane tribe in Bolivia found that both groups can similarly differentiate tones and notes, but differ in pitch relationships, which is a large part of Western music and holds little value in Tsimane music⁴⁵. For example, the combination of the C and F# notes is often reported as irritating to Westerners, but enjoyable to the Tsimane⁴⁵. The authors suggest that the difference is likely from the brain's tuning to different phonetics and sounds during critical development periods, similar to how exposure to different languages can evoke different responses⁴⁵. This tuning impacts how sounds are processed, influencing emotional responses and memory⁴⁶. Furthermore, individuals from specific cultures may find it easier to recognize rhythms from their own upbringing, and synchronization to these elements of music stems from genetics and cultural factors, only increasing the listener's individuality⁴⁴. However, there are a few subconscious responses that are similar between every person, including facial expression or emotional reactions, demonstrating that instinctive psychological responses are integrated into culture⁴⁷. The cultural aspect of music may also add to the individuality of a person, defining how the music is processed and how it is emotionally and cognitively outputted, provid-

ing a foundation for understanding individual differences that affect musical experience^{2,45}.

Beyond cultural factors, there are numerous meaningful individual differences that impact these factors that have not always been accounted for in prior research. For instance, research on music perception has identified that emotional states play an important role². Emotional states while listening to music vary widely from person to person, and can be differentiated based on a variety of factors, including the present psychological state of the listener, personality traits, music preference, and how and what the individual has learned in the past²⁵. These individualized aspects of a person shape how they react to different types of music. Second, an individual's cognitive style also plays a key role in their response to music²⁵. Two dissimilar cognitive styles that hold notable differences between each other are the "empathizer", an individual who focuses on music that is easier to grasp and possesses little physiological arousal, and the "systemizer", an individual who leans towards complex music, including heavy metal, punk, or jazz²⁵. Because music affects individuals personally, it becomes challenging to generalize findings, especially when studies must regulate the music used⁴¹.

The individual and physiological aspects of music make listening extremely personal, making it difficult to make general, population-level conclusions in research studies that will often need to standardize the music that they are exposing the individual to¹⁴. Future work should continue to take an individual differences perspective to answer these important questions. For instance, those in the field could investigate if individuals who share traits like personality type or musical preference share similar neural responses to the same piece of music in comparison to those with different traits. This experiment could involve measuring brain scans (fMRI, EEG) across various groups with alike or unlike traits while listening to the same songs, to see the similarities or differences in their responses. This would show us that individual differences change how music is processed in the brain.

Discussion

This review highlights the key relationships between music and the brain, specifically its relationship with emotional processing and memory function. Findings highlight that music engages crucial parts of the brain, including the auditory cortices, particular parts of the limbic system such as the amygdala and hippocampus, and reward systems^{2,48}. This engagement facilitates psychological arousal, vivid episodic memory recollection, and reward processing^{3,10}.

This work exemplifies how the broad effects of music can contribute to areas including mental health, therapy, and education^{16,40}. Music's effect on emotion and memory is not ubiquitous; however, it is extremely personalized and is dif-

ferentiated based on cultural background, mood, and cognitive style^{18,25}. It is critical to consider the unique traits of the listener in order to have real-world applications for this research. Future work should explore these questions further in order to fully understand these relationships, which have real-world implications. For instance, in clinical settings, music therapy can be used to lessen anxiety and improve recall in patients with Alzheimer's disease or dementia, as well as general psychological well-being^{16,34,36}. In addition, educators can strategically use music to improve focus and concentration in the learning environment^{40,41,43}. Understanding the listener's musical experience and how it affects them as an individual allows for more personalized ways to improve cognitive function and emotional advancement^{19,25}.

Although there have been multiple advancements in music's connection to emotion and memory, the effects differ due to individual and cultural differences^{18,44}. Future work should examine personality and preference to better understand how individual differences shape neural responses. Investigating the associations between music and the brain can broaden our perspectives and help us progress to expand our understanding.

