Music Therapy & Neuroscience: Opportunities & Challenges

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Note to those accessing the slides online...

• To read the full open access paper version of this presentation go to: https://voices.no/index.php/voices/article/view/872/720
Modern Neuroscience

- study of the nervous system at a molecular, cellular and systems level
- Drawing on cellular and systems models, neuropsychology, cognitive, behavioural & social neuroscience are disciplines of particular interest to music therapists
- E.g. how neural systems relate to each other to generate a range of behaviours or cognitive functions such as memory, attention and language
Music Therapy

• NHS registered profession under HCPC governance

• Improvisation, song writing, receptive, functionally oriented techniques (gait, aphasia etc)

• +ve Cochrane reviews for neuro-rehabilitation, schizophrenia, depression..
Music Medicine

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Perception of basic acoustic cues (e.g., pitch, intensity, temporal variation, motion, location)

Perception of higher-order musical features (e.g., melody, harmony, tonality, rhythm)

Focusing and keeping track of music in time (attention, working memory)

Recognizing music and recalling associated memories (episodic and semantic memory)

Music evoked emotions and experiencing pleasure and reward
The Neurochemistry of music
Chanda & Leviten 2013

<table>
<thead>
<tr>
<th>reward, motivation and pleasure</th>
<th>dopamine and opioids</th>
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<td>stress and arousal</td>
<td>cortisol</td>
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<tr>
<td>immunity</td>
<td>serotonin</td>
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<td>social affiliation</td>
<td>oxytocin</td>
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Structural change in the musician brain

Brain areas found to be enlarged in musicians in MRI studies (Münte et al 2002)

**Red:** primary motor cortex

**Yellow:** planum temporale

**Orange:** anterior part of the corpus callosum
Large-scale brain networks emerge from dynamic processing of musical timbre, key and rhythm. 


https://www.youtube.com/watch?v=ZPYyqUnQJ3I

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Musical memory preservation in Dementia
Jacobson et al. 2015

Objective scientific evidence for musical interventions that could enhance the well-being of dementia sufferers by engaging the ‘healthy’ part of the brain, where strong connections between music and meaningful autobiographical moments, identity and self-expression may lie.
Girl woken from coma after listening to Adele
A seven year old girl suffering from a brain haemorrhage woke up from a week-long coma after her mother sang her Adele songs.
### Table 1.2. Definitions of disorders of consciousness.

| Coma                  | A state of unrousable unresponsiveness, lasting more than 6 hours in which a person:  
|                       | - cannot be awakened  
|                       | - fails to respond normally to painful stimuli, light or sound  
|                       | - lacks a normal sleep–wake cycle, and  
<table>
<thead>
<tr>
<th></th>
<th>- does not initiate voluntary actions.</th>
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<tr>
<td><strong>Vegetative state (VS)</strong></td>
<td>A state of wakefulness without awareness in which there is preserved capacity for spontaneous or stimulus-induced arousal, evidenced by sleep–wake cycles and a range of reflexive and spontaneous behaviours.</td>
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| **Minimally conscious state (MCS)** | A state of severely altered consciousness in which minimal but clearly discernible behavioural evidence of self- or environmental awareness is demonstrated.  
\[\text{MCS is characterised by inconsistent, but reproducible, responses above the level of spontaneous or reflexive behaviour, which indicate some degree of interaction with their surroundings.}\]
Relationship between arousal and awareness

Healthy

Coma

VS

MCS

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Laureys et al., 2005
Relationship between arousal and awareness

Laureys et al., 2005
Relationship between arousal and awareness

Healthy

Arousal

Awareness

Coma

Arousal

Awareness

VS

Arousal

Awareness

MCS

Arousal

Awareness

Laureys et al., 2005

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Music Therapy Rehabilitation with Disorders of Consciousness

• Using behavioural, EEG and ANS measures to explore potential of music therapy to support the rehabilitation process for PDOC patients and provide prognostic indicators

Further reading...

Open Access Web Links:

To the paper version of this presentation, with all references:
https://voices.no/index.php/voices/article/view/872/720

To the main O’Kelly et al. study on Music Therapy & Disorders of Consciousness

To Melbourne Uni Mooc ‘6 ways music can change your life’
https://www.coursera.org/learn/music-life

To the E book ‘Dialogues in Music Therapy and Music Neuroscience
Acknowledgements

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Dr Sophie Duport

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