Musicians Outperform Nonmusicians in Speech Imitation

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Abstract. Recently can be observed a growing interest in the effects of music on humans. Music has been called a food or a multi-sensory fitness of the brain. Many studies have already confirmed that practice and active involvement in music improve spatio-temporal functions, verbal memory, visuo-spatial abilities, reading, self-esteem, and generally cognitive processes. In the present paper, a general overview of research on the influence of music on humans has been provided. Moreover, it has been presented data on a research project, which was conducted with the aim to examine whether music education may be viewed as one of the factors, that improve second language acquisition.

Keywords: musicianship, musical abilities, foreign language acquisition, speech perception, auditory functions, cognition.

1 General Characteristics of Music Education

The faculty of music is, in a sense, unique to humans. Humans are the only creatures who have developed notation, who compose music, and who are able to learn to play and sing music as well as play instruments in a group. All activities in the music faculty – e.g. music performance, playing an instrument, singing, composing, etc. – are very demanding, requiring sophisticated abilities and skills whose attainment demands conscious and goal-directed practice.

Music education and training engages all human senses and involves all cognitive processes (sensory, perceptual and cognitive learning, memory, emotion, etc.), but it also requires motor activation (utilized while playing an instrument) and appropriate articulation (utilized while singing or playing).

1.1 Influence of Music on Humans – Musicians Versus Nonmusicians

While it is well documented that the human brain is a dynamic rather than a stable system, there are still relatively few data answering the question of whether the plasticity of neural circuits is accompanied by changes in behaviour [19].

Several factors may influence neural circuits and one of those factors seems to be music education and training, which alters the organization of the auditory and somatosensory cortices in people active in music domain. Research that conceives of music

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as an important medium for understanding the human cognitive processes and development, as well as the human brain, is relatively new.

The topic gained more attention after the study done by Bever and Chiarello in 1974 [3], in which they examined the patterns of cerebral dominance among musicians and nonmusicians and found that intensive musical training resulted in the modification of hemispheric lateralization during music processing. After the study, the traditional view of a hemispheric dichotomy in which music was processed in the right hemisphere and language in the left could not be maintained, as there was evidence that professional musicians processed music in the left hemisphere and nonmusicians processed it in the right hemisphere.

Most of the work in this field has been done in the last ten years. According to many investigators, the human brain is both functionally and structurally adaptable to environmental stimuli, as well as to different kinds of requirements and even injury-related impairments. One of the most vital topics is the question of how musicians' brains differ from the brains of nonmusicians. Several studies have reported that there is generally a high degree of plasticity in the brains of trained musicians. Several of the most recent studies reveal that the brains of musicians and nonmusicians differ in terms of function and structure/anatomy.

Some functional differences have been observed by Ohnishi and co-workers, who found that there is "a distinct cerebral activity pattern in the auditory association areas and prefrontal cortex of trained musicians" [17].

In a detailed discussion of the structural and functional brain differences between musicians and nonmusicians, Schlaug enumerated several anatomical adaptations. He reported differences in the corpus callosum that had been observed by himself and his co-workers in a study, which revealed that the anterior half of the corpus callosum was significantly larger in musicians. This difference was particularly noticeable when contrasting musicians who started training early (<7 years old) with musicians who started music lessons late (>7 years); however, the difference between the brain structures of musicians and nonmusicians was still more significant.

Schlaug also mentioned that there was greater symmetry in the intrasulcal length of the posterior bank of the precentral gyrus in musicians [25], and thus there were differences in the motor cortices of musicians and nonmusicians. Schlaug also cited studies whose results suggested "microstructural adaptations in the human cerebellum in response to early commencement and continual practice of complicated bimanual finger sequences" [25].

These results were posited to suggest that there might be differences between musicians and nonmusicians that were indeed the result of microstructural changes caused by long-term motor activity and motor skill acquisition. Schlaug also provided evidence of regional differences in gray matter volume between musicians and nonmusicians. More specifically, "professional musicians showed higher gray matter concentrations compared to nonmusicians in the perirolandic region, the premotor region, the posterior superior parietal region, the posterior mesial perisylvian region bilaterally, and the cerebellum" [25].[1]

[1] "The superior parietal cortex does play an important role in music performance, since it may serve to integrate of visual and auditory information with motor planning activities" [25].