

Cognitive Function of Music and Meaning-Making

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Abstract

This publication also contains a detailed review of extensive studies if involvement with music improves performance in other disciplines; though this topic is not a primary subject of this paper. Here we explore the mechanism of how music influences cognition. The main novel contribution of this paper is that music helps to overcome cognitive dissonance. The referenced publication has discussed in details that the cognitive dissonance have been actually involved.

Introduction

Biomusical engineering would benefit from knowing cognitive function of music, its role in balancing complexity of emotional states. Much has been understood recently about the mind mechanisms of music perception. A number of publications have reviewed these topics, including [1-5]. But despite significant effort the fundamental questions about music: why does music so strongly affect us? Does it have a fundamental cognitive function? What is this function? -these question still remain without answer [1,2,5,6-10].

These questions are not new [11] considered the power of music among the unsolved problems alongside the existence of God and finiteness of the world, "why music being just sounds reminds states of soul." [12] wrote that the musical ability "must be ranked amongst the most mysterious with which (man) is endowed." Why indeed an ability to enjoy sounds emerged in evolution. Music is present in all societies all around the globe. Clearly music serves some tremendously important function. What is this function? Many hypotheses have been proposed for various social use of music, but as exhaustively discussed by [13], none of these even touched on why music (just sounds!) turned so important.

Here I discuss a hypothesis that music serves a concrete cognitive function of tremendous importance for human psyche, a function related to making meaning of human life and tremendously important to musical therapeutic use and value [7,8,14]. This function of unifying human cognition is closely related to overcoming cognitive dissonances, unpleasant emotions experienced due to contradictions in knowledge [15,16]. This hypothesis has been experimentally confirmed [17] as discussed later.

A theory of cognitive dissonance is considered among significant achievements in social psychology of the 20th century [18]. Recently it has been discussed that overcoming cognitive dissonances has been essential for cultural evolution, including evolution of language [19]. The reason for this is that language creates a multiplicity of new knowledge. Knowledge contained in every new word contradicts to previous knowledge [19]. These contradictions create a multiplicity of cognitive dissonances, unpleasant emotional feelings. It is known that these contradictions are resolved fast by discounting new knowledge. Therefore evolution of language millions of years ago had to overcome cognitive dissonances, otherwise evolution of language and cultures could not proceed [14,9,3,19]. Overcoming these dissonances has been and still remains fundamental for evolution of languages and cultures.

Vocalizations of pre-human animals convey semantic and emotional contents without separating them. Vocal muscles are governed from ancient emotional neural center in the limbic system. Initially music and language were one [14]. Due to a slow pace of natural evolution

animals do not experience cognitive dissonances. Evolution of language required rewiring of human brain, new emotional centers in cortex emerged which partially kept vocalization under voluntary control. But our ancestors had to pay a high price for this new ability. Psyche of our ancestors was not any longer whole. Words introduced new knowledge, contradicting to instincts and to old knowledge. As mentioned above these led to cognitive dissonances. If a new ability helping to overcome cognitive dissonances did not evolve, language and culture were stopped in their tracks. This ability enabling culture was music [14,9,3,19-22].

Music helped unify human psyche split by language. It helped create meanings out of disconnected pieces of knowledge. This hypotheses received some preliminary experimental support. In a classical cognitive dissonance experiment [23] children devalued a toy if they cannot play with it. Desire 'to have' contradicts the inability 'to attain'; this creates cognitive dissonance, which is resolved by discarding a contradiction. This experiment is classical for cognitive dissonance theory and it has been repeated many times [24] The first time discarding a contradiction has been described 2500 years ago by Aesop: the fox unable to attain the grape devalues a contradictory cognition, "the grape is sour." [25,17] have reproduced the above experiment with music in background and, according to the hypothesis in this article, observed that the toy is not devalued; music has helped children to overcome the cognitive dissonance.

Another experiment demonstrated that academic test performance may improve while listening to music [26]. demonstrated (1) that students allocate *less* time to more difficult and stressful tests (as expected from cognitive dissonance theory), and (2) with music in background students can tolerate stress, allocate more time to stressful tests, and grades improve. It may follow that "Mozart effect" is not at all the long debunked unscientific idea [27] instead there is a real effect of the appropriate music that may be related to overcoming cognitive dissonances.

Still other experiment [28] has demonstrated that taking music lessons improves grades in all subjects. These experiments have

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confirmed the hypothesis in this paper that music helps overcoming cognitive dissonances and therefore helps learning.

This explains another fundamental mystery about music, why it affects us so strongly? Over the course of cultural evolution music have influenced development of many emotions helping to overcome cognitive dissonances. This process continues incessantly, the essence of cultural evolution is accumulating diverse knowledge with much contradictions, which continuously creates cognitive dissonances. It is possible that overcoming stresses from these cognitive dissonances limits the speed of cultural evolution (which “could have been” much faster otherwise). We live in constant stresses from contradictions in knowledge. Music helps alleviating these stresses and this is the reason it affects us so strongly. A significant part of music (including much of popular music) helps overcoming contradictions familiar to many of us, contradictions related to unrequited love, betrayals by friends and loved ones. It also explains often mysterious reasons why so many people enjoy sad music such as *Adagio* by Barber, which is impossible to listen without tears. The reason is that this music helps to overcome the highest cognitive dissonance between a hope for eternal existence and knowledge of our finiteness in the material world.

Many thousands of experiments have been conducted to confirm and further explore the theory of cognitive dissonance. Similarly thousands of experiments can be conducted in future to further explore the proposed hypothesis. Two experiments described in this paper and confirming the proposed hypothesis is but a first step toward this new direction in science.

Another fundamental unresolved question about music is a number and diversity of musical emotions. Among distinguished musicologists some insist that musical emotions are few and no different from everyday emotions [29], other insists that there are dozens of specifically musical emotions [30]. A hypothesis advanced here implies that there are as many musical emotions as cognitive dissonances, on the order of a number of combinations of words and phrases, at least, many thousands [14,20]. There are no words for these emotions, and measuring these emotions is an unsolved mystery [31,4].

The hypothesis proposed here implies that music might have been fundamental for overcoming cognitive dissonances throughout cultural evolution. Details of this implication along with correlations of historical changes in musical styles with changes in dominating cultural, philosophical, and spiritual views on humans and the world is discussed in [20]. This opens a whole new direction of research from cultural evolution to individual composers, and could be an interesting and important direction for future research.

Extending these ideas to non-western cultures, e.g. to Chinese and Indian cultures with long and rich musical and cultural traditions, is another direction for future research.

Cognitive dissonances play important role in many psychic disabilities. It is known that music is often helpful. Possibly theoretical view explaining the role of music in overcoming cognitive dissonances can help engineering more powerful music intervention methods. This represents another direction for future research and development.

I would add that the idea discussed here that music emerged for unifying split consciousness and for overcoming cognitive dissonances is the only theory of the music origin and evolution leading to unexpected experimentally verified predictions. Experimentally confirmed predictions are fundamental for science from Newton to Einstein.

In summary, it is likely that music emerged and evolved for a fundamental cognitive function: music makes possible accumulation of knowledge and human evolution; music unifies cognition split by language, and participates in creating the “highest” meaning [32,33].

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