

Music Therapy & Neuroscience: Opportunities & Challenges

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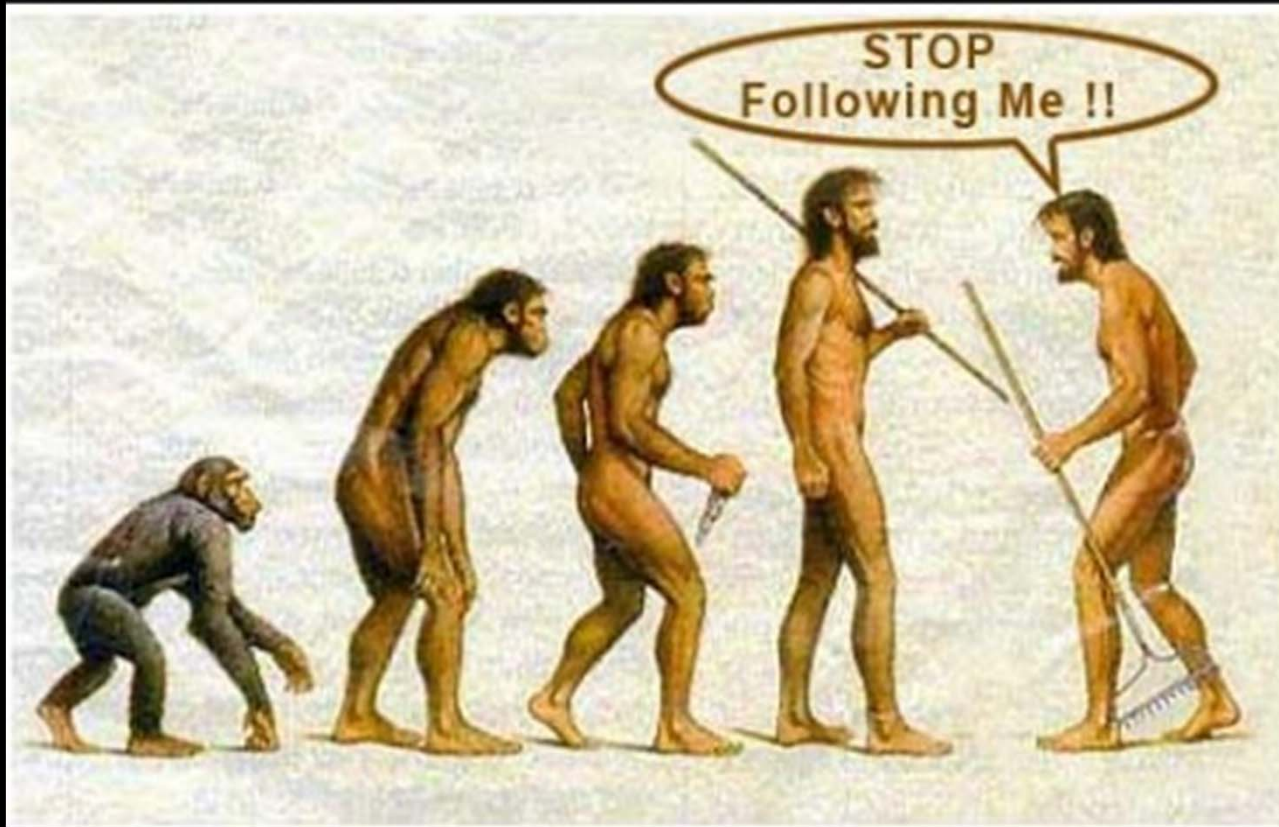
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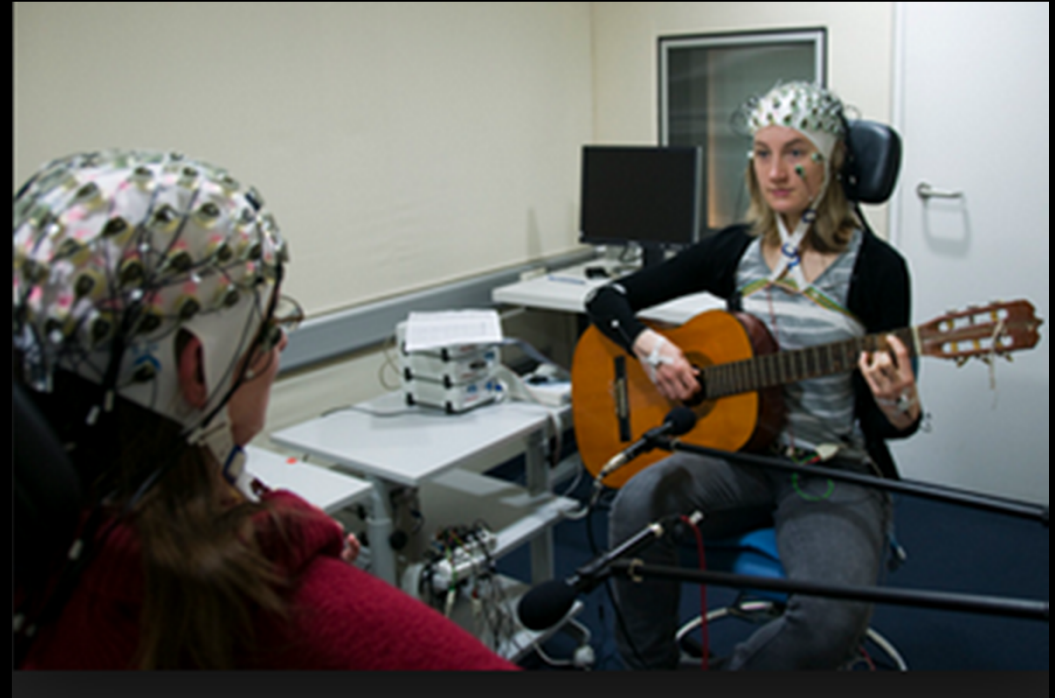
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Modern Neuroscience

