

## Full-Length Article

**Music Medicine's Influence on Music Psychotherapy Practice with Traumatized Individuals**

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<sup>1</sup>Wilfrid Laurier University, Ontario, Canada**Abstract**

This article describes the key neurological findings that impact music psychotherapy practice. I will also contemplate whether such findings could provide a foundation for music psychotherapy. Within the framework of music medicine research, this article will seek to strengthen and qualify rationale for the common acknowledgement of the 'power of music,' a phrase typically invoked to explain essential aspects of the music psychotherapy process. A neurological foundation may serve to support a grounded rationale in the utilization of how music can be best implemented within a music psychotherapy construct with clients. The article will introduce the following most essential neurological rationale supporting the therapeutic impact of music engagement, (music listening or music-making). The following premises pertain to music psychotherapy practices: 1) Music is multisensory and may stimulate various sensory areas, 2) Music may retrieve memories and evoke emotions, and 3) Music may elicit changes in hormones and neurotransmitters.

**Keywords:** *Music psychotherapy, music medicine, music and brain, hormones.*

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**Introduction**

Working as a music psychotherapy clinician for over 25 years, I have learned to trust music as a useful tool in the therapeutic processes of traumatized individuals. [1,2] It is always a pivotal moment when music begins to sound as our feelings feel. It is no longer 'just music.' Rather, music touches our emotions and triggers our memories on the deepest level. There is something in music that is transformative, making a difference in people's lives. But what is it that really makes music so powerful? What do we mean with the phrase: 'the power of music?' Is it the collective unconscious that allows us to understand each other's music on a deep, intimate level? Is it that certain melodies, harmonies, and rhythms can impact both our emotions and perceptions? Or is it because as human beings we actually are musical beings? Or as, Oliver Sacks [3] claims, we have not even begun to understand the power of music...

While not comprehensive, in this article, I will attempt to introduce those neurological studies that were eye openers for

me when I first approached them. These studies helped me begin to formulate ideas of the underlying neurological mechanisms that could perhaps explain why music seems to be such a good tool for psychotherapy, particularly when working with traumatized individuals. I will attempt to explain the often heard and whimsically sounding therapeutic 'power of music' within the framework of music medicine research. As a psychotherapist, could I indeed have a neurological rationale in my mind when I choose, or use music for my music psychotherapy clients? Could some of the music medicine research findings expound upon what exactly in music is therapeutic, and if so, what is it that happens during those processes?

**Music Therapy, Music Psychotherapy or Music Medicine?**

A major distinction separating *music medicine* from *music therapy* is the therapeutic relationship that must exist in music therapy. The therapist uses music experiences and interventions to accomplish different therapeutic aims that have been defined during the assessment, and are based on the client's therapeutic needs. Conversely, music medicine uses music as if it were a prescription, i.e. 'take music twice a day', or 'take a particular rhythmic pattern when you walk to provide entrainment for the brain', or 'use 40Hz low frequency vibration before you go to sleep.'

Music medicine is defined by the International Dictionary of Music Therapy [4] as

*"the use of music to assist in medical treatment, whereby music is used as the means of intervention or stimulus. The term was coined by Ralph Spintge (Spintge and Droh, 1987, 1993; Pratt and Spintge,*

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International Association for Music & Medicine (IAMM).

1995) and implies scientific evaluation of musical stimuli in medical settings through physiological, psychological and medical research, as well as therapeutic applications to compliment traditional medical treatment. (Joanne Loewy)" (p. 90) [5, 6, 7]

Although music medicine can refer to varying practices, i.e. music as medicine or music in medicine, a common element is that it is based on cognitive neuroscience, functional neuroscience, or neurophysiological research. In this article, my focus is to explore how some of these findings may shape clinical music psychotherapy practice.

Based on different clientele and their therapeutic needs, and various theoretical orientations, music therapy currently employs various methods, with music psychotherapy being one of them. According to Bruscia, [8] music psychotherapy, is "the use of music experiences to facilitate the interpersonal process of therapist and client as well as the therapeutic change process itself" (p. 2), and can be categorized by music as psychotherapy, music-centered psychotherapy, music in psychotherapy, and verbal psychotherapy with music. For the purposes of this article, the use of the term 'music psychotherapy' refers to all 4 practices. In my own clinical work, I incorporate the *Bonny Method of Guided Imagery and Music* (GIM), [9] and *Group Analytic Music Therapy* (GAMT). [10] GIM is based on a client listening to carefully selected music programs, and at the same time freely sharing their images with the therapist. GAMT sessions incorporate clinical improvisation, therapeutic music listening, and discussion. 'Music sounds as feelings feel' is a theme that often emerges when working with people who suffer psychological trauma, posttraumatic stress disorder (PTSD), depression, or anxiety. The role of musical interventions is to enhance communication and allow the internalization-externalization process by providing a playful transitional space and a symbolic distance for the client to work through their trauma. It may be music that makes one feel safe to express and communicate even the most painful emotions and experiences.

