

The Relationship Between Music and the Human Brain

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ABSTRACT

Music, which each culture uses as a form of communication within its own fabric of existence, is also universal. Music and the brain, which until now have been the subject of research by neurologists and neuropsychologists, are now also attracting the attention of musicians. In this study, some ampric research on "music and the brain" was included.

It can be said that the reasons for the things that have been done instinctively since the literature researches have arisen from the need to learn more scientifically and apply them more consciously. The research is expected to contribute to other studies on the field.

INTRODUCTION

Music, which is a source of complex sounds that occupy a great place in our lives, has been involved in every aspect of our life and has not lost its abstract meaning throughout history (Karolyi, 1999:9). Music, which plays a phonogenetic key role in the evolution of language, has important functions in interaction, group coordination and commitment behaviors, but is also one of the most fundamental and oldest sociocogmatic basises in human life (Soysal vd, 2005: 107).

When we start listening to music, almost all parts of our brain are affected. When listening to music, nucleus akumbens, the pleasure center in the brain, activates, releasing neurochemical dopamine, which makes us feel good. This chemical is the chemical that is secreted when eating something that we love very much or when orgasm. In addition, endorphins are secreted in the brain when listening to music. As is known, endorphin secretion increases when in pain or stress and endorphins work like a natural painkiller.


Daniel Abrams, a postdoctoral researcher at Stanford University School of Medicine, said:

Despite the differences in our musical tastes, the brain's experience of music occurs very consistently.

For neurologists, musicians are an ideal group of subjects to observe brain development and plasticity (adaptability); because music requires very different perceptions and characteristics, both in terms of performance and creativity, it is one of the oldest and most basic socio-cognitive areas of the human species (Schlaug, 2001).

requires high brain function, just like math or chess. Dealing with music also lays the foundation for well-developed "spatial" intelligence. Spatial intelligence is the ability to perceive the visual world, to create images of objects in the mind and to understand their differences (Boettcher vd., 1994).

Subjects who had not studied music and participated in the study listened to four symphonies while undergoing an fMRI brain scan. The researchers found that music had almost the same effect on the

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brain of all participants: Brain regions involved in movement, planning, attention and memory were activated. This study has shown that listening to music is processed differently in the brain than any other sound.

The results of the research, conducted by neuroscientist Valorie Salimpoor, published in Nature, are as follows: Since music is an abstract stimulus, it can evoke feelings of euphoria and longing. Psychophysiological measurements of autonomic nervous system activity using raclopride positron emission tomography scans found that endogenous dopamine was secreted while listening to music.

When functional magnetic resonance imaging was used on the same listeners, it was understood that the brain region nucleus akumbens was the most reactive when listening to music. These results suggest that intense sensation in response to music can lead to dopamine release.

The physical, mental, emotional, spiritual, ethical and musical functions of life are the activities of the brain. Although there have been significant advances in understanding the various structures and functions of the brain in recent years and much has been learned about the functioning of the brain, it still needs a lot of progress to be made before this information can be applied to daily life and our level of consciousness (Reimer, 2004).

Brain Research

Throughout the brain ages, it has been a riddle for scientists. Even today, scientists can understand only a tiny fraction of what is happening inside the brain. Greek scientists Herophilos and Erasistratos were the first to scientifically study the brain in the 3rd century B.C.

These two scientists were the first to cut down and study animal and human bodies to understand what was happening inside. Their most important achievement has been finding the nervous system. This discovery has proven that most of what happens in our bodies is managed by the brain (Treays, 1998, s.30).

Our Brains When Playing Musical Instruments

Playing musical instruments is one of the most complex things humanity does because musicians simultaneously convert visually perceived notes into motor commands.

When the brains of musicians were examined by fMRI method, more gray regions were found in some parts of their brains. Gray matter is the part of the outside of the brain that plays a key role in language, thought, memory, attention, comprehension and consciousness.

Brain scans of professional musicians showed that, significantly, there was more symmetry, larger areas responsible for motor control, auditory processing, spatial coordination and more advanced corpus callosus. Corpus kallosum is called the band of nerve fibers that connects the two sides of the brain and provides communication. So learning to play a musical instrument is one of the best things you can do for your brain at any age.