- 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

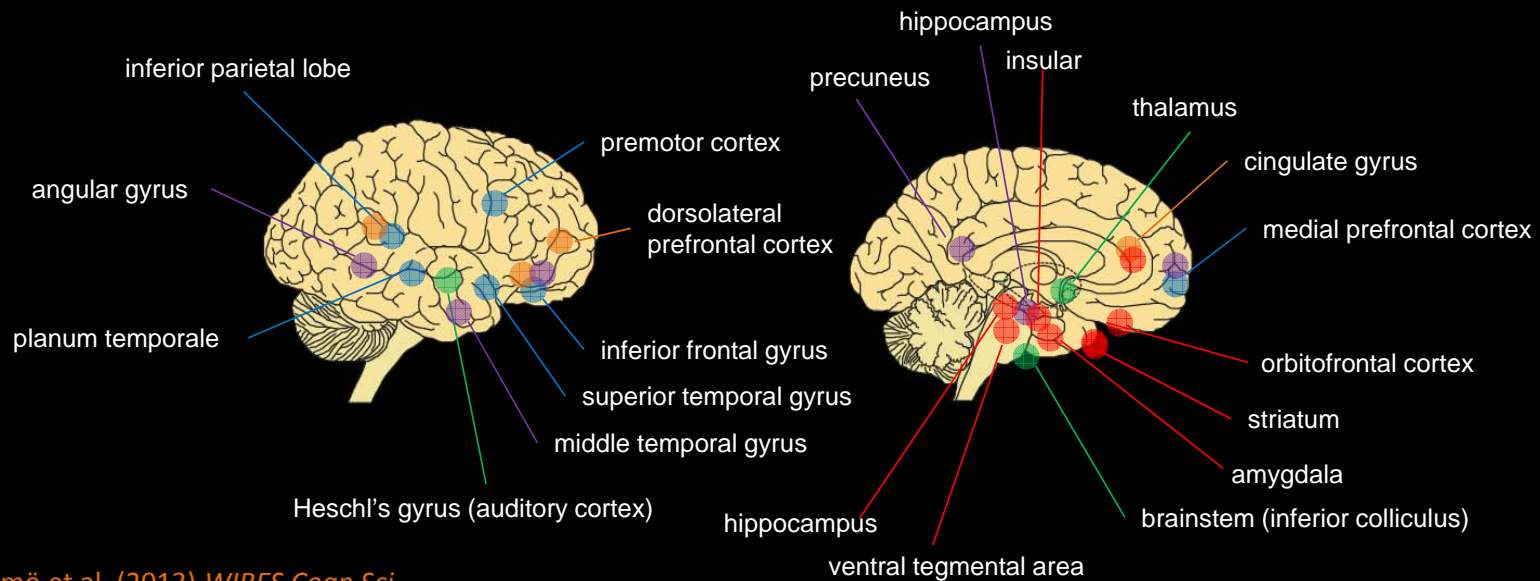
- NHS registered profession under HCPC governance
- Improvisation, song writing, receptive , functionally oriented techniques (gait, aphasia etc)
- +ve Cochrane reviews for neuro-rehabilitation, schizophrenia, depression..



