

## Music Therapy in Neuroscience

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Accepted 3 July 2015.

### ABSTRACT

From ancient times music therapy has been appreciated as a non medicine treatment. Studies on neuroscience shows that music can enhance neurological functions via eliciting the secret chemicals in stress. There is no culture without music on the earth. Since ancient times music was seen as a mystical phenomenon. NeuroMusic, located in the central nervous system and brain shell, thinking, learning, speech, body control is warned about the centers. Neuro Music has its own language and for this reason, has a universal dimension. In this scope Uskudar University Music Therapy and Research Center (MUTEM) conducted studies in NeuroMusic Therapy, developing methods of treatment using creative artistic methods. It is a therapeutic application of music to cognitive, sensory, and motor skills. Neuro Music Therapy in MUTEM is divided into receptive and active forms in medicine. In the world of Neuroscience music has been held again as a therapy instrument by behavioral sciences. Our research is progressing on this path.

**Keywords:** Neuro science, neuro musik, music therapy, motor skills.

### Introduction

From ancient times music therapy has been appreciated as a non medicine treatment. The most prominent ancient Greek philosophers Pythagoras, Aristotle, Plato indicated preventive and curative power of influence music. They believed that music sets the order of the entire universe, including the lack of harmony in the human body. It has been noticed that music, especially its main components - the melody and rhythm, mood change, rearrange his emotional state.

Known Platonic ideas related to music therapy. According to him, rhythms and harmonies, influencing thought, make it according to themselves. Following Plato and Pythagoras ideas about the influence of art on human Aristotle developed the doctrine of catharsis - the concept of purification of the soul of man in the perception of art. He pointed out that such cleansing (catharsis) like the elimination of unbridled pathos as subjective rampage - hence updating moral criteria, namely separated as their suffering from the life of society the individual rises from his private particularity to universality.

The pleasurable emotions caused melodies, increase the activity of the cerebral cortex improve metabolism, stimulate respiration and circulation. Positive emotional experiences during the sound of soft music enhance attention, tone up the central nervous system. The music builds up the body rhythm at which physiological reactions occur most efficiently. The result lifted the mood, performance, reduced pain sensitivity, normal sleep is restored stable heart rate and breathing. Incidentally, music beneficial effect not only humans but also in animals or even plants. Plants and animals prefer harmonious music. Dolphins gladly listen to classical music, especially Bach. Plants and flowers classical music quickly reveal their leaves and petals. If enumerate the names of the composers whose music has beneficial effects on human health, the first in the list will be Mozart. For example, it is found that Mozart effect was investigated in spatial rotation task research. Results figured that Mozart's music, by activating task-relevant brain areas, enhances the learning of spatial-temporal rotation tasks (Thompson, 2001).

Recent studies showed that music can enhance neurological functions via eliciting the secret chemicals in stress. Music therapy has been used in treatment of neurological language and speech disorders (Kim L. Baker, 2002) Neurologically music therapy provides effective treatment option for patients with recent-onset tinnitus. TQ (the tinnitus questionnaire ) and APSA (the Attention and Performance Self-Assessment Scale ) was implemented and 73.3% of the patients showed a reliable reduction in individual TQ-score (Grapp, M *et al*, 2013) Another study testing the effects of music on depression and comparing with the effects of psychotherapy has been revealed that the music-therapy group had less depressive symptoms than the psychotherapy group ( Castillo-Pérez *et al*, 2010). In addition to that acute psychotic episode patients' results showed a significant decrease in delta, alpha and beta waves when listening to music compared to resting condition in terms of gender studies on music therapy sex differences in reactivity patterns to musical stimuli in psychophysiological measures show that women tend to show hypersensitivity to aversive musical stimuli (Morgan *et al*, 2010). Patients with traumatic brain injury was investigated in order to observe usefulness of music therapy results shows that Music therapy enabled a significant improvement in mood and reduction in anxiety-depression (Guétin *et al*, 2009).