In another study, 17 composers were asked to compose a new composition while their MRIs were being taken. First, they were shown a bar note and asked to imagine and complete the rest of the composition with their eyes closed.

At the end of this five-minute experiment, activity in the brain was examined before and during composing. According to the results, during composing, the connection in the visual and motor regions of the brain decreased, and the connections in other parts of the brain increased.

Especially in the anterior cinsulat cortex (responsible for empathy, controlling impulses, decision-making processes and regulating emotions) and in the default mode network (Eng. default mode network or DMN) The default mode is the part that is active when dreaming the network or thinking about the past or the future) connections have increased. These networks are important for emotional processing and information integration.

Music Therapy

Music therapy improves brain health in a number of different ways that we all experience at some point in our lives. Known as one of the largest forms of art, music is one of the greatest entertainment stimuli that can improve learning. 7 ways music improves brain function:

Listening to music regularly can stimulate the whole brain through various neural circuits that stimulate better brain metabolism. Listening to enjoyable music improves brain function and can often set you in motion!([1](#))

The brain is divided into right and left hemispheres. The right brain is often thought to understand and process information through artistic cognition. The left hemisphere is often understood as the analytical side that processes mathematical and verbal inputs. Corpus kallosum connects both hemispheres and controls complex communication between them ([2](#)).

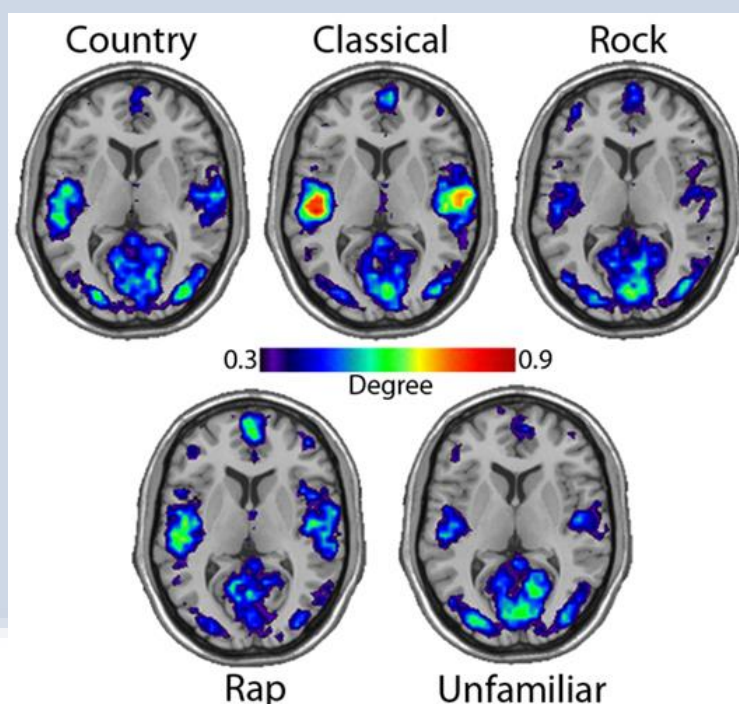


Figure 1. Corpus kallosum

Connects The Hemispheres of Your Brain

Music improves brain function due to its ability to activate the sequence of neurons throughout the corpus collosum, creating a conductive state of harmony between the two hemispheres. While nonverbal melodies stimulate the right hemisphere, singing stimulates the language center in our left brain ([3](#))

Music therapy, which has the potential to change an individual's conscious state, can change an individual's perception of time and stimulate emotions and memories. Music increases the release of endorphins, which boosts our spirit and triggers positive emotional responses and feelings of euphoria.

Music Therapy Helps Boost Creative Energies

Music improves brain function and boosts creative energies through alpha and theta waves. The flows of alpha waves offer enhanced sense of creativity, while theta waves are linked to learning, daydreaming and relaxation.

To increase creative energies, one needs to listen to the type of music that one enjoys. If he is looking for an inspiration for language and mathematics, he should listen to music by singing melodically, while instrumental music without singing helps stimulate visual and artistic senses (4).