### Using music medicine binoculars to expand my music psychotherapy horizon

Using a set of music medicine research binoculars, I wondered if I might expand my early perspectives to explain why musical interventions seem to work? Could it be possible to explain the therapeutic impact of music engagement by using technologies such as *functional Magnetic Resonance Imaging* (fMRI), *Diffusion Tensor Imaging* (DTI), *Electroencephalography* (EEG), *Electrocardiography* (ECG), *Magnetoencephalography* (MEG), and *Electrodermal activity* (EDA)? [i.e. 11,12,13]

In the next sections, I will introduce the key neurological findings that continue to influence my music psychotherapy practice. I will introduce neurological rationale for utilizing

music engagement in music psychotherapy practices based on the following: 1) Music is multisensory and may stimulate various sensory areas, 2) Music may retrieve memories and evoke emotions, and 3) Music may elicit changes in hormones and neurotransmitters.

### The first neurological rationale for utilizing music engagement in music psychotherapy: Music is multisensory and may stimulate various sensory areas

Oliver Sacks [3] claims that music is everywhere in our brain. McDermott states: "One of the core debates surrounding music is to what extent it has dedicated mechanisms in the brain and to what extent it piggybacks off of mechanisms that primarily serve other functions"(1) [14] Moreover, according to a recent study [15], "anatomically, music and speech selectivity are concentrated in distinct regions of non-primary auditory cortex." (p. 1281) Although higher level processing of music occurs across the brain, current research suggests a music specific neuronal population recruited in initial stages of musical processing.

Music-making and music listening are multisensory and may stimulate various sensory areas (auditory, tactile, and visual) at the same time. Even if one is simply listening to music (i.e. clients during the GIM session), music can recruit multiple brain regions involved in increasingly hierarchical levels of processing. When the music psychotherapy clients I treat improvise with instruments, their brains' response involves various regions outside the auditory cortex, including areas that more commonly associated with other activities. [16,17].

Music engagement activates both hemispheres in the brain. The left auditory cortex processes the sequencing of words, sounds, and perception of rhythm; the right auditory cortex processes hierarchies of harmonic relations and rich overtones. Furthermore, the *corpus callosum* connects both sides of the brain [18], making it possible for a person who cannot speak to sing, (i.e. after a certain type of stroke or brain injury). If the access to the language unit is locked or damaged, music engagement may encourage plasticity, stimulating alternative brain areas to compensate for damaged areas with loss of function [19,20,21]. This, and the fact that music-making and music listening are multisensory and stimulate various sensory areas same time could be one of the influencing principals for using music in psychotherapy with stroke patients who have a need to work through their grief process and traumatic experiences but cannot do it via verbal psychotherapy. A fascinating study [22] introduces a patient who suffered brain damage in both temporal lobes. After a traumatic event, her intellectual capacities and speech did not change, but she was no longer able to recognize any familiar melodies nor changes in the pitch, even if they were repeated several times during the experiment. However, she still expressed that she was able to feel emotion and enjoy music. The results of the study suggest that the emotional, conscious

effects, and the processing of music may be partially distinct. Perhaps music engagement with the support of a therapist may support plasticity allowing undamaged regions to compensate for, and take over function of damaged regions [23].

### **Second neurological rationale for utilizing music engagement in music psychotherapy: Music may retrieve memories and evoke emotions**

The *limbic system* of the brain colors life experiences with a particular emotional tone. Consequently both music listening and music improvisation, the most used interventions in music psychotherapy, seem to trigger memories and emotions [24,25,26,27]. Neurologically, both the *amygdala* and *hippocampus* are involved in perception and processing of emotional responses, storing memories, and regulating hormones. Indeed, the amygdala is specifically involved in initial decoding of the emotional valence. The hippocampus processes more complex vocal and musical emotions providing memory-based and contextual associations and projecting to areas of the cerebral cortex for long-term storage of memories or retrieving them as needed [28,29]. Since trauma memories are stored as sensations, similar type sensations may trigger the memories. During music engagement, a trauma re-experiencing and re-enacting may take place when a client hears atonal, chaotic, or loud music because it may retrieve memories of the original traumatic event. Because the nervous system communicates the somatic trauma memories between the brain and all other parts of the body, it may be possible to experience an implicit, emotional, bodily, or sensory memory of trauma, without the explicit (cognitive and verbal) memory [30,31,32]. Perhaps it could be speculated that this could happen because music, as a sensation itself, may have an easier access to the implicit memory than words, thus bypassing the verbal processing (left brain). As therapists, it is important to realize that this could be either therapeutic trauma re-construction, or re-traumatizing experience for the client that may trigger sensory memories, bypassing the verbal processing (left brain).