Music Medicine



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Särkämö et al. (2013) *WIREs Cogn Sci*

- 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

Ford et al. (2011) *Neuropsychologia*, Groussard et al. (2010) *NeuroImage*, Janata (2009) *Cereb Cortex*, Peretz et al. (2009) *Ann N Y Acad Sci*, Plailly et al. (2007) *Cereb Cortex* Platel et al. (2003) *NeuroImage*, Saito et al. (2012) *PLoS One*, Satoh et al. (2006) *Am J Neuroradiol*,

The Neurochemistry of music

Chanda & Leviten 2013

reward, motivation and pleasure	dopamine and opioids
stress and arousal	cortisol
immunity	serotonin
social affiliation	oxytocin



DR. STEFAN KOELSCH
NEUROSCIENTIST

<https://www.youtube.com/watch?v=68Q5SNBZwMw>

Structural change in the musician brain

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

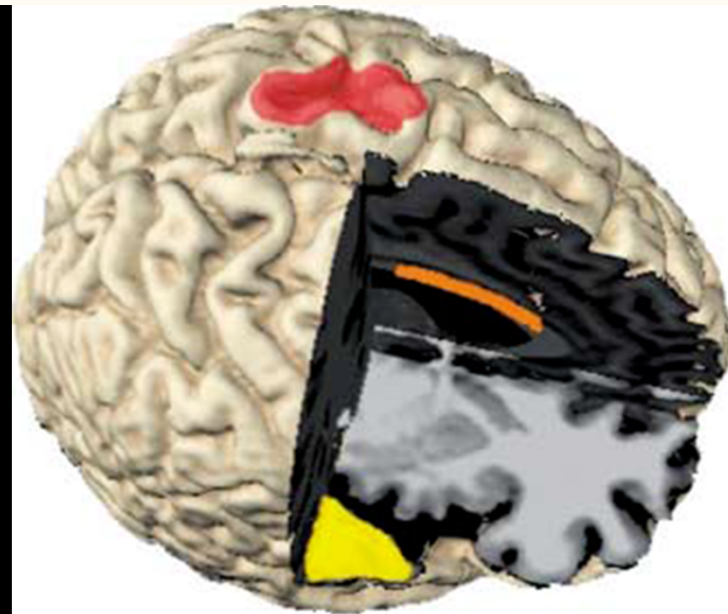
Red: primary motor cortex

Yellow: planum temporale

Orange: anterior part of the corpus callosum

The musician's brain as a model of neuroplasticity

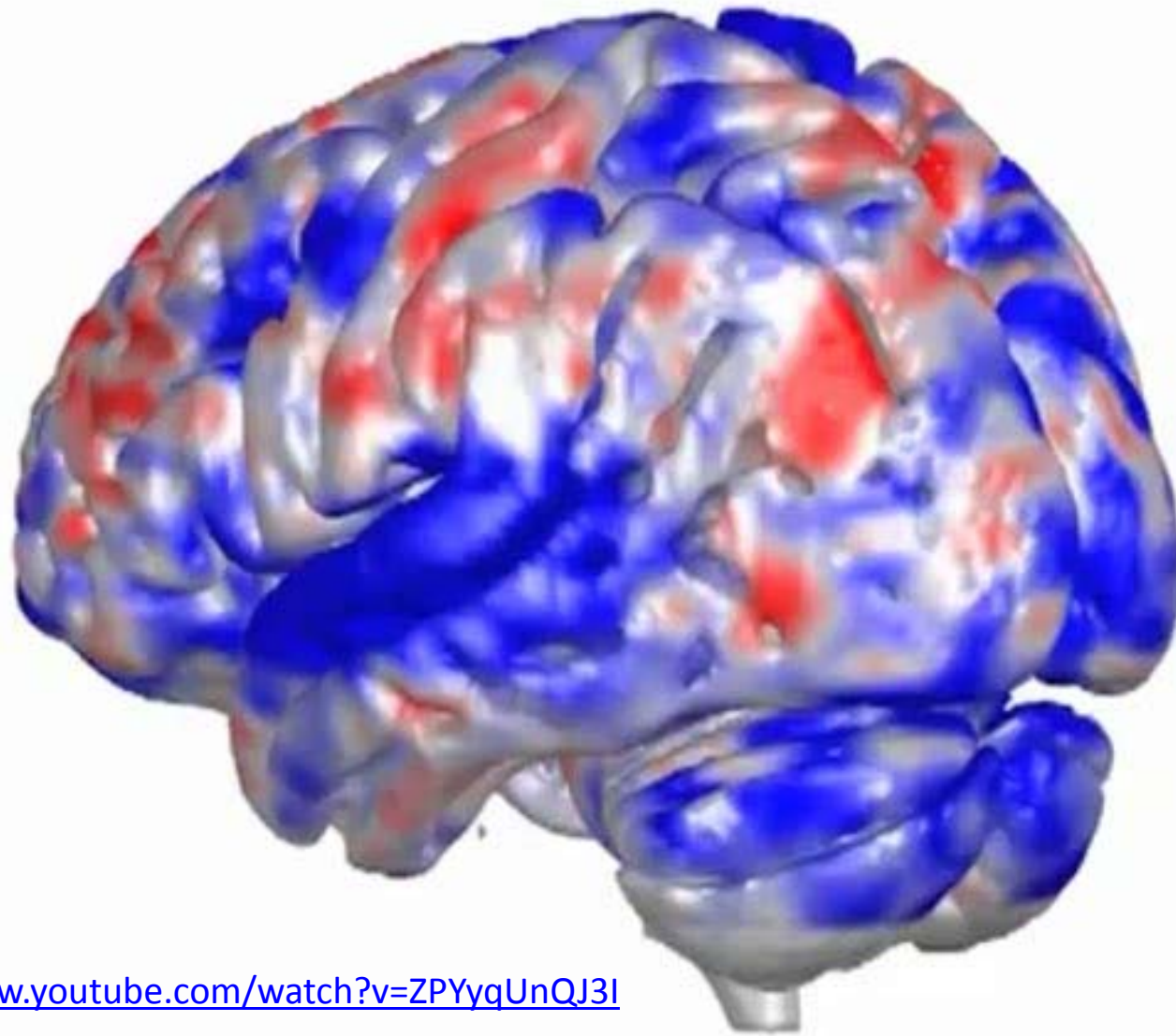
Thomas F. Münte, Eckart Altenmüller and Lutz Jäncke



Alluri V,
Toiviainen P,
Jääskeläinen IP,
Glerean E, Sams
M & Brattico E.

Large-scale brain
networks
emerge from
dynamic
processing of
musical timbre,
key and rhythm

NeuroImage
(2012),
doi:10.1016/j.neuroimage.2011.
11.019 (



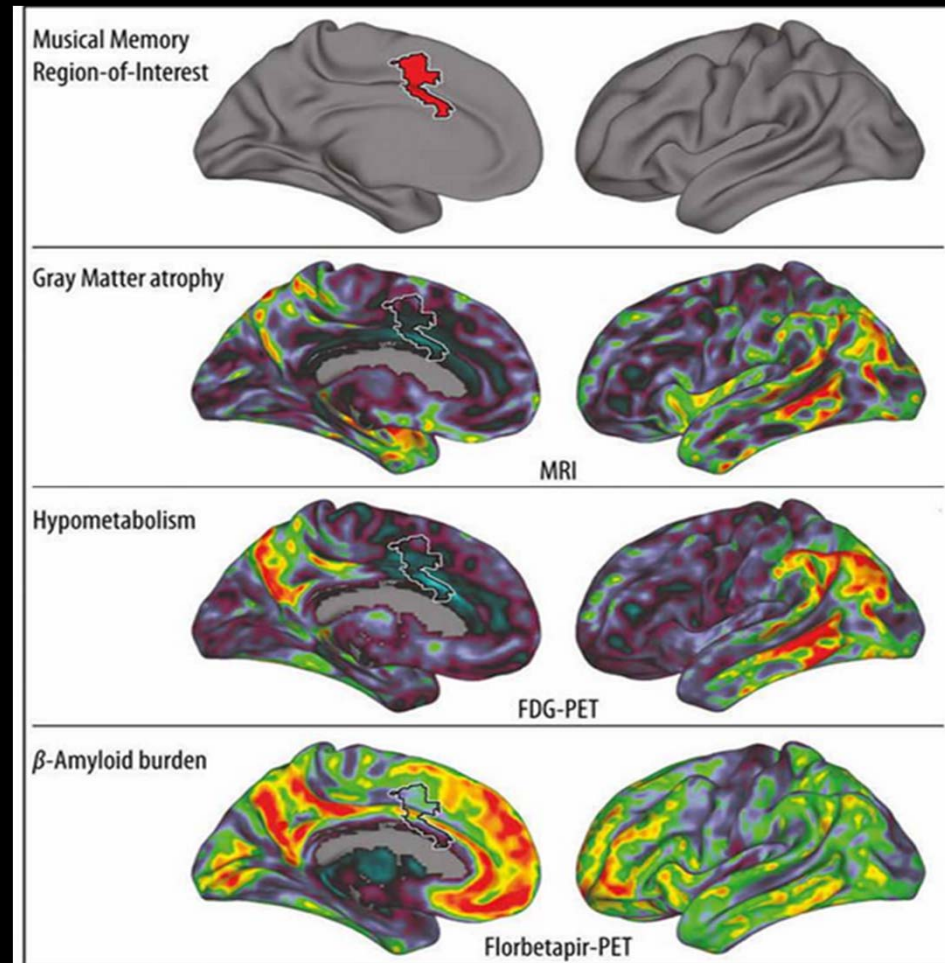
<https://www.youtube.com/watch?v=ZPYyqUnQJ3I>