Music can also be used to balance the brain's hemispheres . Someone who works as an accountant can find an increasing level of peace and stability when listening to classical or other music determined by the right brain.

With this in mind, a far-right brain-centric individual can succeed in listening to rock music or more lyrical-based music to strengthen his left brain. At this point, it should be noted that all this depends on individual-specific trends and subtleties. Additional research strengthens the relationship of music to balance the brain's hemispheres (5).

Music Therapy and Health

Classical music improves brain health by helping to create a “state of calmness, increase circulation and lower blood pressure”. Research shows that listening to calm, light music for a few minutes each day tends to stabilize blood pressure.”

suffering from neurological disorders saw improvements from music therapy (6).

This style of therapy stimulates unique regions of the brain and stimulates the metabolism of the brain by accelerating blood flow. This type of therapy was popularized by Dr. Oliver Sacks and shown in the film "Awakenings".

Music and the brain

Playing and listening to music works several areas of the brain

Corpus callosum:

Connects both sides of the brain

Motor cortex:

Involved in movement while dancing or playing an instrument

Prefrontal cortex:

Controls behavior, expression and decision-making

Nucleus accumbens and amygdala:

Involved with emotional reactions to music

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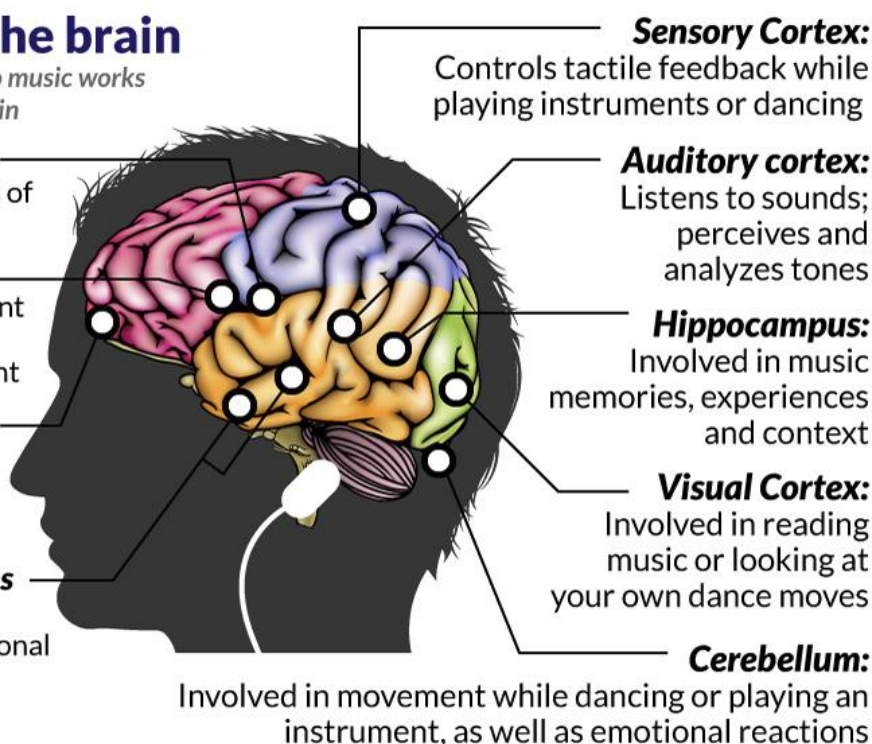


Figure 2. Music and the Brain

Music Therapy and Alzheimer's Disease

Alzheimer's disease is associated with temporal lobe damage. The temporal lobe processes and guides memories. Music helps to revive memories that can have a positive effect on Alzheimer's disease .(7)

Research has found that listening to music can indirectly collect pieces of memory that would otherwise remain fragmented. This can help provide emotional comfort and improve brain function .

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Music Therapy and Parkinson's Disease

Parkinson's disease is a pathogenic process that destroys basal ganglia. This region of the brain converts thoughts and movements into action. With this in mind, powerful, rhythmic beats of music stimulate motor control, movement and coordination, which can help revive basal ganglia and help to piece together muscle memory .

Combining this style of music with dance and other movements has been shown to improve the speed and coordination of movement for those suffering from Parkinson's disease .

