

*Editorial***Music, Music Therapy and Trauma****Stephen W. Porges^{1,2,3}, Andrew Rosetti⁴**¹*Indiana University Bloomington, Indiana, United States of America*²*University of North Carolina at Chapel Hill, North Carolina, United States of America*³*University of Illinois at Chicago, United States of America*⁴*Louis Armstrong Center for Music and Medicine, Mount Sinai Medical Center, New York City, United States of America*

This special issue of 'Music and Medicine' entitled 'Music, Music Therapy and Trauma' highlights the important role that music therapy may play in the treatment of trauma-related disorders. As illustrated in the following articles, music therapy contributes a powerful component to successful treatment by helping those who have been effected by trauma to navigate from chronic states of defense to more regulated states with the capacity to self-regulate and to connect with others. These clinical observations are consistent with the history of humanity, throughout which music has been used to soothe and calm young children and those suffering from pain and illness.

Implicit in the therapeutic applications of music has been the assumption that music has a direct effect on the human mind and body and can efficiently shift physiological and mental state to promote health, growth, and restoration. Thus, music may functionally 'retune' our nervous system's capacity to regulate visceral organs, shift mood states, and optimize social behavior, trust, and connectedness. Music therapists, especially those working with survivors of trauma and children coming from families at-risk for abuse, frequently report the prosocial influences of music.^{1,2,3,4} Functionally, these observations would reflect a reduction or inhibition of the mobilized defensive behaviors (e.g., rage, tantrums, etc.) that disrupt healing and restorative processes.

Contemporary neuroscience provides theories, methods, and testable hypotheses to document the positive impact of music on the homeostatic functions upon which mental and physical health depend. It is now possible to conduct research that could document music-related shifts in autonomic state. Based on the Polyvagal Theory^{5,6,7} the physiological mechanisms through which music soothes and calms can be explained. The theory directs research to test hypotheses that link music to a down-regulation of the sympathetic nervous system involved in mobilization behaviors (e.g., fight/flight) and an up-regulation of a component of the parasympathetic

nervous system (i.e., ventral vagal complex) that fosters the spontaneous social engagement behaviors involved in co-regulation and optimizes homeostatic processes.

Ancient traditions have used sounds as agents of healing, and researched-based music therapy can be seen as a logical continuation of these practices. Perhaps, the most ubiquitous and obvious application of music, as an agent of nurturance, is the instinctive vocalizations of mothers and fathers when their infants are distressed. When mothers and fathers use their voice to engage and calm their infants, they reflexively raise the pitch of their voice and expand the range of intonations^{8,9}. This seemingly unlearned strategy has been labeled as infant-directed speech or 'motherese.' Perhaps, as these maternal intonations became culturally structured, the primitive musical compositions that we call lullabies evolved¹⁰. Lullabies, when improvised by parents often contain elements of infant-directed singing¹¹, and as such, have features that may vary depending on culture, but may include an exaggerated range of intonation, simple pitch contours, and a center or predominant pitch that unambiguously reflects the vocal range of a female (even when sung by a male)¹². When contrasted with typical speech, both infant-directed speech and singing employ greater modulation within a frequency band emphasizing positive social communication that is outside the frequencies used to convey life threat (i.e., very low frequencies) or danger (i.e., high frequencies).

When vocalizations convey positive emotional states related to trust, love, and support, a similar range of frequencies is used with a more restricted degree of intonation modulation. It is important to note that a lack of prosody is one of the vocal characteristics frequently observed in survivors of trauma and children who either a diagnosis of a developmental disorder (e.g., autism, Fragile X syndrome, Prader Willi Syndrome) or who have behavioral regulation problems and developmental delays (e.g., language delays).