According to Legge's and Moore's research [33,34] memory and cognitive functioning seem to be closely intertwined to one another, and music interventions may play a role in facilitating memories. For example, while listening to familiar music, the brain may form a specific route of associated memories, (semantic, visual, and autobiographical). This may explain why music listening during GIM seems to retrieve different levels of memories and images. Likewise, different styles of music seem to correlate with different emotions, which is also relevant for music psychotherapy. For example, Krumhans and Gangrade [35,36] explored the physiological changes in blood circulation, respiration, skin conductivity, body temperature, and emotions associated with certain musical structures. Music with a fast tempo in a major key seemed to correlate with

happiness; a slow tempo in a minor key with sadness; a faster tempo with dissonances correlated with fear. As music interventions incorporated in music psychotherapy should always comply with the clients' therapeutic needs, this research brings essential information for choosing music for the client. Furthermore, controversial studies of the 'Mozart effect' may help explain why in music psychotherapy sessions the clients could 'retrieve' their memories through listening to familiar music. The original studies concluded that hamsters who were 'listening to' Mozart finished spatial mazes faster and with fewer errors than those hamsters doing the same task without music. The outcomes suggest that spatial temporal reasoning and music may trigger the same neural pathways in the hippocampus. [37]

Pertinent to music psychotherapy are the many studies indicating that people value music primarily because of the emotions it can evoke. [38]

Juslin and Vastfjäll's research [39] results introduce 6 mechanisms through which music listening may induce emotions: (1) brain stem reflexes, (2) evaluative conditioning, (3) emotional contagion, (4) visual imagery, (5) episodic memory, and (6) musical expectancy. Interestingly, the results concluded "music evokes emotions through mechanisms that are not unique to music." (p. 1). Perhaps we could argue that in music psychotherapy, music evokes emotions that are not unique to music but unique for the person engaged with the music allowing the internalization-externalization processes. Lundqvist, Hilmersson and Juslin's research [40] about emotional responses to music continued to explore whether music evokes genuine emotional responses in listeners or whether listeners merely perceive emotions expressed by the music. The results revealed that a 'happy music' caused more facial muscle activity, lower finger temperature, more 'happiness', and less 'sadness.' "The finding that the emotion induced in the listener was the same as the emotion expressed in the music is consistent with the notion that music may induce emotions through a process of emotional contagion." (p. 1). Likewise, noteworthy for the GIM practitioners, according to the Logeswaran and Bhattacharya' study [41] music may affect how we see visual images. 30 participants were presented happy or sad music together with a photograph of a face. Some people were shown a smiling face, others a sad or neutral faces. Music seemed to influence the emotional ratings of the photographs; happy faces looked even happier with happy music, and sad music made even neutral faces look sad. The researchers claimed that because music is emotionally evocative, even unrelated pictures felt more pleasant with happy background music.

Some research [42,43] indicates that when either joyful or fearful music was played with a neutral film excerpt, it evoked stronger signal fluctuations in the amygdala than music or film played alone. Furthermore, the combination of fearful and neutral film excerpt induced even stronger signal changes in the hippocampal area although, according to the subjective

rankings of the participants, they did not perceive music in combination with film any differently than music alone. Based on these studies, it seems that the amygdala does not only regulate fears, but may be deeply intertwined in both negative and positive emotions. The interesting notion that the visual system may moderate the signal changes in the amygdala is verified by Lerner's study, [44] demonstrating an increased amygdala activity when listening to fearful music with eyes closed. This finding may have interesting connotations for the GIM-process during which the clients usually listen to music with their eyes closed. Again, interesting to music psychotherapy practices, according to Koelsch, [45] music engagement may indeed evoke real, not imagined emotions.