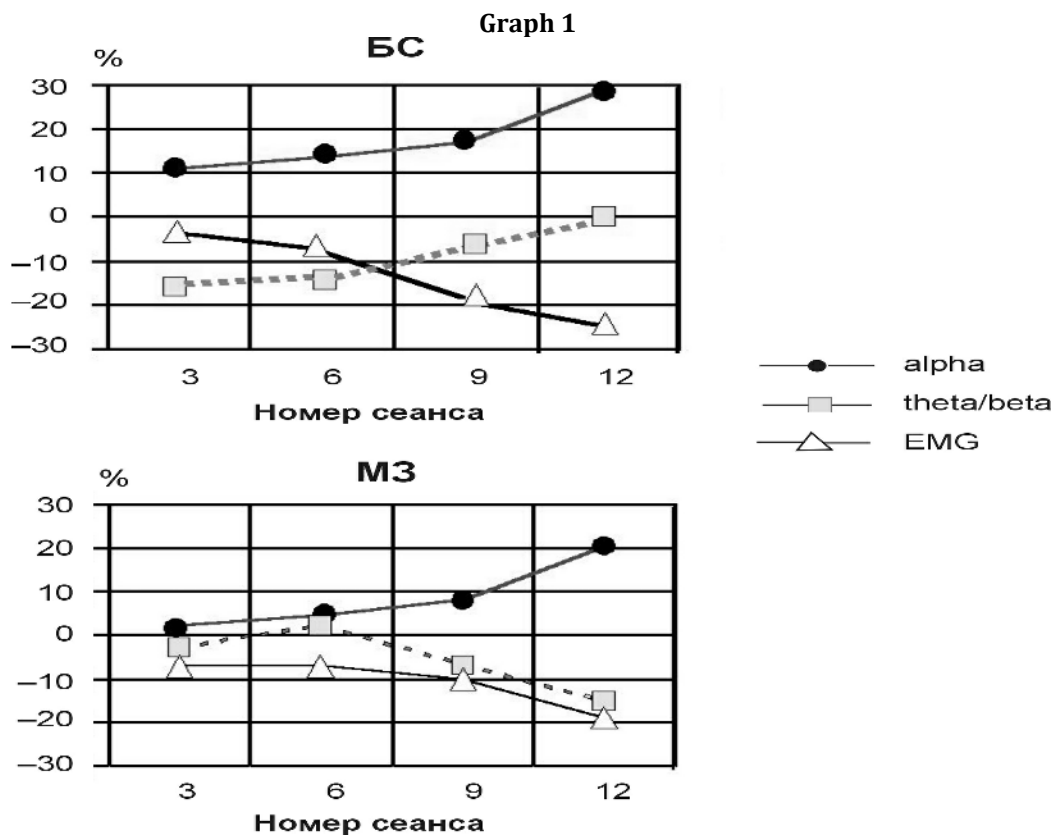
A small study, the results of which were published on the website of the American Association of Occupational Therapists, showed that classical music has a certain rehabilitation of the property.

The experiment was conducted with the participation of 16 stroke patients, the right hemisphere of the brain. For one week, researchers monitored the same as classical music, white noise and silence affect visual perception and care for each patient. The results obtained were recorded by scientists using a specially developed visual analog scales (VAS are commonly used to determine the degree of pain intensity). As is the case with creativity and driving, the silence did not meet expectations of scientists, but classical

music has greatly increased the duration and concentration of patients improved their visual memory.

In terms of EEG studies, EEG, EMG of musical perception of musicians and non-musicians 93 people were identified average power values alpha1 -rhythm (8 to 10 Hz) in all brain areas investigated, the intensity of beta - 1 rhythm ( 14-19

Hz) in the C3 and C4 and the power - 2 beta rhythm ( 20-25 Hz) in groups in C4 musicians were higher than in the group of non-musicians . For indices of all ranges of the alpha rhythm were the highest in the group of highly professional musicians and the indices of the alpha rhythm of low-frequency ranges were higher in non-musicians (Bazanova, 2004).



Note. From "Bio Optimization n Music Therapy" by O.M. Bazanova, M.V. Shtark, 2004, Journal of Russian Scientific Academy, 3, p.113.

Music therapy conveys elements of sound, rhythm, melody, harmony, dynamic and tempo that affects cognitive states, emotions, movements of the participants.

### **Rhythm**

This is the original and fundamental element of music. Music is the only primitive communities of rhythm. It is referred to as "the heart of the music." Rhythm and has the strongest direct effect on the human - and on his body, and emotions. Life in our body based on different rhythms: breathing, heart, different movements, activity and rest, not to mention more subtle rhythms at the level of cells and molecules. Psychological state of the individual also has its complicated rhythms: winged and depression, grief and joy, zeal and apathy, strengths and weaknesses and so on. All these states are very sensitive to musical rhythms. Is it because they have the magic to excite and soothe, heal and destroy. There are certain actions in which the rhythm of the body, emotions and music interpenetrate and merge into a single entity. This happens in the dance, which can be called the live music coming from the very soul of man.

It is known that at constant drunkenness endogenous ethanol - a natural alcohol produced in small quantities in the body, gradually disappears, and to make up for his loss, requires an

alcoholic to take a daily dose in the nearest stall. It was found that the drum rhythms increase the level of natural ethanol and mental state returns to normal.

### **Melody**

The combination of rhythms, tones and accents give birth each time a unique melody. It affects the listener particularly intense and diverse. Melody evokes not only emotions, but also feelings, images, and beliefs strongly influenced almost all vital functions, especially the nervous system, breathing and circulation.

### **Harmony**

Melody formed sequence of sounds. Harmony also made simultaneous sounding of several sounds, harmony with each other, which form chords. Thanks to the various vibrations emitted by these chords in the soul of listeners feeling arises either harmony or dissonance, that in any case has a certain physiological and psychological effects. The predominance of dissonance in contemporary music is an expression of the disorder, conflicts, crises that bring suffering to modern man.

### **Timbre**

Anyone who has an ear for music, feels the charm of a violin or flute, harp, or soprano. Composer, artfully combining

various instruments in an orchestra can bring a huge audience into a frenzy, the whole stadiums.

In Uskudar University Music Therapy and Research Center (MUTEM); Pet studies showed that that listening to music activates the right hemisphere in general listeners but in professionals the left hemisphere, the "rational" side, is instead activated. In music-evoked memory recall or visual imagery comes into play, the posterior portion of the precuneus recruited bilaterally.