Prosody is the term used to describe the emotional tone embedded in speech through the modulation of vocal intonations. If we think of infant-directed speech as exaggerated prosody, then lullabies and vocal music can be conceptualized or even operationalized as extremely exaggerated prosody or hyper-prosodic vocalizations.^{13, 14} Thus, there appears to be a continuum of intonation modulation as the acoustic features of vocalizations shift from

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positive social engagement, to infant-directed speech, and to infant-directed song and vocal music. This continuum helps explain the efficiency of music as a treatment modality in conveying cues of safety and trust to a 'prewired' neurobiological portal that evolved to detect conspecifics, which were safe to approach (see Polyvagal below).

The acoustic features of lullabies and the emotional impact of the lullaby on the infant provide insights into how listening to music can contribute to the healing journey of those who have been traumatized including children exposed to physical and emotional abuse. Using lullabies¹⁵ as a model, Polyvagal Theory provides a plausible explanation of how music therapy may work. According to the theory, based on the physics of middle ear structures, all mammals have a species-specific bandwidth in which the acoustic signals are optimized. This frequency band has been labeled 'the frequency band of perceptual advantage (6, 7). The primary cues of social communication occur within this band and their detection is optimized when individuals are in safe contexts and is compromised during physiological states that support defense.

The frequency band of perceptual advantage can be recruited when the individual is exposed to modulated intonations within the band. Infant-directed singing such as lullabies, provide efficient and potent vocal stimulation by modulating intonations within this band. The theory also explains how the recruitment of the neural mechanisms involved in optimizing the processing of acoustic information within the frequency band of perceptual advantage functions as a 'neural exercise' of an integrated social engagement system. Listening to the hyper-prosodic vocalizations that constitute melodies in both vocal and instrumental music provides an efficient mode of exercising and optimizing the functions of the social engagement system. As this system is exercised, there is improved regulation of both the muscles of the face and head involved in the communication of emotional state (i.e., facial expressions and vocal intonations) and autonomic state through vagal pathways resulting in calmer and more resilient behavior.

Polyvagal Theory provides a lens to understand the impact of trauma and chronic stress on the social engagement system. Trauma and chronic stress turn off the social engagement system with consequences to both mental and physical health. These consequences 'retune' the nervous system from being spontaneously trusting with a capacity to co-regulate to being hypervigilant and defensive. However, as a species, we evolved with an accessible portal that has the potential to reverse these disruptive effects by conveying cues of safety and trust. Listening to music targets this portal and provides an efficient vehicle to 'retune' and rehabilitate our nervous system and to support the healing journey following trauma-related disorders. The papers that follow provide poignant examples of the power of music, and music therapy in supporting processes of recovery, and further document the

unique and important contribution of music in the treatment of trauma and stress-related disorders.

In the first article of this thematic volume of Music & Medicine, Stephen Porges, Katherine E. Bono, Mary Anne Ullery, Olga Bazhenova, Andreina Castillo, Elgiz Bal, and Keith Scott provide a clinical study from this issue's co-editor, Dr. Stephen Porges in *Listening to Music Improves Language Skills in Children Prenatally Exposed to Cocaine*. Porges is the author of the paradigmatic Polyvagal Theory. Few mental healthcare professionals would dispute this theory's impact and reach, and how it informs and is vital to understanding trauma and its treatment. While not addressing trauma directly, this study looks at a population and environment typically at risk for developmental or complex traumas. Porges underscores the importance of environmental factors as opposed to teratogenic agents, and how those factors may produce the chronic hypervigilance that are often a marker of the failed attachment that may engender emotional trauma. A staunch advocate of music's use in clinical contexts, his study interestingly compares two active arms of music intervention: the first with a filtered music group that listened to vocal music filtered to emphasize frequencies within the bandwidth of spontaneous human speech, an unfiltered music group that listened to the same vocal music in its original unaltered form, and a control group that only received the standard early intervention services provided by the preschool. Polyvagal Theory provides a model to explain how listening to music might have a positive impact on children with language delays, listening impairments, and/or auditory hypersensitivities. The next piece *All Roads Lead to Where I Stand: A Veteran Case Review* by Kristen Stewart give us an in depth illustration of music therapy as an integral part of treating PTSD within the sensate and physiological domains in veterans. Increasingly there is a movement of music therapists' adapting and incorporating music based interventions in current models and paradigms of trauma treatment formulated by leading figures from the fields of psychiatry, psychology, and neuroscience. Stewart explores models, the challenges of working with fragile clients within a complex system, and presents a compelling case study of one veteran's journey through PTSD and music therapy. Mary Coughlin-McNeil's *Trauma Informed Care in the NICU: Implications for Parents and Staff* is an informative commentary that reinforces the viewpoint that trauma not only affects one's ability to cope but alters their biology as well. Coughlin examines the presence of trauma on the NICU from an interesting perspective; not from that of the obvious medically induced trauma suffered by neonates in the NICU, but from the implications of the unaddressed acute and repeated exposure of parents and staff to stressors. She provides insight on just how damaging unmitigated stressors can be, not only to parents and staff, but neonates themselves regarding its impact on reduction of allostatic load and avoidance of re-traumatization of neonates.