Correspondingly, music psychotherapy practices support the findings of these studies. Sometimes, during improvisation and music listening, music seems to evoke emotional responses in clients allowing them to feel and remember. However, sometimes clients merely perceive emotions expressed by the music, recognizing that the music sounds as their feelings feel. Could these studies also explain why certain GIM music programs work best for certain moods and therapeutic needs? Additionally, research has also demonstrated [46,47] that the emotional effect of music may be dependant on what has been stored and tagged in a person's limbic system, or even their basal ganglia and cerebellum. Perhaps familiar music from our childhood and youth is a gemstone with therapeutic potential that will remain with us forever. According to Levitin, [48] the music we liked, listened to, were obsessed over, and identified with during our highly emotional adolescence years, when all feelings were heightened and considered extremely important, will forever stay in our brain. An explanation for this phenomenon may involve the neurological development occurring in the adolescent brain: we more robustly retain the music from our teenage years due to the heightened brain plasticity during that developmental stage. Remembering songs from our youth is called musical nostalgia. These songs are often memory laden and associated with our teen social life, dreams, and our self-image. It is as if they create a soundtrack to what we felt back then, and how we coped with our emotions and life-drama. The often described, 'awakenings' of Alzheimer's and dementia patients are also reactions to these autobiographically significant songs stored in our brain. [49,50,51,52]

### **Third neurological rationale for utilizing music engagement in music psychotherapy: music may elicit changes in hormones and neurotransmitters**

The *thalamus* regulates the hormones through the hypothalamus in the limbic system. The hormonal impact associated with music has a direct implication for music psychotherapy interventions providing the rationale for choosing certain music based on the clients' therapeutic needs. Fancourt, Ockelford, and Belai's [53] systematic review

investigating the psychoneuroimmunological effects of music concludes that:

*Research into the psychoneuroimmunology of music has the potential to influence our holistic models of healthcare. If music is found to have a significant effect on the immune system's ability to fight disease, it will have a profound impact on its incorporation into healthcare settings including hospital waiting rooms; procedures such as surgery; and treatments such as chemotherapy and psychotherapy; as well as placing a larger significance and responsibility on our day-to-day consumption of music. This could not just affect the domain of medicine, but also the roles of musicians and the missions of arts organizations. It is hoped that by taking stock of previous research in this review, future studies will be aided and encouraged, increasing our insight into an intriguing field. (p. 24)*

Furthermore, Chanda and Levitin's review [54] on the neurochemistry of music confirms that music may impact brain chemistry and enhance health benefits in four areas: management of mood, stress reduction, boosting immunity, and as an aid to social bonding. The following chapters describe certain hormonal/neurotransmitter changes that may explain some of the 'power of music.' I will explore how music may elicit changes in endorphins, adrenalin, cortisol, serotonin, prolactin, oxytocin, dopamine, and melatonin.

### **Listening to music we enjoy produces activity in brain areas known to exhibit endorphin activity, correlating with a sense of pleasure.**

Chemically, endorphins are like morphine increasing our body's threshold for pain, affecting emotions, and bringing pleasure. According to many researchers [36,55,56] brain areas known to be involved in endorphin activity were activated during music engagement although endorphin activity was not always directly measured. Uplifting music seems to activate areas in the limbic system, which then may release endorphins. Furthermore, an energized, synchronized, rhythmic, music-making in a group-setting, such as drumming, jamming, dancing, or singing together, compared to a solitary music listening, may facilitate endorphin release and social bonding even more. [57] Moreover, adding music into a group exercise may enhance a greater endorphin activation and therefore affect the mood, and ability to endure energetic exercise. [58]

The production of endorphins associated with 'liking music' is dependent on a number of factors such as the level of emotional arousal and pleasurable response to music. For example, certain melodic elements (i.e. notes that remain close together) and culturally familiar harmonic structures appear to be more pleasing to the brain, and therefore both



anticipated and pleasure provoking. [59] Furthermore, we are usually most pleased by the tones from our cultural origin; it is as if we are 'wired' to anticipate certain harmonic resolutions. Based on their cultural background and previous musical experiences, people's brains may have different ideas of what is or is not organized. [60,61,62] This knowledge is imperative when working in multicultural settings i.e. with traumatized refugees.

Although both cultural aspects and personal preferences play a role when it comes to our musical taste, there are some fascinating studies on the emotional effects of music using PET scanning. [55,63] In one study when the research participants heard musical dissonance, only the areas of their limbic systems responsible for unpleasant emotions showed activity. Conversely, tonal music stimulated parts of the limbic system that are associated with pleasure. In another study [64] while being scanned using MRI, participants were asked to listen to songs they had never before heard, but within a familiar style. They were asked to bid for each track and pay with their own money for the chosen tracks. According to the results, many brain regions were stimulated if the listener liked a particular song. However, only when they liked it enough that they were willing to pay was there also a strong correlation with *nucleus accumbens*, which has a significant role in the cognitive processing of aversion, pleasure, reward, and reinforcement learning. It is vital for music psychotherapists to understand that only music a person likes, and that their brain considers organisable, elevates endorphins.