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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.



The Telegraph

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.

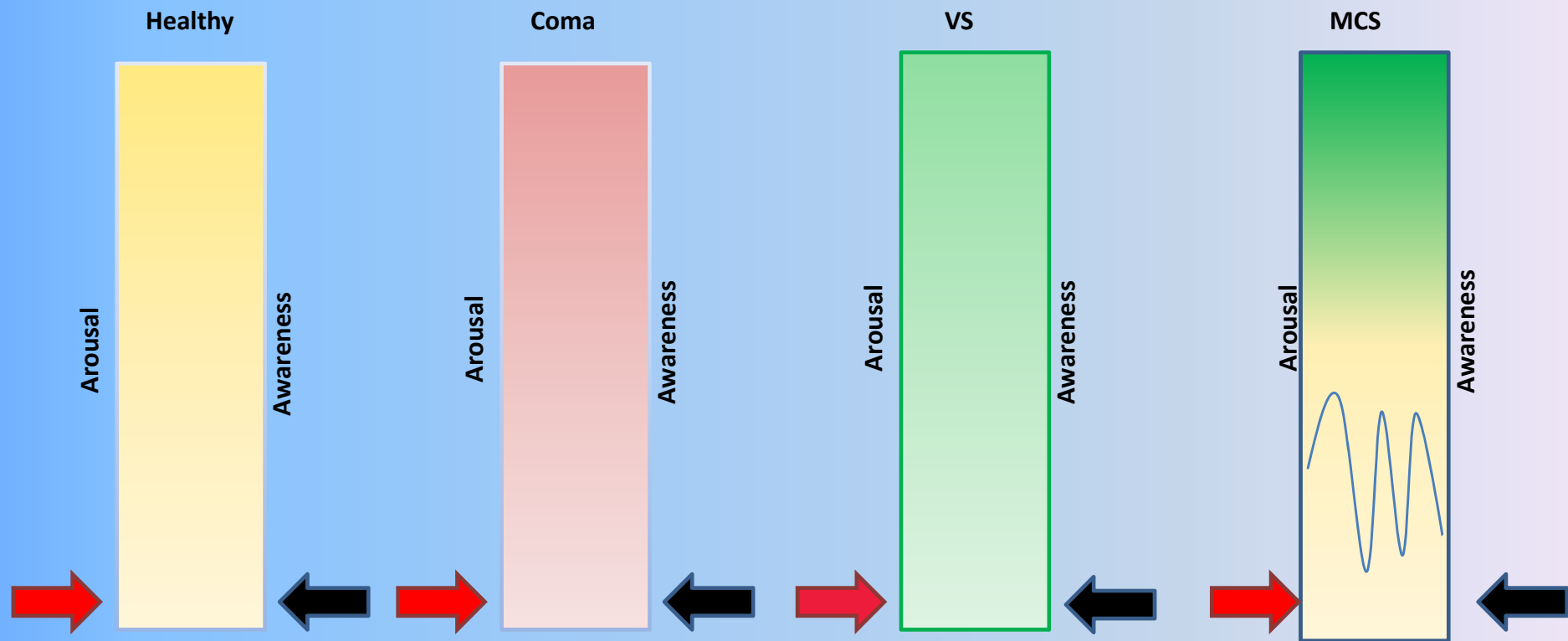


Prolonged DOC (4 weeks)