Following from her initial article on moral injury, Torrey Gimpel expands upon this recent concept and transgressive events in this issue's second article exploring music therapy's role in trauma and PTSD in combat veterans --in *Moral Injury and Music Therapy: Music as a Vehicle for Access*

Perhaps one of the most difficult aspects of working with one's own trauma is to not only disclose it in a public forum, but also to write about it. David Abbott provides profound aspects of his personal experience with trauma and offers readers unique insights about how music therapeutically served him in his most difficult hour and beyond. His article *Trauma Disability and the Development of the Wounded Healer Identity: A Music Therapist's Personal Perspective* is indeed a gift to patients, caregivers, and to music therapists. It is always a deepened perspective when authors reflect upon their work as a team.

Veteran music therapist Gillian Stephens Langdon, and her milieu of colleagues Faye Margolis, Kristina Muenzenmaier article is *Weaving Words and Music: Healing from Trauma for People with Serious Mental Illness*. In keeping with the theme of multi-faceted approach to treating trauma victims, it uses multiple vignettes to explore the development of a music /verbal therapy program to address the alarmingly high incidence of trauma in another fragile population; that of people struggling with severe mental illness in gritty urban areas of New York City.

Finally, Andrew Rossetti, co-editor, shares a glimpse into the great mind of Janina Fisher. In *Music-Related Sensibilities in Trauma Treatment: A Interview with Janina Fisher* readers have an opportunity to delve into her perspectives on current and past trauma theory and treatment. Of particular interest is Dr. Fisher shares how her background as a university level music student has impacted her views on her clinical work and training of new traumatologists, and provides many gems of thought on the nature of therapy itself.. It was a meaningful opportunity to be able to sit down with such a prominent leader in the trauma world, and to contextualize some of her sharing and then to provide commentary. Most usually, journals contain research or theoretical articles. Less often do we have exact words, and texts captured in discourse. I had a deepened perspective from my meeting with Dr. Fisher, and so too did Marija Pranic as our transcriber. I enjoyed the activity of providing commentary on certain points of our topics. It is our hope in finishing this special issue that readers will be tempted by this interview to delve more fully into the topic of trauma, and trauma's capacity to transform when aligned within music therapy experiences.

As a 'digestif', Amy Clements-Cortes provides a meaningful piece in her poem-*I'm Still Alive*. This is a powerful remembrance that the trauma of being critically ill can be contained and softened with music. It is a reminder that we have ways to make meaning and instill life energy, even when traumatic times may seem most prolific.

As co-Editors of this special issue, we are grateful to each of the authors, and to the wonderful team of 'Music and Medicine.' We are hopeful that this issue and its topics will continue to unfold and unveil the vitality of how music therapy, and trauma theory may advance through research, description and case study inclusive of those who treat trauma.

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