### **Music engagement may decrease cortisol levels enhancing calm and relaxation**

Our mind and body's stress system depends on cortisol and adrenaline. Adrenaline works in the short term while cortisol in the longer term. People may experience periods of acute stress, which, if frequent enough, may turn into episodic stress. If continuing, or not resolved, it can become chronic stress. Elevated levels of cortisol may contribute to long-term concerns with respiratory and cardiovascular systems, lowered immune function, increased weight gain, and blood pressure, to name a few. A tremendously high amount of cortisol may damage the brain, for example shrinking the size of hippocampus, enlarging the amygdala, and affecting the prefrontal lobe. [65,66,67,68,69,70] This may underlie some of the typical PTSD symptoms like flashbacks, always-present memories, difficulties in regulating fears and other emotions, memory loss, or difficulty in focusing and sharing their trauma story in a chronological order. During a dangerous or panic-filled situation, it is the sympathetic nervous system that automatically floods our body with hormones preparing us for the fight, flight or freeze response. Conversely the parasympathetic nervous system triggers a calming response. [71]

Many studies have tested cortisol levels during or after music by examining blood, urinary, and saliva samples. Although these tests have limitations, these studies may offer insight into underlying neurophysiological mechanisms in music therapy. Numerous studies claim levels of cortisol or stress related symptoms drop after listening to relaxing music [72,73,74, 75,76] or while singing. [77,78] When rhythmically consistent music was combined with breathing exercises for a half hour each day, there was a measurable reduction in blood pressure lasting for one month. [79] Another research study with seniors [80] showed a drop in blood pressure from listening to just 25 minutes per day. Other studies [81,82] investigated the effects of three types of music, one with a regular rhythm, and another with an irregular rhythm, and a meditative piece without rhythmic characteristics. Levels of cortisol and noradrenaline were reduced by the relaxing music. Peretz-Lloret's team [83] assessed the effects on the autonomic nervous system activity through heart rate variability (HRV) to different styles of "relaxing" music with similar tempo (classical, new age and romantic melodies). As results, "relaxing" music seemed to evoke significant autonomic responses (measured by HRV analysis). However, contradicting another studies i.e. 84], although participants reacted differently to different musical styles, their personal preferences or feelings regarding musical styles seemed to have no effects on their autonomic responses. Instead, participants seemed to show "different patterns of autonomic activation to these melodies" [83, p. 283]. According to the results: "listening to music may exert part of their effects in the human body by influencing autonomic activity" [83, p. 283]. Typically, an increase in the high frequency component (HF) and a lower LF/HF is indicative of parasympathetic activation (physical relaxation). A high LF/HF ratio is generally associated with stress. Interestingly, in this study, the HF was significantly lower when subjects were listening to new age music. Similarly, new age music also increased the LF/HF ratio whereas listening to classical or romantic music reduced it (15-20%). Although these reductions were not statistically significant they may still have a physiological meaning. But what could the decrease in HF mean regarding new age music? The researchers debated whether the changes simply reflected changes in the breathing pattern and not with increased sympathetic activity (physical exert). Important finding of this study was that different musical styles seem to show "particular profiles of autonomic responses, pointing out the need to explore the effects of different music styles on the brain and body before they can be proposed as an effective music therapy." [83, p. 283]

In another study [85] university students majoring in music or in biology were asked to listen to two selections from a contrasted Holst's Planets', 'Jupiter' and 'Venus'. Interestingly, the biology majors experienced a decrease in cortisol but the music students had significant increases. Instead of relaxing, they were actively involved in analyzing

the music, listening critically for nuances and musical accuracy, while some were even mentally "playing" their instruments, or conducting an orchestra. Later researchers [86] found similar results using unpleasant tragic music with a similar group of participants. Comparably in my clinical work, I have experienced clients who are also musicians, during their first GIM sessions often imagine themselves playing in an orchestra while non-musician clients never do. Interestingly, these research findings show that there seems to be certain elements in music that all people consider relaxing. However, in an almost contradictory sense, the prior experience the client has with a piece of music influences their response more than any elements of the music.

While most researchers seem to agree that music reduces levels of stress hormone levels, as a music psychotherapist it is important to be aware that music can also be an excellent way to deliberately promote energy. Brownley [87] investigated how music can sometimes increase cortisol in trained and untrained runners; there were increased levels of cortisol for fast music during the experiment. It is also crucial to understand that music that a client deeply dislikes may induce a negative reaction. Rather than a calming or energizing effect, it may increase irritation and stress levels.

