Part VI Introduction

Listening to and Making Music Facilitates Brain Recovery Processes

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Emerging research over the last decade has shown that long-term music training and skill learning can be a strong stimulator for neuroplastic changes in the developing as well as adult brain. Making music places unique demands on the nervous system, leading to strong coupling of perception and action mediated by sensory, motor, and multimodal integrative regions distributed throughout the brain. Furthermore, listening to music and making music ("musicking") provokes motion, improves and increases between-subject communication and interaction, and is considered to be and experienced as a joyous and rewarding activity.

Several reports in this volume have now shown that listening to music and musicking may have the power to make rehabilitation processes not only more enjoyable, but also possibly more effective. Why is music so special and how does listening to and making music achieve its rehabilitative effects? Music is a strong multimodal stimulus that simultaneously transmits visual, auditory, and motoric information to a specialized brain network consisting of frontotemporo-parietal regions whose components are also part of the putative human mirror-neuron system. Among other functions, this system might support the coupling between perceptual events (visual or auditory) and motor actions (leg, arm/hand, or vocal/articulatory actions). Music might be a special vehicle to engage components of this mirror-neuron system. Furthermore, music might also provide an alternative entry point into a "broken" brain system to remediate impaired neural processes or neural connections by engaging and linking up brain centers that would otherwise not be engaged or linked with each other.

The chapters in this section will demonstrate several music-based experimental interventions whose effectiveness in clinical populations is demonstrated and whose underlying neurobiological mechanisms are being examined. These neurologically based music therapies are grounded in specific effects on brain networks involved in listening to and making music and on the effects of music on emotion, perception-action mediation, and social cognition networks. Using an instrument or using one's own voice alone or within a group involves, in a unique way, a feed-forward and feedback circuit in the brain that connects sensory and motor regions. Training-induced and use-dependent plastic changes within the nodal points of these networks and in the fiber bundles connecting these regions might underlie effects that outlast the duration of the actual intervention. Nevertheless, the gold standard of proving the efficacy of an intervention will be a randomized clinical trial (RCT), in which participants are randomly assigned and a new music-based intervention is tested against a gold standard or an established intervention. Having a scientific basis for the interventions and obtaining

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evidence from RCTs are the most important steps in establishing neurologically based music therapies as accepted interventions.

Thus, listening to and making music, including singing, if used appropriately and based on a neurobiological understanding of how music is processed in the brain and what brain regions are active in music making ("musicking"), can serve as a powerful and engaging treatment modality that can enhance brain recovery processes and neuroplasticity in general as shown in the following chapters.