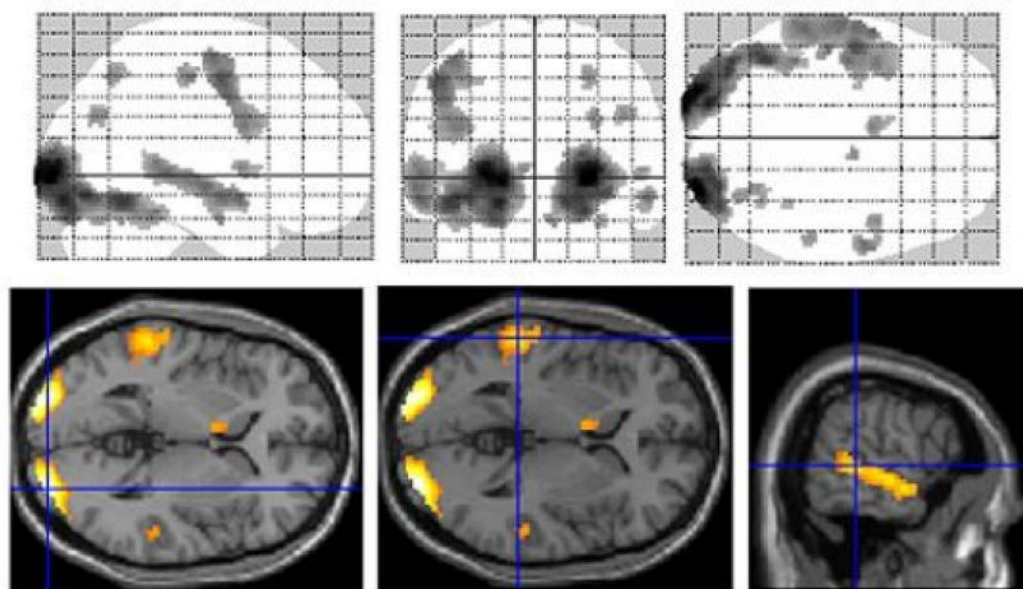


Figure 3. Music Therapy and Parkinson's Disease

Image shows the brain activity whilst reading © Professor Adam Zeman - University of Exeter

The relationship between arts and science is extremely rich; And it's much more complicated than the view opposed by physicist Richard Feynman: 'Poets say that science steals from the beauty of stars, reducing them to gas atom lumps.

Can see and feel the stars at night in a desert. And in this case, do I see less or more?"

In this context, a study conducted by Cognitive Neurologist Professor Adam Zeman of the University of Exeter School of Medicine, Rick Rylance, who was dean of the Faculty of Arts, Language and Literature at the University of Exeter at the time, and colleagues also addresses how the brain responds to prose and poetry.

In the reading study in Exeter, participants were asked to measure the degree of sentimentality of the passages they read. According to Professor Zeman, the research group found an association between the increase in emotions and activation in brain areas that 'Robert Zatorre identified in his study of goosebumps'

Some of the open-ended findings have intrigued Professor Rylance. 'When we compared poetry with prose, we found more information in areas of the brain associated with a network called the "Default Network,"' says Professor Zeman.

With what we do while these areas are resting, it seems to be about thinking about what we've been through recently, what's going to happen in the near future, or other people. It's like this network has a stronger connection to poetry than prose.'

Source: <https://www.britishcouncil.org.tr/programmes/education/cubed/poetry-music-emotions-and-brain>

Effects of Music on Our Lives

- Music releases endorphins, triggering positive emotional responses.
- It has been demonstrated by many studies that music improves brain function.
- As a result of the researches, it has been observed that music helps relieve depression and reduces chronic pain.
- Music therapy is also used in the treatment of neurological diseases. With this therapy, certain areas of the brain are stimulated, brain metabolism is stimulated and blood flow is accelerated.
- Research has also shown that listening to music indirectly helps stimulate memories; therefore, music therapy is applied to Alzheimer's patients.
- Since studying music increases memory capacity, it also increases the capacity to think indirectly. It has been observed that the auditory vocabulary and auditory attention of musicians have improved. This affects indirect learning. In other words, music education positively affects learning in an auditory way. In one of the studies, it was observed that the vocabulary and reading capacities of children studying music were higher than those of children who did not study music.