Cortisol and endorphin activity may underlie the clinical effects of music-based intervention we observe in regards to decreasing pain and anxiety. [88, 89] Many studies claim that patients who listened to music either before, during, or after a medical procedure had lower blood pressure than the control groups, an indication of having less anxiety and feeling more relaxed. Yinger and Goodins's review [90] investigated the effects of music-based interventions (music therapy and music medicine) on pain and anxiety in children and adults undergoing medical procedures. According to their results, 48% of the studies indicated less anxiety and 36% reported less pain for music intervention participants. Klassen [91] and Nilsson [92] reported similar results as well as Evans [93] who also studied the effectiveness of music as an intervention for hospital patients, and Engval [94] who reviewed effects of music with postoperative pain. There are several music therapy studies indicating how music lowers pain and anxiety significantly in patients with cancer related pain. [95,96,97]

From these numerous studies we might hypothesize that it is possible to reduce stress, relax, and calm ourselves by slowing the heart rate, deepening the breathing, lowering the blood pressure, and relaxing the muscles with music. Aiming at triggering the parasympathetic response of traumatized clients, an important component of my music psychotherapy sessions are relaxation and grounding activities, such as deep abdominal breathing and relaxation techniques, during music listening or improvisation. The GIM music programmes are also developed so sessions end with music allowing mental grounding of images (i.e. tonal harmonic structure, repetitive melody line, and slow tempo). Neurological research about music's capacity to increase or decrease cortisol confirms that

I must have a clear justification in the kind of music used, or not used, with individual clients.

### **Music listening may increase serotonin battling against depression**

Reduced blood levels of serotonin have been reported in people who suffer from depression although the relationship between brain concentrations of serotonin and serum levels has not been established. Despite their many side effects, anti-depressant medications that increase serotonin are currently the most prescribed pharmaceutical drugs. Interestingly for psychotherapy, studies have already reported the effects of psychotherapeutic interventions on increased serotonin levels in depressed patients. [98,99] Likewise, according to Evers and Suhr, [100] there could be an increase in platelet serotonin in response to "pleasant music," and a decrease in response to "unpleasant music." From this we might hypothesize that music therapy mechanism at a neurological level in treatment of depression may involve an increase in serotonin in response to client preferred music. Interestingly, a study of the preferred music listening of depressed individuals shows an exaggerated response to sad-sounding music. [101] They also seem to consider the music with negative valence as sadder and angrier than what the healthy controls consider. [102] Furthermore, depressed individuals' reason to engage with music seems to be, to express, experience, understand, or regulate their emotions. [103,104] Although the serotonin levels have not been measured in many music therapy studies, there have been studies that suggest that clinical improvisation [105] and music listening [106] can be an effective intervention for depression [107,108,109] allowing for different emotions to be experienced and expressed.

### **Music regarded as sad may release prolactin allowing a cathartic experience and comfort**

Why, as a music psychotherapist would I play a sad chord with traumatized clients? According to Huron, [110,111] although music may 'feel sad,' there is nothing happy or sad in music itself. There are no emotions inherent in notes themselves. Moreover, our personal reaction to music may be dependent on our prior experiences and cultural origin. To feel something around music means that our limbic system has been activated and began to process the emotions. Nevertheless, a sad chord can also change our mood. [112] According to Sachs, Damsio, and Habibi's [113] systematic review, music that communicates sadness can be experienced as pleasurable because it has aesthetic value. It has no immediate real world implications, i.e. it is non-threatening, and it generates psychological benefits, such as elicitation of memories, mood regulation, and empathy:

*...in art, the immediate social and physical circumstances usually associated with the negative*

*valence, are not present. In addition, it may be that music that pertains to grief and sorrow is more often found beautiful than music that pertains to joy and happiness because it deals with eudemonic concerns such as self-expression, social connectedness, and existential meaning. Finally, sad music can help individuals cope with negative emotions in certain situations, depending on their personality, their mood, and their previous experiences with the music.* [113 p. conclusions]

Interestingly, although not scientifically tested, Huron [114] suggests that the hormone prolactin could be responsible for allowing the enjoyment of sad music, by enabling a listener to have a ‘good cry.’ Prolactin is a soothing hormone, boosting bonding and attachment, fluctuating when mothers nurse their babies, hear them cry, or during a mourning process, for example. It is released in the hypothalamus, by endocrine neurons, as a response to the emotions such as sadness, grief, sadness, and tears. [115, 116, 117] Huron suggests that musical engagement of sad-sounding music may be able to simulate sadness outside a grief process or emotional pain because it would stimulate the release of prolactin as a compensatory response.

