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The Central Role of Music in Our Life

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The fundamental attribute of music to our life: Our life without music is unthinkable. Not only is it among the main entertaining means since humans gathered in caves, the need for music evidently had intensified to almost total control on our living habits. People listen to music when relaxing at home, when driving on the highway, while socializing, and during customary rituals. Such intensive consumption, observed as well at the most remote human tribes, clearly demonstrates the importance of music and its contribution to our daily as well as spiritual activities. Together with the vast variation of music types, its central place in human's life raises questions about how our cognition is affected and why people relate so differently to various music types: While certain music may excite the audience, other people may feel irritated, pinpointing to differences in music perception and mental processing. Although feelings of preserving memories and sensations, and although these brain centers (or regions) have been mapped, and shown to be manipulated by changes in concentrations of various chemical effectors (e.g., hormones), the underlying molecular processes associated with changes of feelings such as pleasure, satisfaction, excitement, but also hatred, envy, sadness or anxiety, are still unclear. In addition, the basis of differences among various levels of good feelings (just good versus extremely good even happy), or various levels of sadness (just sad versus deep anxiety), and how are they affected by the various concentrations of brain chemicals, still remains to be described. The question in this respect is how do we distinguish, actually, how does our brain perceive and respond among the enormous spectrum of feelings or nuisances.

Another enigmatic issue is the vast difference among people in music preferences. While most people enjoy familiar music (usually memorized in their brain), they may often enjoy music that they have never heard before, raising the question how the brain categorizes a certain piece of music as good or bad. A simple answer that associates harmonious sounds with pleasure does not provide a satisfactory answer, as is clear from people enjoying other music types including sounds that seem disharmonious to ears of the older generation (e.g., certain genre of Jazz, or noisy metal music types that lack a catchy melody). Thus far, attempts to enlighten neuronal regions involved in music perception have shown that almost the entire brain was activated, particularly centers in the limbic system that controls emotions, memories, motivation, and motor activity. Numerous positive effects of music on cognition, behavior, health, socializing skills, and physical abilities have been described (ref. 1), but there are also negative effects such as increase of sadness, depression, fear and aggression, that could perhaps result from activation of neuronal connectivity associated with previous unpleasant memories, bad experience, evil scenarios, but also embedded traits of viciousness and cruelty (ref. 2). Despite such problems, and in contrary to the development of many human traits due to survival needs, the brain attraction to harmonious sounds, as well as certain rhythms (e.g.,

drumming that automatically triggers our motion) seems like built-in needs, but why? or in other words, at what stage of development had this responsive behavior influenced our evolution? Although the effects of music often depend on the background of the listeners (e.g., education, ethnicity, age, and familial and national habits), it is well accepted that music may function as a universal language, in entertainment, and as means of socializing. Live music is particularly effective due to the need of the players to coordinate and cooperate. When such coordination is successful, the brains of both, players and listeners, emits endorphins, which raise pleasure and together with the hormone oxytocin (a hypothalamic peptide produced and released by the posterior pituitary gland) generates feelings of togetherness and stronger social bonding. Since every culture in the world has some kind of musical traditions, besides the personal entertaining facet, music is an important means in cultural habits, national formalities, as well as historical events.

Extensive research of the effects of classical music revealed a number of chemical effectors involved in the stimulation of positive feelings, pleasure and relaxation, (ref. 1) such as increase in brain concentrations of the neuronal messenger dopamine (derivative of the amino acid tyrosine). Increase in its brain levels was found to correlate with feelings of satisfaction, reward, and motivation, similarly to the feelings stimulated when enjoying a good meal, sex, or any other pleasant activity; Another brain transmitter involved in music perception is serotonin (monoamine compound) that may enhance relaxation and pleasure, particularly in response to gentle classical music; Oxytocin, called also the 'love hormone', stimulates feelings of communications and faith; Endorphins (short peptides capable of binding to opioid receptors in the brain and in the spinal cord) are known for their relaxation effects as well as being natural pain killers; Gamma-aminobutyric acid (GABA; an inhibitory neurotransmitter) reduces neuronal activity associated with pressure and anxiety, thus supporting calmness, similarly to the effects of low concentrations of cortisol (steroidal hormone produced by the adrenal gland), named also the "stress hormone"; Norepinephrine and Adrenalin (neurotransmitters), that raise alertness and emotional arousal, affect particularly in response to exciting music. Overall, listening to classical music has shown also improvement in neuronal connectivity related to memorizing, concentrating and creativity, raising the term 'Mozart Effect' (improving cognitive abilities mostly in infants; ref. 3), which a few years later was suggested to be almost fake (ref. 4). Thus, in the lack of particular explanation of the molecular mechanism involved, listening to classical music has been proven to develop exciting, as well as relaxing and pleasant feelings due to the effect of various secreted chemical effectors.