In Uskudar University Music Therapy and Research Center (MUTEM); Neuro Music Therapy is divided into receptive and active forms. In receptive one; patients chooses the song and also it employs other forms of therapy. Specific emotions are aroused during musical interventions. These emotions result from recalls and memories. The songs help in recalling good or bad memories. Both assumptions are emerging as a result of research.

In active one; patient creates the melody and suitable bodily movement with the guidance of trained therapist. The therapist and patient engage in singing together, and the therapist lets the patient improvise. Emotional impact is important as in receptive one. But in this case rather than recall - an experience, actual performance arouses actual feelings and let feelings adjusted in to healthier one. When we come to the content of the music therapy in terms of music selection we see that pleasant or cheerful music decreased perceptions of pain and anxiety while unpleasant or sad music increased perceptions of pain under the same conditions (Zavyalova, 1995).

Music instruments are also used as a therapeutic Notion. For instance. Drum stimulates the immune system, strings tone the cardiovascular system, violin relaxes, piano soothes, wind instruments positively affects blood circulation. The other music genres also effective as classical music.

In a session of music therapy children with delayed speech development learn to express their feelings and emotions through music. It was a monotonous piano playing and loud bangs on the drum. That is everything that kids do doctors try to find the so-called musical elements. Even crying sometimes is perceived as musical-vocal utterance, which are responsible for using the familiar musical instruments. Thus, children begin to realize that their messages are expressed through sound, not remain unanswered. Gradually, step by step, the doctors added to the music and verbal support by teaching patients to proper reaction and speech.

In another project "Drums", aimed at correcting the relationship students have with their peers and teachers. It is no secret that many teenagers observed pronounced aggression towards others. To suppress it, the children had to get unlimited opportunity to express themselves in such a peaceful way like music. The experimental results showed that students aged 10 to 13 years who participated in the psychological project allowed in the classroom all the unspent energy, forgetting about the negative thoughts and in return only positive impressions.

In terms of children, playing various musical instruments, musical games and dances contribute to the development of

motor coordination, gross and fine motor skills, the formation of the child's internal control over their actions. If the early stages of a child with impaired motor areas may play only the most simple tools (maracas or bells, which are attached to the arm bracelet), then during the course, the child become conversant with variety of instruments, many of which require a more developed motor skills and coordination - not just the shaking toy, and pounding, getting a stick on a drum or a small wooden box. Subsequently, the child can using instruments and provide the active participation of all motor skills.

Complicated and larger movement, which involved all the child's body. On the first lessons children learn to just walk to the music and stop when the music stops. During the year, expanding the repertoire of movements available for kids - they go under slow music and run - a fast, waving their "wings" like a bird, and transhipped from foot to foot as bears, jumping and whirling in place, etc. This exercise requires children to a certain view of their body and its capabilities. In addition, they learn to move alongside other children who are not encountering them (Zavyalov, 1995).

Movement in space music hall during the dance useful for the development of spatial representations. First, the child moves erratically around the room, coming to the wall by the window. When he settled into the space of the hall, he begins to walk like an adult asks: alternate walking and running, sits on a chair in a certain place, lies on the floor, etc. During the training and complicated dances that make up the mandatory part of the group sessions, completing it. First children-only movement in a circle, with each child holding the hand of an adult, not letting him go out of the circle, or move in the wrong direction. Adults gradually becomes smaller, so that the children are left to keep the direction, the dances themselves are complicated, there are movements with his hands, turning, jumping, walking at different speeds in different directions.

Repeated diagnostic study showed that the use of music therapy in the educational institution is effective to prevent and self-correction of negative psycho-emotional states. The art of music has a positive effect on the psycho-emotional state students. The results were confirmed by two criteria: the level of education, level of personal anxiety (Arkhipova, 2009).

Work on methodological development has shown us that the use of music therapy as the breaks between lessons, so during extracurricular activities promotes creativity, helps to express feelings, relieve nervous tension, cope with psychological problems and restore emotional balance (Grapp *et al*, 2013).

Music therapy for the elderly in the form of case musical evenings are held regularly once a week in the afternoon, as a group of people -15-20; in the direction of music therapy as a karaoke therapy. In the pension organized cozy karaoke lounge where each living can manifest itself on - new, different roles. once a week the results are tested; use of music therapy results in a good manner comprehensive program of medical, social and psychological rehabilitation of the disabled and elderly people (Arkhipova, 2009).

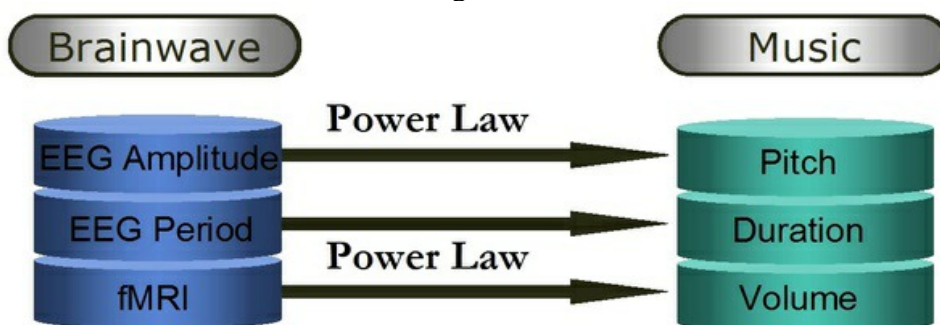
For group psychotherapy with older people music therapy used quite widely. Most often in medical practice used receptive music therapy with a focus on communicative tasks.