Musical engagement as emotion regulation and the effects of sad music are widely researched. [118,119,120,113] According to neuroimaging studies, [121,122] sad music activates brain regions involved in processing feelings of sadness. Several studies report the involvement of the amygdala and hippocampus. [42,43,55,123] In one study, sad music also increased activation in the thalamus as well as in the caudate nucleus. [124] Sad music can stimulate a sense of pleasure, both directly from the music and indirectly through the experience of sadness while listening. [125] Music regarded as sad often includes minor mode, slower tempo, softer dynamics, legato, less energy, narrower and lower pitch range, monotonous and darker timbres, and lower valence and arousal. [126,127] The musical characters associated with sadness can also involve lyrics of songs and themes of classical music. According to Levinson, [128] there are eight rewards that bring a sense of pleasure when listening to sad music: catharsis, apprehending expression, savouring feeling, understanding feeling, emotional assurance, emotional resolution, expressive potency, and emotional communion. The further benefits of sad music include an ability to engage imagination, allow intense emotions without real-life consequences, regulate negative emotions, and allow comfort, and sense of connectedness [129, 113]. Sad music also seems to trigger of specific memories from past, and allowing a distraction from current problems. [130]

According to Peltola and Eerola, [131] listeners’ sad response to music includes either grief, melancholia, or sweet sorrow. Therefore, there is a psychological rationale for music psychotherapist to play a minor chord or select a sad piece of

composed music, after a discussion of a sad experience with their client. It not only evokes empathy, but may also induce comfort and cathartic grief often associated with a ‘good cry’. Prolactin activity may contribute to our cathartic experience of sad music, and may be a neural mechanism involved in music psychotherapeutic processes. Music may first put the client’s mind into a sad, grief-like stage. Thalamic activity via prolactin release may then play a role in the experience of comfort when listening to sad music. When a client listens to sad music either pre-composed or played by the therapist, it may become a moment of validation, and a corrective and compensating experience. However, music may also trigger painful past memories causing the listener to re-experience them [114]. Therefore, it is essential music psychotherapists know how to use sad music safely with traumatized individuals, and how to discuss with them about their reactions to sad music thus helping them to better understand and cope with their emotions.

#### **Oxytocin and dopamine activity in the brain during music engagement may underlie bonding behaviour and peak experiences**

Oxytocin and dopamine are both suspected to be involved in any attachment and bonding behaviour, impacting feelings of trust and trustworthiness. [132,133,134] According to many fMRI studies, abnormal oxytocin—dopamine interactions in the amygdala may be the underlying rationale for problematic social functioning in schizophrenic patients, [135] autism, [136] and attention deficit-hyperactivity disorder (ADHD). [137] Furthermore, according to recent studies, [i.e. 138] oxytocin and dopamine interact in various ways. However as much of the research was only conducted on animals, questions exist whether these results carry over into humans. According to MacDonalds’ study: [139]

*... though the investigations mentioned above have noted correlations between plasma oxytocin levels and different conditions, no convincing evidence of a direct relationship between central levels of oxytocin, peripheral levels of oxytocin, and psychiatric conditions has been found, and elevated levels have been found in several conditions with social anxiety as a hallmark. As such, the most direct way to assay the central actions of oxytocin in humans is via intranasal delivery, which provides a direct pathway to the brain.* (p. 16)

The levels of oxytocin and dopamine can be tested using blood, saliva, and urine but each test has its limitation. The molecular imaging techniques such as *Dopamine Transporter Single-Photon Emission Computed Tomography* (DAT SPECT), *DOPA Positron Emission Tomography* (PET), and *Transcranial Sonography* (TCS) seem to be more accurate. [140, 141]

The suspected neurochemical action of dopamine and oxytocin during music engagement may underlie why music has always played such a prominent role in any rituals or emotional events in every culture around the world - weddings, funerals, or even after a terrorist attack that shatters the community. Listening, singing, and playing music together may release oxytocin that helps us feel bonding and trust. Music listening may also cause the release of dopamine in the brain, just like other pleasurable stimuli. [142] According to an MRI study, [143] even the anticipation of the participants' preferred music stimulated dopamine release.