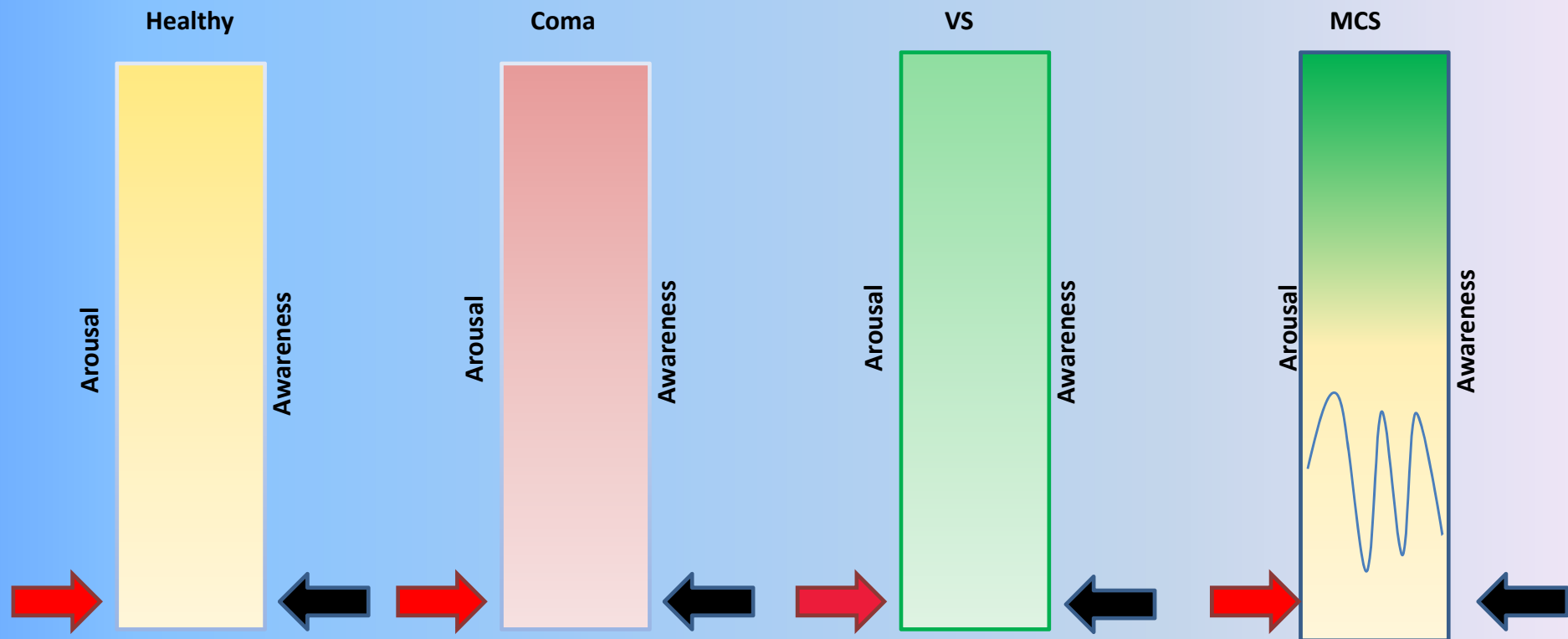
Table 1.2. Definitions of disorders of consciousness.

Coma (Absent wakefulness and absent awareness)	A state of unrousable unresponsiveness, lasting more than 6 hours in which a person: <ul style="list-style-type: none">• cannot be awakened• fails to respond normally to painful stimuli, light or sound• lacks a normal sleep–wake cycle, <i>and</i>• does not initiate voluntary actions.
Vegetative state (VS) (Wakefulness with absent awareness)	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. VS is characterised by complete absence of behavioural evidence for self- or environmental awareness.
Minimally conscious state (MCS) (Wakefulness with minimal awareness)	A state of severely altered consciousness in which minimal but clearly discernible behavioural evidence of self- or environmental awareness is demonstrated. ⁵ MCS is characterised by <i>inconsistent, but reproducible</i> , responses above the level of spontaneous or reflexive behaviour, which indicate some degree of interaction with their surroundings.

