

EDITORIAL

MUSIC LISTENING AND MUSIC MAKING IN THE TREATMENT OF NEUROLOGICAL DISORDERS AND IMPAIRMENTS

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Emerging research over the last decade has shown that long-term music training and associated sensorimotor skill learning can be a strong stimulant for neuroplastic changes in the developing as well as in the adult brain, affecting both white and gray matter as well as fore-brain and hindbrain structures. Making music, including singing and dancing, leads to a strong coupling of perception and action mediated by sensory, motor, and multimodal brain regions. Music making also affects important sound relay stations in the brainstem and thalamus either in a top-down or bottom-up fashion. Furthermore, listening to music and making music provokes motions and emotions, increases between-subject communications and interactions, and is experienced as a joyous, pleasurable, and rewarding activity through activity changes in the amygdala, ventral striatum (i.e., nucleus accumbens), and other components of the limbic system.

These new insights from brain research using music listening and music making experiments have changed our understanding of how music can be used in rehabilitation and how to incorporate music into therapies that are geared towards retraining and rewiring an injured brain. Neurologically based approaches to music therapy techniques are now emerging and are being implemented in well-designed studies. Music makes rehabilitation not only more enjoyable, but also can provide an alternative entry point into a “broken” brain system, and can remediate impaired neural processes or neural connections by engaging and linking brain centers that might otherwise not be linked together. Why is music so special and how does music

listening and music making achieve rehabilitative effects? Music is a strong multimodal stimulus that simultaneously transmits visual, auditory, and motoric information to a specialized brain network consisting of fronto-temporo-parietal regions whose components are also part of the putative human mirror neuron system. Among other functions, this network of brain regions might support the coupling between perceptual events (visual or auditory) and motor actions (leg, arm/hand, or vocal/articulatory actions). In this context one can think of music also as a cognitive brain language. As such, it may couple perception and cognition and enhance attention, memory, and executive control. Music might represent a special vehicle that allows us to engage components of this mirror neuron system while affecting the pleasure and reward systems in the brain at the same time.

Music-based experimental interventions similar to other experimental interventions need to be grounded on a neurobiological understanding of how and why particular brain systems could be affected and the efficacy of these experimental interventions should be assessed quantitatively and in an unbiased way as one would require with any other experimental intervention. This special issue of *Music Perception* was planned to highlight, review, and present new evidence of the special role that music listening and music making has in the treatment of various neurological disorders and impairments. Although we were not able to discuss every possible intervention or disorder, we intended to provide a broad cross-section of neurological disorders for which there already is some evidence that music listening and music making has a beneficial effect in case series, open-label treatment studies, or even randomized clinical trials. A neuroscientific basis for music-based interventions and data derived from randomized clinical trials are important components in establishing and further guiding neurologically and neurobiologically based music therapies that might have the power to enhance brain recovery processes, ameliorate the effects of developmental brain disorders, and facilitate neuroplasticity in general.

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