The toti-potential effect of music: Music affects human brain in multiple ways, most of which are positive. Besides of being a major entertaining means, it may assist in communication and delivery of emotions and in reduction of bad mood even anxiety. In addition to its pleasurable effect, music is a cultural outlet of creativity and adds much to the beauty of visual presentations and natural sight-seeing. Music may improve our frame of mind and health particularly at older ages for relaxation and overcoming loneliness. The positive effects of music are proven as well in reducing blood pressure and pain in old people, as well as supporting sleep quality or mental alertness. Furthermore, music has shown to positively affect learning skills by generating a pleasant background in a large variety of circumstances (e.g., while reading, studying, eating, relaxing, socializing). Music is often being associated with memories particularly of pleasant experience. The positive influence of music is definitely obvious when learning to play an

instrument as it improves memorization and develops discipline-requiring skills, even raising a child's IQ, confidence, and self-esteem. Additional aspect of music effects is its therapeutic potential by improvement of emotional communication, stress relief, and reduced depression and anxiety, and particularly important in patients suffering from cognitive deterioration, such as Dementia, Alzheimer, and Parkinson, as well as in cases of neurobehavioral disorders like ASD (Autism), ADHD (Attention Deficit Hyperactive Disorder), and DCD (Development Coordination Disorder). Favorable music improves recovery after surgery or physical training. Music also helps to relax prior to getting to bed, or in the morning by increasing the concentrations of various brain hormones.

Despite the large variety of positive effects, some music types, or exaggerated loudness, may stimulate unpleasant feelings and irritation. Studies of such effects have shown increase in stress hormones (e.g., elevated concentrations of cortisol, adrenaline, and noradrenaline) concomitant to elevated blood pressure and heart rate. Astoundingly, music was also used as a weapon: loud, piercing tones (Scottish soldiers with bagpipes, or American Cavalry with trumpets). Besides using these instruments for signalized commands, the loud tones frightened the enemies and encouraged the defending soldiers. Overall, music may have a diverse effect: On the one hand it may sound beautiful to the majority of listeners, while under certain circumstances it may stimulate negative or even depressive feelings (e.g., at funerals or memorials, or negative rumination) leading to increase in the concentration of prolactin (a 199 amino acid peptide secreted by the pituitary gland at the base of the brain), and demonstrating how music perception depends on the mood, age, and readiness of the audience to listen. Albinoni's Adagio may be an example of beautiful music that evokes negative feelings if played under sad circumstances.

Personal experience of music-assisted recovery from anxiety: Listening to music is a major delight for most people, whereas deprivation from music is usually a symptom of depression, lack of happiness, deliberated isolation or elimination under pressure (e.g., during a war or arrest). Following the consequences of the Corona viral pandemic, and war in the Middle East (that still continues) my mood dropped to a level where my pleasure of listening to classical music declined tremendously. However, restoration from this apathy and bad mood occurred twenty months later, thanks to one of the greatest composers, Antonine Dvořák. Accidental listening to his masterpiece 'The New World' (9th symphony), while watching the Gimnazija Kranj Great Christmas concert 2018 playing under the conduction of Nejc Bečan was so overwhelming, that I felt as if the door to the magic world of pleasurable music opened again. Meticulous listening to the symphony (crafted during his 1892-1895 visit to the US) enabled me to identify once again with Dvořák's emotions and wondering from nature expressed so nicely in his music. Curiously about my own excitement, I wondered how much of it was due to watching the players, or was it the music per se that impressed me so much. For that I compared my musical satisfaction by listening to several orchestras, playing various music types, with and without watching the players and the conductors. Importantly, I have realized that watching the players contributed much to my pleasure. Then I examined my satisfaction by comparing numerous orchestras playing Beethoven's 6th symphony (Pastoral). Not only that this comparison convinced me once again that listening while watching the players (concentrating on their contribution and enjoying their part) excited me mostly, I was particularly attracted with the execution of Beethoven's symphony by the young Proms orchestra conducted by

Daniel Barenboim in 2012. Although the music played by the Berliner Philharmonic was perfect (as always), the older players lacked the performing spirit and atmosphere produced by the younger orchestra. Notably, and due to my curiosity, I listened to the first part of the 6th symphony played by the Teheran Symphony composed mostly of young women, whose playing skills were acceptable, but less attractive, possibly due to their religious appearance and overall fawning interaction with the young conductor. This experimental experience corroborated my conclusion that the pleasure of listening to classical music can intensify by watching young, perfect players enjoying their performance under a passionate conductor. In light of these emotional conclusions I changed the saying "Thank Goodness its Friday" to "Thank Goodness for the MUSIC".

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