Participants will hear a special group selected music, and then discuss their own experiences, memories, thoughts, associations, fantasies (often projective nature) arising from them during the audition. On one session is tapped, typically 3 or more product or less complete passage (every 10-15 minutes). Music program works are based on gradual changes in mood, dynamics and tempo, taking into account their different emotional stress. First work must generate a certain atmosphere for all classes to show the mood of patients develop contacts and enter into Music classes, to prepare for further listening. It quiet work, characterized relaxing effect. The second work - a dynamic, dramatic, intense, has primary load, its function is to stimulate intense emotions, memories, associations projective nature of his own patient. After listening to the group paid significantly more time to discuss

the experiences, memories, thoughts, associations, occurring in patients. Third product should relieve stress, create an atmosphere of peace. It can be calm, relaxing or, conversely, energetic, giving cheerfulness, optimism and energy. In the process of group psychotherapy patients may activity stimulated with various additional tasks, such as: try to understand, whose emotional state to a greater extent corresponds to a given piece of music, from the available music library to pick up your own "musical portrait", ie, work, reflecting the emotional state of a member of group (Brusilovsky, 1979).

An original research conducted in transferring EEG output into melodies. In general researchers search for the EEG output corresponding to musical intervention. However, in this research EEG signal transferred into melodies.

Figure 1



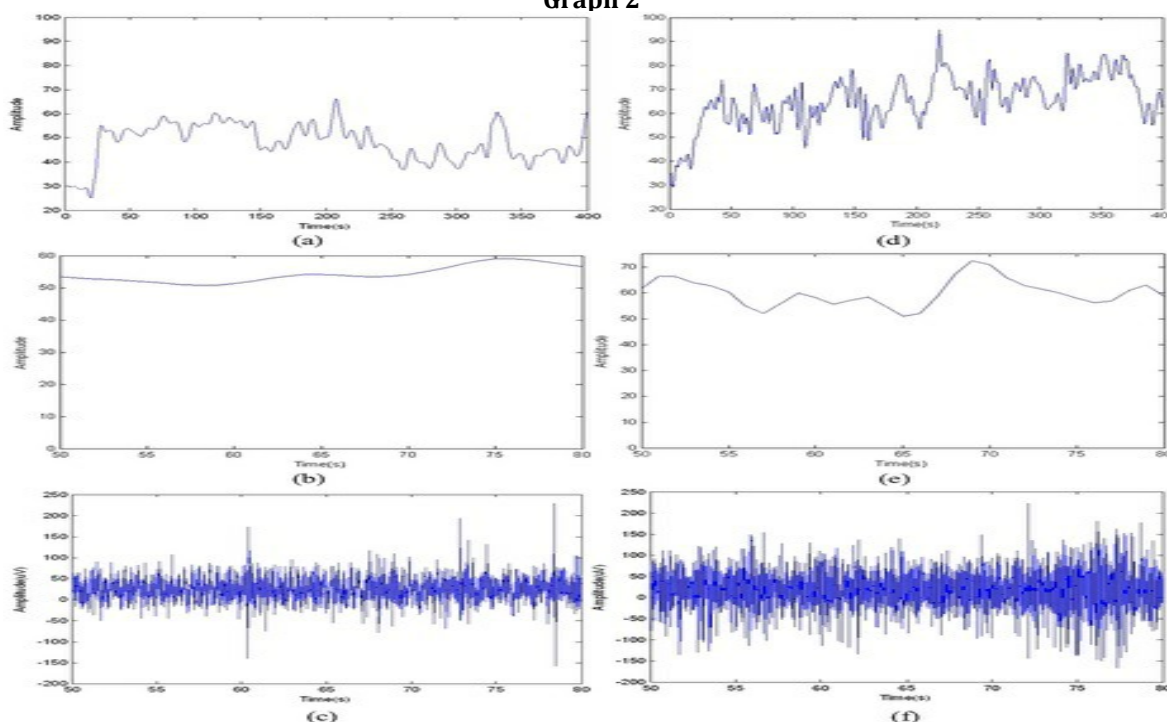
Note. From "Scale-Free Brain-Wave Music from Simultaneously EEG and fMRI Recordings" by Jing Lu *et al*, 2012, PlosOne.

Pitch, timbre, duration and intensity are the character of the music. Pitch and intensity are explored in this research. Power law rule is considered in defining pitch of melodies.