The study investigated the exceptional musical responses called 'chills' (goose bumps or shivers), something quite characteristic during our meaningful moments in music psychotherapy. While being MRI scanned, the research participants listened to their own selection of instrumental music. They were to anticipate what was going to happen next and whether it was going to be something anticipated or something surprising. The results showed that the brain releases dopamine *both* during the musical anticipation and during the chills. A study by Mori and Iwanaga [144] suggest that there could be two types of peak emotional responses to music: chills and tears (weeping, lump in the throat), both distinctive client reactions during GIM, and clinical improvisation. The results showed that the chills increased both electrodermal activity and subjective arousal of music listeners. However, tears only produced slow respiration during heartbeat acceleration. As stated by the researchers:

*A song that induced chills was perceived as being both happy and sad whereas a song that induced tears was perceived as sad. A tear-eliciting song was perceived as calmer than a chill-eliciting song. These results show that tears involve pleasure from sadness and that they are psychophysiological calmings; thus, psychophysiological responses permit the distinction between chills and tears. Because tears may have a cathartic effect, the functional significance of chills and tears seems to be different.(p.1).*

The above-mentioned studies may shed light on the neurological nature of peak experiences characteristic in GIM. Dopamine action may underlie the rewarding aspects of music, i.e. a pleasure we feel during an anticipated chord resolution, and sudden spurts of nice memories while listening to music. Perhaps dopamine action may also underlie some of the cathartic occurrences often experienced during clinical improvisation?

According to a review by Chanda and Levitin, [54] we could hypothesize that musical activities may increase oxytocin levels. Freeman's research [145] demonstrated that musical engagement that involves emotions, physical activity, and social relationships, may enhance oxytocin release.

Furthermore, a study by Nilsson [146] suggests that listening to a soft, relaxing, and soothing music may increase oxytocin levels during bed rest after a surgery. Other studies [147] found that social vocalizing, or only mother's voice alone seemed to release oxytocin with their children. Moreover, several studies involving animals support the idea that music may play a role in bonding and attachment. For example, singing mice and hamsters that after being injected oxytocin, increased their vocal repertoire during their courting action. [148,149]

Both theories about the roles of oxytocin and dopamine and the findings thus far, regarding their involvement in music processing and perception may provide rationale for music psychotherapy interventions to support bonding. This could also provide a significant rationale for using music in both group psychotherapy practices and community music therapy.

### **Music listening may release melatonin, improving sleep quality**

Insomnia and various sleep disturbances are typical symptoms with music psychotherapy clients suffering PTSD, depression, and many other mental health issues. A decrease of melatonin impacts the sleep-wake cycle. According to a study, [150] melatonin concentration in serum was increased significantly with Alzheimer's clients, after music therapy consisting of playing, drumming or singing together. The levels were also found to increase further at 6 weeks follow-up. As a behavioural outcome, the participants experienced relaxed and calm mood. Although the study had several limitations, such as the small number of participants and absence of a placebo control group, the results are thought-provoking and may give a rationale to encourage psychotherapy clients who suffer from insomnia to listen to relaxing music or play an instrument before going to bed.

There are several studies involving the use of musical engagement for the treatment of insomnia. The findings of Jespersen and Vuust's [151] review that included 6 studies [152,153,154,155,156,157] examining the effect of music listening, and suggest that music may be effective for improving subjective sleep quality in adults suffering with insomnia symptoms

### **Closing thoughts**

In music psychotherapy we try to improve the quality of life in a diverse clinical population with music. Current neuroscience research shows that music not only stimulates the brain, but additionally may influence plasticity.

There are over twenty neuroimaging studies indicating various specific brain changes after different psychotherapy modalities with clients suffering PTSD, [158] anxiety, [159,160] borderline personality disorder, [161,162] and depression. [163,164,165,166] Karlsson's [167] comparative study shows that any change in our psychological processes is



reflected by changes in the functions or structures of the brain. fMRI and PET scanning suggest that even our very subjective experiences may affect the brain. In light of research results suggesting that verbal psychotherapy can impact neurological functions in combination with a growing body of research results suggesting the diverse neurological impacts of music, it would be intriguing to conduct a series of tests using fMRI and PET to investigate the effect of music psychotherapy experiences for PTSD, depression, and anxiety. My hypothesis is that including music in the therapeutic process would hasten and hone neurological changes underlying clinical progress as compared to verbal psychotherapy. However to conduct such research we need to acknowledge the limitations of different neuroscience tools as well as limitations in prior research.

In music therapy, we are already using music for almost every conceivable therapeutic need imaginable, including trauma survivors. [168, 169, 170, 171] There are different approaches and interventions available including medical music therapy, [172, 173] and neurologic music therapy. [174] Yet, the current music medicine research could better shape music psychotherapists' work by providing an evidence-based rationale for using music interventions. The current knowledge about music's neurophysiological impact could better support music therapy practices in future. Furthermore, it could provide wider access to available research grants supporting ground breaking evidence-based research using the newest technologies available.

Music medicine binoculars will continue enlightening my clinical music psychotherapy practice by providing new reasoning to rationalize the underlying mechanisms of the therapeutic power of music experienced in music psychotherapy when working with traumatized individuals.

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