



## Drumming as an Effective Therapy within a Neurobiological context

Over the last thirty years there have been significant gains in understanding how the processes of neurobiology impact on the development of the child and the way in which interruptions to these processes through trauma and neglect can impair development across the lifespan, <sup>1</sup>(Barfield et al, 2009). Correspondingly, developments in cognitive neuroscience have increased our understanding of the way in which music impacts the brain, and how this impact can be utilised to support those with a range of different disorders <sup>2</sup>(Levitin, 2013).

At the centre of this understanding is the realisation that the human brain is sequential in its development, with specific developmental time frames allocated to different parts of the brain responsible for different developmental functions, and with the sequence moving from those most basic (brainstem) functions through to the more complex (limbic, cortical). Each element of the brain has its own unique timetable for development, but are closely connected through organising neural networks that originate in the lower brain and hence any interruption or impairment of the lower brain (formed in utero and in early childhood) has significant impact on those areas that follow <sup>3</sup>(Perry, 2009).

The response to stress is mediated through the primal parts of the brain, which responds more quickly than the higher order networks, shutting them down and at the same time overwhelming rational thought<sup>4</sup> (Goleman, 1995). When people are stressed it is common to hear them say "I just can't think straight" this is because the ability of the brain to process information is being impeded by the survival mechanisms of lower order brain processes.

Prolonged activation of the bodies stress response has detrimental consequences for health. Stress activates neuro-chemical responses that aim to restore a loss of homeostatic balance. Music at certain tempos has been found to impact brain stem responses that regulate homeostasis. Heart rate, blood pressure, body temperature and muscle tension that are correlates to stress can be remediated by music at specific tempos <sup>5</sup>(Chapados & Levitin, 2008). This is thought to be due to the fact that brainwaves respond to sound as a mirror - the two waveforms are identical with neurons firing in synchronicity with tempo.

In the neuro-sequential modelling of Dr Bruce Perry, both the brainstem and the diencephalon or midbrain are strongly affected by positive rhythms as they organize in the womb and during the first year of life. The basic rhythm is the mother's heartbeat at 60-80 beats per second and other typical rhythms include the rocking and patting patterns mothers and other close caregivers provide (also at that frequency). In a loving home, these steady rhythms are associated with

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<sup>1</sup> Barfield, S., Gaskill, R., Dobson, C., & Perry, B. D. (2009). Implementing the neurosequential model of therapeutics (NMT) with filial therapy in a therapeutic preschool setting: Implications for work with children with serious emotional disturbance.

<sup>2</sup> Levitin, D.J. 2013. Neural Correlates of Musical Behaviours - A brief overview. Paper prepared for the American Music Therapy Association

<sup>3</sup> Perry, B.D.(2009). Examining Child Maltreatment Through a Neurodevelopmental Lens: Clinical Applications of the Neurosequential Model of Therapeutics. *Journal of Loss and Trauma*, 14:240–255,

<sup>4</sup> Goleman, (1995). *Emotional Intelligence*. New York: Bantam

<sup>5</sup> Chapados, C and Levitin, D.J., 2008. Cross-modal interactions in the experience of musical performances: physiological correlates, *Cognition* 108, 639-651

satisfying and pleasurable care. Music that employs steady rhythms has also been found to be nourishing to the developing brain of the infant <sup>6</sup> (Levitin, 2006).

These developmental patterns then directly influence the impact of different clinical approaches with the realisation that in order to address higher functioning deficits such as cognitive function, social and emotional communication and moral reasoning, the lower order neural networks must be addressed and well regulated. It is thus unrealistic to address these higher order issues if we have not first looked at interventions for realigning the lower order neural networks that impact on issues such as anxiety and impulsivity.

This is where rhythmic interventions such as drumming have been found to be particularly useful with a growing evidence base in clinical practice highlighting the positive impact of repetitive motor activity in cognitive recovery. ‘Somatosensory interventions that provide patterned, repetitive neural input to the brainstem and diencephalon monoamine neural networks, assist in organizing and regulating input that diminishes anxiety, impulsivity, and other trauma-related symptoms which have their origins in the dysregulation of these systems’<sup>7</sup> (Perry, 2009).

The Holyoake DRUMBEAT program and the social learning computer game DRUMBEAT Quest combine these sensory exercises (for the lower and mid brain) with cognitive approaches (for the limbic and cortical brain), in a flexible format that the facilitator can adapt in order to deliver the appropriate balance required by the individual as necessitated by the stage of their developmental trauma.

Further evidence from neuroscience supports anecdotal reports that music impacts positively on social affiliation. Research indicates that music regulates the release of certain neuropeptides that can help promote trust and reduce social anxiety. Music is a system of emotional communication. Playing music together is believed to promote a sense of empathy and social bonding through both the release of these neuropeptides and the synchronisation of motor activity and sensory neural networks that improve communication <sup>8</sup>(Chandran & Levitin, 2013, Overy, 2012).

Music, especially with a strong beat and tempo has been shown to facilitate sensorimotor coordination <sup>9</sup>(Altenmuller, Wiesendanger & Kesselring, 2006). Problems with motor coordination are markers for many children who have experienced trauma and are also commonly found with children who have sensory perception disorders. Both the Holyoake DRUMBEAT program and the social learning computer game DRUMBEAT Quest utilise cross body movements of the arms to improve gross motor coordination and increase neural connectivity between the two hemispheres of the brain. These forms of exercises have been associated with improvements in cognition, memory and attention<sup>10</sup>(Hannaford, 2007).

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<sup>6</sup> Levitin, D. J. (2006). *This is your brain on music*. Dutton, Penguin

<sup>7</sup> Perry, B.D.(2009). Examining Child Maltreatment Through a Neurodevelopmental Lens: Clinical Applications of the Neurosequential Model of Therapeutics. *Journal of Loss and Trauma*, 14:240–255,

<sup>8</sup> Chapados, C and Levitin, D.J., 2008. Cross-modal interactions in the experience of musical performances: physiological correlates, *Cognition* 108, 639-651

Overy, K. 2012. Makin music in a group: synchronisation and shared experience. *Annals of the New York Academy of Sciences*, 1252, 65-68

<sup>9</sup> Altenmuller, E., Wiesendanger, M., and Kesselring, J (Eds) 2006. *Music, motor control and the brain*. Oxford: Oxford University Press

<sup>10</sup> Hannaford, C. (2007). *Smart Moves: Why Learning Is Not All In Your Head*, Salt Lake City: Great River Books