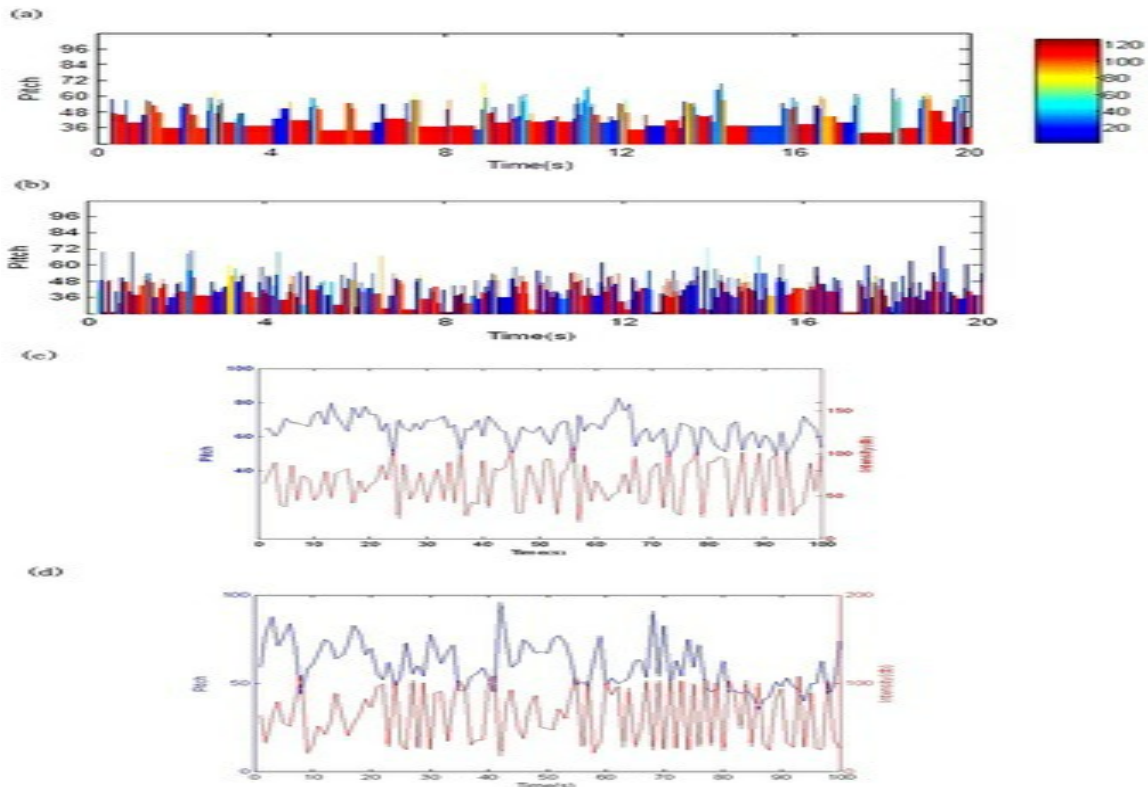
According to Fechner law is employed in defining intensity of the melody.

Pitch and intensity graphs are shown below.

Graph 2



Note. From "Scale-Free Brain-Wave Music from Simultaneously EEG and fMRI Recordings" by Jing Lu *et al*, 2012, PlosOne.

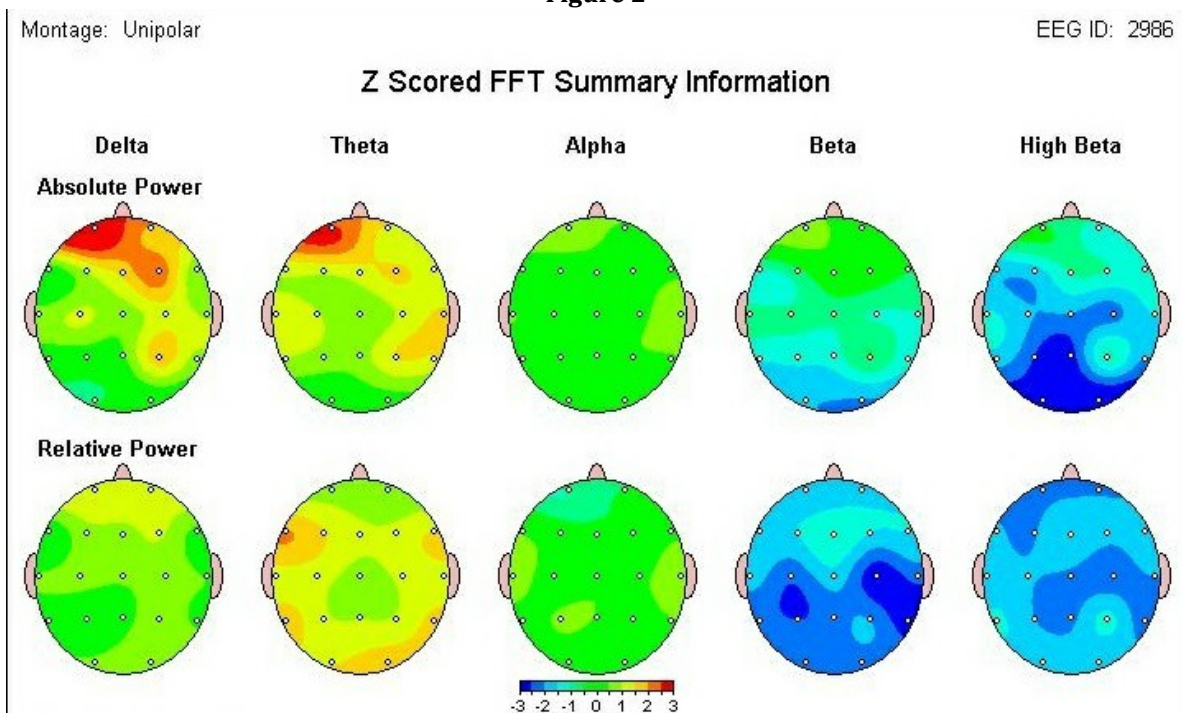


Note. From "Scale-Free Brain-Wave Music from Simultaneously EEG and fMRI Recordings" by Jing Lu *et al*, 2012, PlosOne

In a small study conducted in Uskudar University NP?stanbul Hospital and MÜTEM, it is shown that music therapy intervention in anxiety disorder patient (patieny;Alican A., 2013) showed increase in theta waves and decrease in beta waves at frontal lobe respected to pre and post EEG records. Where the theta wave increase is correlated to relaxation and decrease in beta waves in frontal lobe is correlated to decrease in cognitive alertness.