References

- C. Toader, C. Tataru, I.-A. Florian, R.-A. Covache-Busiuc, B.-G. Bratu, L. Glavan, A. Bordeianu, D.-I. Dumitrascu and A. Ciurea, *Brain Sciences*, **13**, 1390,.
- S. Koelsch, *Nature Reviews. Neuroscience*, **15**, 170–180,.
- P. Janata, *The neural architecture of music-evoked autobiographical memories. Cerebral Cortex*, <https://doi.org/10.1093/cercor/bhp008>.
- A. Belfi, B. Karlan and D. Tranel, *Memory (Hove, England)*. **Vol. 24**, 979–989,.
- P. Juslin and D. Västfjäll, *The Behavioral and Brain Sciences*, **31**, 559–575.
- A. King, S. Teki and B. Willmore, *Recent advances in understanding the auditory cortex. F1000Research*, <https://doi.org/10.12688/f1000research.15580.1>, F1000 Faculty Rev-1555, 2018,.
- K. Rauss and G. Pourtois, *What is bottom-up and what is top-down in predictive coding? Frontiers in Psychology*, <https://doi.org/10.3389/fpsyg.2013.00276>.
- Y. Zhang, G. Chen, H. Wen, K.-H. Lu and Z. Liu, *Scientific Reports*, **7**, 17066,.
- J. Cannon and A. Patel, *How beat perception co-opts motor neurophysiology*, <https://doi.org/10.1016/j.tics.2020.11.002>.
- V. Salimpoor, M. Benovoy, K. Larcher, A. Dagher and R. Zatorre, *Nature Neuroscience*, **14**, 257–262,.
- L. Jäncke, *Journal of Biology*, **7**, 21,.
- R. Teleanu, A.-G. Niculescu, E. Roza, O. Vladăcenco, A. Grumezescu and D. Teleanu, *International Journal of Molecular Sciences*, **23**, 5954,.
- L. Ferreri, E. Mas-Herrero, R. Zatorre, P. Ripollés, A. Gomez-Andres, H. Alicart, G. Olivé, J. Marco-Pallarés, R. Antonijoan, M. Valle, J. Riba and A. Rodríguez-Fornells, *Proceedings of the National Academy of Sciences of the United States of America*, pp. 3793–3798,.
- A. Blood and R. Zatorre, *Proceedings of the National Academy of Sciences of the United States of America*, pp. 11818–11823,.
- V. Pando-Naude, T. Matthews, A. Højlund, S. Jakobsen, K. Østergaard, E. Johnsen, E. Garza-Villarreal, M. Witek, V. Penhune and P. Vuust, *European Journal of Neuroscience*, **59**, 101–118,.
- A. Matziorinis and S. Koelsch, *Annals of the New York Academy of Sciences*, vol. 1516, pp. 11–17,.
- A. Raglio, *Frontiers in Neurology*, **6**, year.
- P. Juslin, L. Sakka, G. Barradas and O. Lartillot, *Music Perception*, **40**, 55–86,.
- B. Gingras, H. Honing, I. Peretz, L. Trainor and S. Fisher, *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, **370**, 20140092,.
- O. Sacks, *Musicophilia: Tales of the Music and the Brain*.
- N. Fuentes-Sánchez, A. Espino-Payá, S. Prantner, D. Sabatinelli, M. Pastor and M. Junghöfer, *Imaging Neuroscience*, **3**,.
- N. Martínez-Molina, E. Mas-Herrero, A. Rodríguez-Fornells, R. Zatorre and J. Marco-Pallarés, *Proceedings of the National Academy of Sciences of the United States of America*, pp. 7337–7345,.
- M. Satoh, T. Nakase, K. Nagata and H. Tomimoto, *Neurocase*, **17**, 410–417,.
- P. Fletcher, L. Downey, P. Witoonpanich and J. Warren, *Frontiers in Psychology*, **4**, year.
- D. Greenberg, S. Baron-Cohen, D. Stillwell, M. Kosinski and P. Rentfrow, *PLoS One*, **10**,.
- Y. Liu, G. Liu, D. Wei, Q. Li, G. Yuan, S. Wu, G. Wang and X. Zhao, *Frontiers in Psychology*, **9**, 2118,.
- Z. Yang, Q. Su, J. Xie, H. Su, T. Huang, C. Han, S. Zhang, K. Zhang and G. Xu, *Scientific Reports*, **15**, 8276,.
- E. Daws, *The Effects of Tempo, Texture, and Instrument on Felt Emotions*, <https://musicscience.net/wp-content/uploads/2019/11/daws.pdf>.
- S. Hennessy, P. Janata, T. Ginsberg, J. Kaplan and A. Habibi, *Human Brain Mapping*, **46**,.
- P. Janata, S. Tomic and S. Rakowski, *Memory (Hove, England)*. **Vol. 15**, 845–860,.
- S. Eschrich, T. Münte and E. Altenmüller, *BMC Neuroscience*, **9**, 48,.
- H. Eichenbaum, *Nature Reviews. Neuroscience*, **1**, 41–50,.
- J. McGaugh, L. Cahill and B. Roozendaal, *Proceedings of the National Academy of Sciences*, pp. 13508–13514,.
- S. Gardener, E. Mukaetova-Ladinska and N. Perera, *The effect of music therapy on psychological outcomes for neurological conditions: a systematic review*, <https://doi.org/10.3390/medicina61091611>, pg. 1611, 2025,.
- A. Raglio, *Frontiers in Human Neuroscience*, **17**, 1204593,.
- E. Fraile, D. Bernon, I. Rouch, E. Pongan, B. Tillmann and Y. Lévêque, *Journal of Clinical and Experimental Neuropsychology*, **41**, 760–768,.
- S. Finkel, *International Journal of Geriatric Psychiatry*, **15 Suppl 1**, 2–4,.
- C. Hurt, S. Bhattacharyya, A. Burns, V. Camus, R. Liperoti, A. Marriotti, F. Nobili, P. Robert, M. Tsolaki, B. Vellas, F. Verhey and E. Byrne, *Dementia and Geriatric Cognitive Disorders*, **26**, 138–146,.
- D. Lai and C. Lai, *SAGE Open Medical Case Reports*, **5**, 2050313 17730264,.
- S. Hallam, *International Journal of Music Education*, **28**, 269–289,.
- E. Christopher and J. Shelton, *Journal of Applied Research in Memory and Cognition*, **6**, 167–173,.
- J. Kämpfe, P. Sedlmeier and F. Renkewitz, *Psychology of Music*, **39**, 424–448,.
- A. Souza and L. Barbosa, *Journal of Cognition*, **6**, 24,.
- Snyder, *Nature Reviews Psychology*, **3**, 439–440,.
- N. Jacoby, E. Undurraga, M. McPherson, J. Valdés, T. Ossandón and J. McDermott, *Current Biology*, **29**, 3229–3243 12,.
- E. White, S. Hutka, L. Williams and S. Moreno, *Frontiers in Systems Neuroscience*, **7**, 90,.
- T. Fritz, S. Jentschke, N. Gosselin, D. Sammler, I. Peretz, R. Turner,

A. Friederici and S. Koelsch, *Universal recognition of three basic emotions in music*. *Current Biology: CB*, <https://doi.org/10.1016/j.cub.2009.02.058>.

48 V. Rajmohan and E. Mohandas, *Indian Journal of Psychiatry*, **49**, 132–139,.