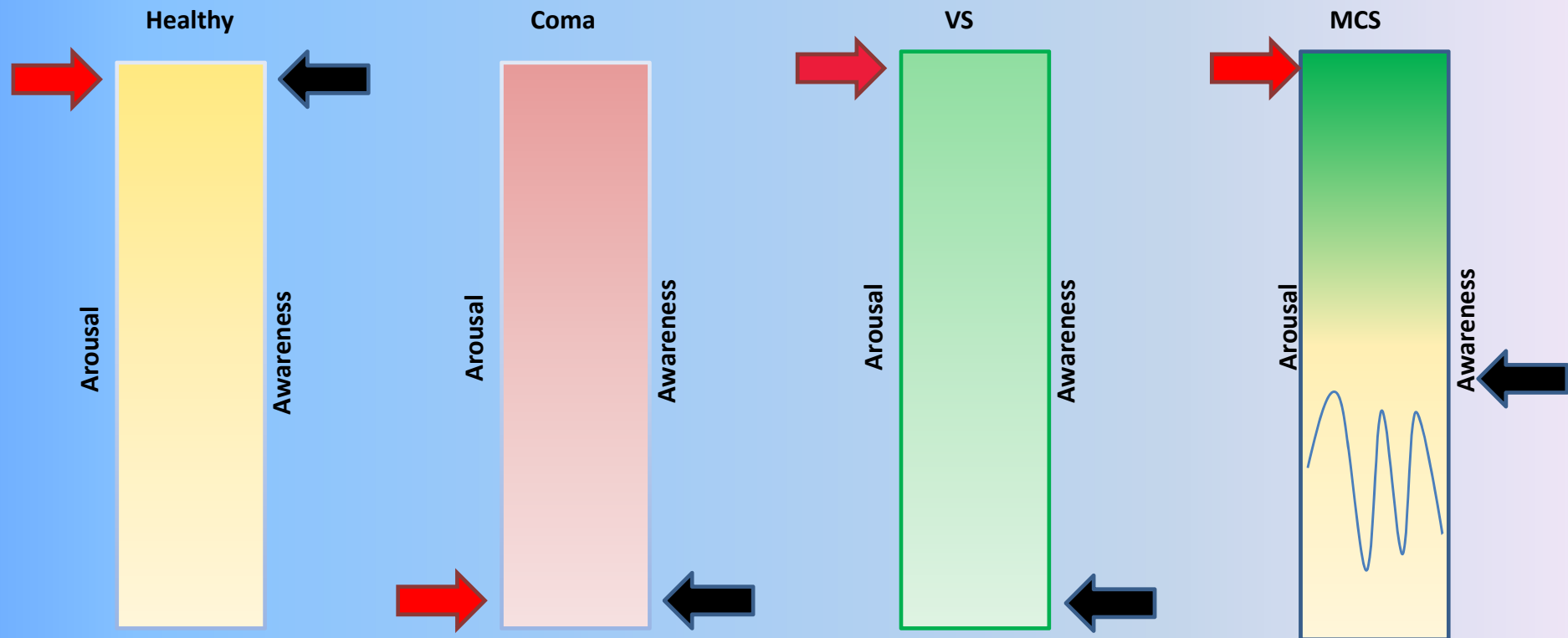
Relationship between arousal and awareness



Relationship between arousal and awareness



Relationship between arousal and awareness



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
- Rappich, R., Palani, R. James, L., O'Kelly, J. (2017) A neurophysiological and behavioural pilot investigation of music therapy in rehabilitation with prolonged disorders of consciousness. *Manuscript In preparation*


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20 HAMMERS HITS



Further reading...



DIALOGUES IN MUSIC THERAPY AND MUSIC NEUROSCIENCE: COLLABORATIVE UNDERSTANDING DRIVING CLINICAL ADVANCES

EDITED BY: Julian O'Kelly, Jörg C. Fachner and Mari Tervaniemi
PUBLISHED IN: Frontiers in Human Neuroscience and Frontiers in Neuroscience

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

<http://journal.frontiersin.org/article/10.3389/fnhum.2013.00884/full>

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

<http://journal.frontiersin.org/researchtopic/3049/dialogues-in-music-therapy-and-music-neuroscience-collaborative-understanding-driving-clinical-advan>

Acknowledgements

Research Clinician: Sophie Rappich
Assistants: Maria Lietor and Christina Cusack



Associate Director of Research
Dr Sophie Duport



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