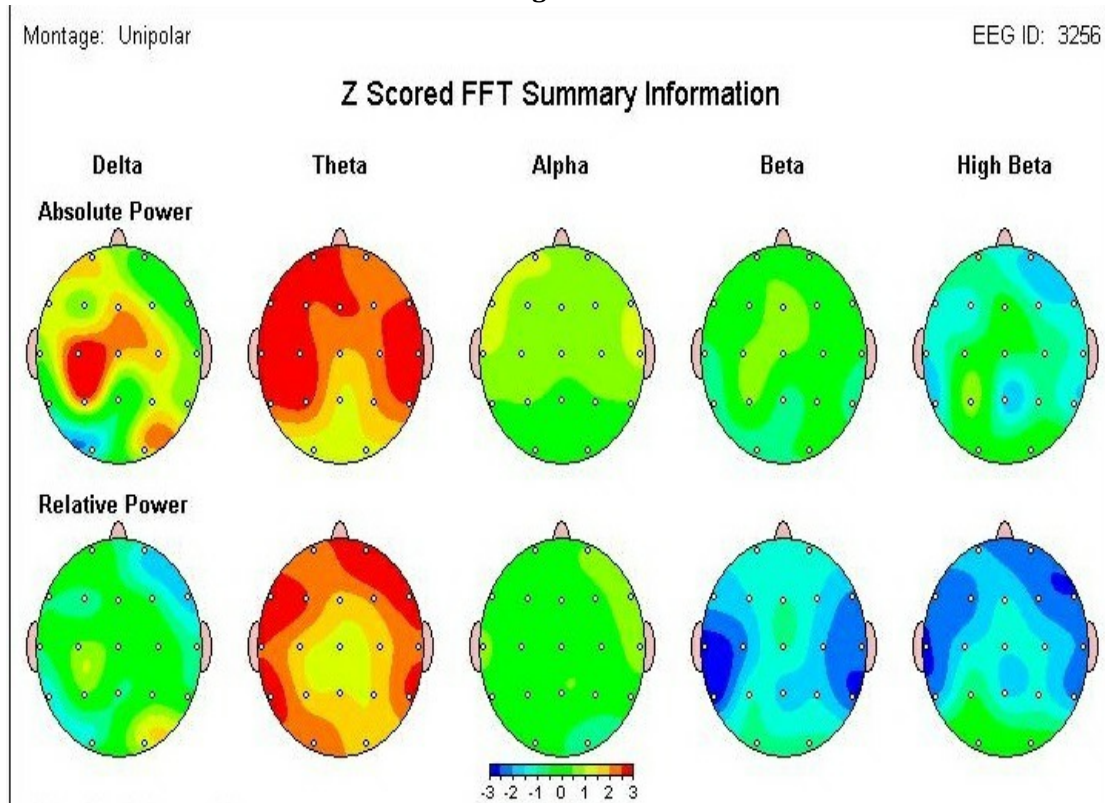
NueroMusic Therapy in MÜTEM adopts humanistic approach and assumes that there is innate ability of music of the patients. Music therapist sets free the patients in generating their own rhythm. And replies the rhythm with his instrument correspondingly. Subsequently, whole of the group joins the interaction. Musical replies of patients are analyzed in respect to their self actualization and their quest for meaning processes. Thus; the musical expression reveals the suppressed emotions via the facilitator effect of music.

Figure 2



Note. EGG records of GAD patient taken at the beginning of the music therapy intervention