The main elements of the music can be listed as tone-tone -pitch (pes-treble), rhythm (number of strokes in a certain period of time), intensity (strong-weak), contour (up and down), tempo (fast-slow), direction and echoion. Our brain can create an infinite variety of music by combining and integrating these basic acoustic elements into the rules of measurement, harmony and melodic .

Our brain is sensitive to all kinds of music. However, the interaction of music in the brain is most pronounced in the way that music is exposed to the culture in which it is experienced, listens regularly and selectively, or actively makes music.

Therefore, listening to music and making music; they are very powerful actions that activate multiple sensory and motor brain networks, stimulate changes in these networks and improve the connections between functionally related brain areas .

The auditory stimuli that make up the music reach the brain areas where motor, sensory and cognitive processes are performed, contributing to the regulation and consolidation of movements, sensory perceptions and cognitive skills.

As a result of the introduction of regulatory and reinforcing contributions, the use of music as a therapy tool has become one of the new developments that are increasingly attracting attention in the medical world.

Today, the most advanced example of acquired musical applications that affect the human nervous system or used with a scientific approach in the rehabilitation of developmental dysfunctions is Neurological Music Therapy (NMT).

NMT studies use applications that support the areas of movement, mood, creativity, harmony and social participation within the framework of the effects of all melodic, harmonic and measurable musical components on the brain (Thaut, et. al. 2014).

The Compromise of the Musical Brain

Cerebral activities between musicians and non-musicians:

"A musical study in which it did not matter to the right or left ear brought differences in cerebral lateralizations between musicians and non-musicians (the privatization of the two hemispheres of the brain to show different functions).

A series of neuro-imaging studies have shown structural differences in the brains of musicians auditory. Although long-term studies have shown the reordering of the functional brain after a short period of music training, it is still not known how long these changes last after training."

(Thaut, 2005) Studies on people with memory problems such as Alzheimer's have shown that neural memory scars created through music are more resistant to neurodegenerative effects and are deeply engrained in the brain.

Individual, randomly defined experiments show that music therapy functions in patients with depression and creates progress in the treatment of mood disorders (Maratos et al, 2008). Moreover, it has been observed that the potential application of music therapy, albeit intuitively, in neuropsychiatric disorders such as the autism spectrum, leads to psychotherapeutic uses to stimulate emotions."

Effects of Music on Humans as a Result of Researches

- When listening to music, it has a stimulating and stimulating effect, as there is an increase in the amount of blood and oxygen going to the brain.
- It directly affects heartbeat and metabolism. The effects of fast-paced and heavy music in practice have had different results.
- Music inspires, stimulates emotions and boosts creativity.
- Music is mathematical, it allows complex ideas to be solved easily.
- It allows the right and left hemispheres of the brain, which are the main element of effective learning, to function in balance.
- Certain types of music increase the secretion and calmness of the soothing endorphin hormone.
- Reduces muscle tension, improves body movements and coordination.
- It improves the brain's ability to perceive the physical world, resuscitate the mind and distinguish differences between objects.
- Music reduces stress, relieves it.

<https://marmaralife.com/2015/08/08/muzigin-insan-uzerindeki-etkisi/>

Result

In order to produce and use information and to be transformed into services that will shape our daily lives, it needs to be developed up to the upper limits of the human brain.

In other words, "Information Society" is a society built on the basis of the brain, driven by well-developed, gifted brains. Thus, questions have arisen about how the brain develops, what mechanisms trigger it, why some brains are more developed, what skills develop the brain and create some structural differences, etc.

Naturally, research on this subject is carried out on people operating in and in areas where special and different skills are used together. Since music is one of the few activities that uses many functions of the brain together, it has been the center of attention of many researchers from the past to the present in terms of perception, creation and interpretation of the brain (Zatorre, 2005). As you can see, listening to music or dealing with music has a lot of positive effects on our brains and our lives.

In this context, it is thought that similar studies should be continued and supported considering the aesthetic and emotional advantages that music education brings to the individual and society.

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