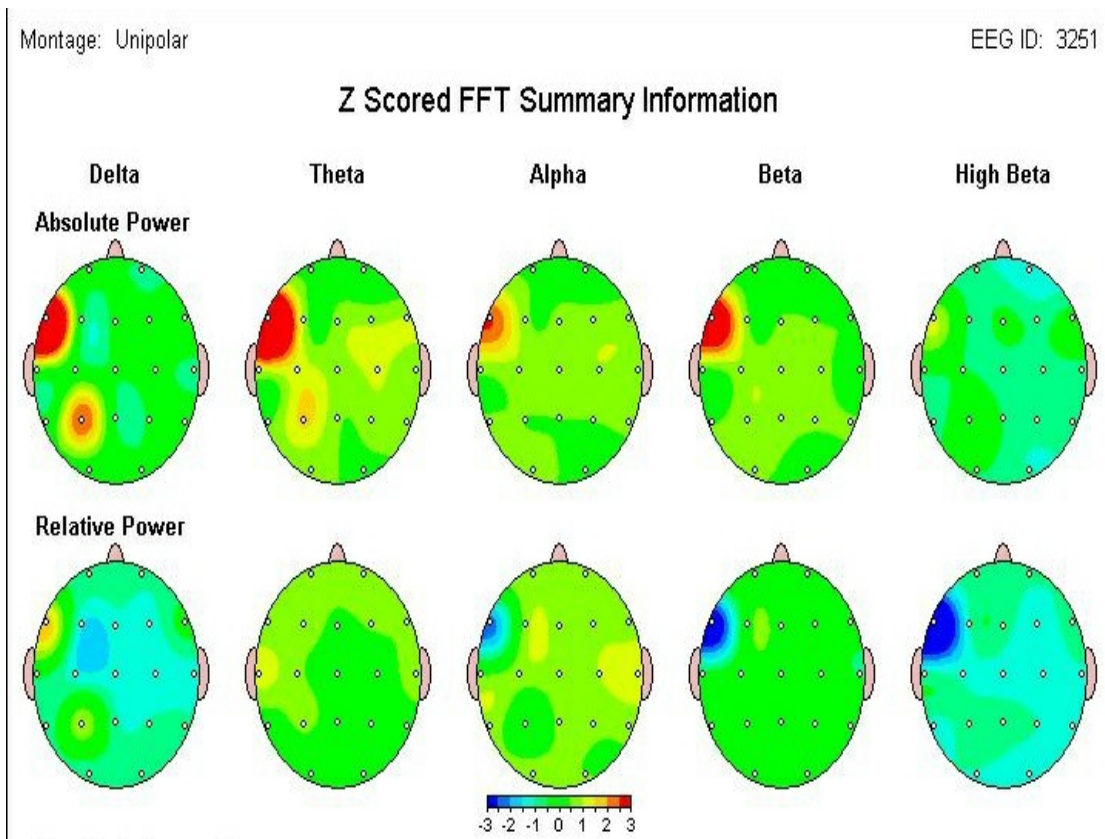
**Figure 3**



Note. EGG records of GAD patient taken after the music therapy intervention

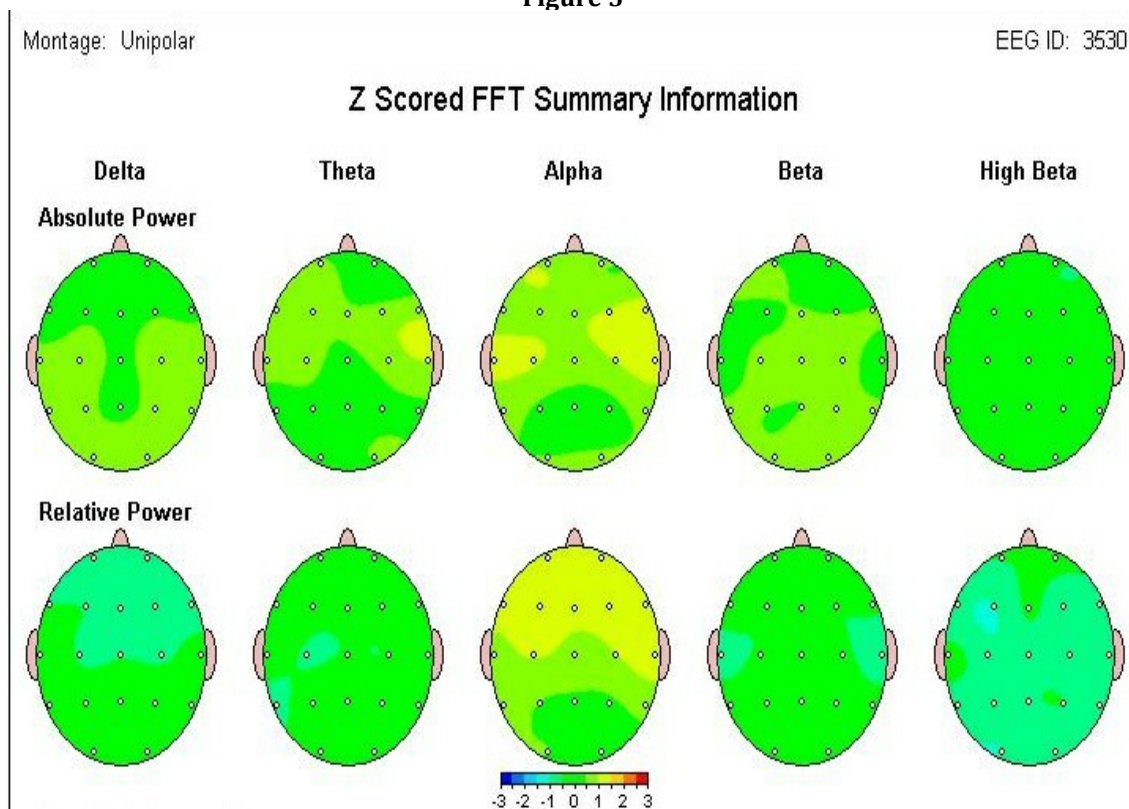
Another NeuroMusic Therapy research conducted in MUTEM reveals the results of theta, delta, beta waves decrease in left perital lobe Where the theta, delta, beta waves decreases are correlated to decrease n negative thoughts (patient; Gülşah T. ,2013).

**Figure 4**



Note. EGG records of depression patient taken at the beginning of the music therapy intervention

Figure 5



Note. EEG records of depression patient taken after the music therapy intervention

Music has such a huge impact on interpersonal relationships. It is a kind of a powerful incentive to bring people together in groups and networking. Even some mammalian species has its own distinctive emotional cries, they comfort or cheer their relatives. We do these voice modulation replaced music. Originally it existed in the form of emotional proto-language that did not have semantic content, but allows expressing feelings. Subsequently, about one hundred thousand years ago, people set proved to be more refined and pleasant to the ear music, in the service of their group cohesion. There are four main areas of music therapy for interpersonal relationships; emotional activation during verbal psychotherapy, development of interpersonal skills, communicative functions and abilities, regulating effect on psycho-vegetative processes, improving the aesthetic needs, emotional release, regulation of emotional state, improving awareness of one's own experiences, confrontation with life's problems, increase of social activity, acquisition of new means of emotional expression, facilitating the formation of new relationships and attitudes (Brusilovsky, 1979).

### Conclusion

From ancient times to current age music therapy has been used and has various beneficial contributions on disabled, elder people and children and other population. We are able to see the rehabilitation process or music therapy via neuroimaging technologies. In this case it is suggested that the most optimum music therapy procedures ought to be designed in the researches in stead of conducting researches on proving the existence of positive effects on music therapy. Since it is convinced that it really works.

**Uskudar University Music Therapy and Research Center (MUTEM)** is located in Istanbul, conducting researches and R&D in psychology, psychiatry, occupational therapy, art therapy, and neuroscience field.

### References

1. Agayeva, C. (2005). Vocational Aducation in The Field of Art Therapy
2. Agayeva, C.(2008). Psychology of Creative Activity
3. Agayeva, C. (2009) Psychology- Research Medhodoxy Problems
4. Asqarova, S.M. (1984). Music, The Essence of Psychological Teach Manners
5. Asqarova, SM. (1989). Music... Children... Imagination...
6. Asqarova, S.M. (1995). Psychological Readings
7. Asqarova, S.M. (1995). Training in Music Therapy
8. Asqarova, S.M. Scientific and Psychological Basis of Training
9. Archipova, O. V. (2009) Pesursnie napravleniya raboti v statsionarnix ucrejdeniyax sotsialnogo obslujivaniya
10. Bazanova, O.M., Shtark M.V. (2004) "Bio Optimization In Music Therapy" 2004, Journal of Russian Scientific Academy, 3, p.113.
11. Brusilovsky, L.S. (1979). MusicTtherapy / / Manual of Psychotherapy.
12. Bernatzky, G., Presch, M., Anderson, M., & Panksepp, J. (2011). Emotional foundations of music as a non-pharmacological pain management tool in modern medicine.
13. Bernatzky, G., Presch, M., Anderson, M., & Panksepp, J. (2011). Emotional foundations of music as a non-pharmacological pain management tool in modern medicine. Neuroscience & Biobehavioral Reviews, 35(9), 1989-1999.

14. Cervellin, G., & Lippi, G. (2011). From music-beat to heart-beat: a journey in the complex interactions between music, brain and heart. *European Journal of Internal Medicine*, 22(4), 371-374.
15. Castillo-Pérez, S., Gómez-Pérez, V., Velasco, M. C., Pérez-Campos, E., & Mayoral, M. A. (2010). Effects of music therapy on depression compared with psychotherapy. *The Arts in Psychotherapy*, 37(5), 387-390.
16. Grapp, M., Hutter, E., Argstatter, H., Plinkert, P. K., & Bolay, H. V. (2013). *Neuro-Music Therapy for Recent-Onset Tinnitus A Pilot Study*.
17. Guetin, S., Soua, B., Voiriot, G., Picot, M. C., & Hérisson, C. (2009). The effect of music therapy on mood and anxiety-depression: An observational study in institutionalised patients with traumatic brain injury. *Annals of physical and rehabilitation medicine*, 52(1), 30-40.
18. Hurkmans, J., de Bruijn, M., Boonstra, A. M., Jonkers, R., Bastiaanse, R., Arendzen, H., & Reinders-Messelink, H. A. (2012). Music in the treatment of neurological language and speech disorders: A systematic review. *Aphasiology*, 26(1), 1-19.
19. Jaušovec, N., Jaušovec, K., & Gerlič, I. (2006). The influence of Mozart's music on brain activity in the process of learning. *Clinical Neurophysiology*, 117(12), 2703-2714.
20. Lu J, Wu D, Yang H, Luo C, Li C, et al. (2012) Scale-Free Brain-Wave Music from Simultaneously EEG and fMRI Recordings. *PLoS ONE* 7(11): e49773. doi:10.1371/journal.pone.0049777,
21. Morgan, K. A., Harris, A. W., Luscombe, G., Tran, Y., Herkes, G., & Bartrop, R. W. (2010). The effect of music on brain wave functioning during an acute psychotic episode: A pilot study. *Psychiatry research*, 178(2), 446-448.
22. Thompson, W. F., Schellenberg, E. G., & Husain, G. (2001). Arousal, mood, and the Mozart effect. *Psychological science*, 12(3), 248-251.
23. Zavyalov, V.Y.. (1995). *Musical Relaxation Therapy: A Practical Guide*.