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Music Therapy

PSYCH32002
Psychology of Music

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1. What is Music Therapy?

"*Music therapy is a healthcare profession in which music is used as a therapeutic medium to address developmental, adaptive, and rehabilitative goals in the areas of speech and language, cognition, sensorimotor, and psychosocial behaviour of individuals with a variety of neurological, psychological, physical, and medical diagnoses.*"

Hurt-Thaut (2016)

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1. What is Music Therapy?

"My wife had gone to bed, and I had forced myself to watch the tape of a movie…At one point in the film…the characters moved down the hallway of a music conservatory, beyond the walls of which, from unseen musicians, came a contralto voice, a sudden soaring passage from the Brahms Alto Rhapsody. This sound, which like all music – indeed, like all pleasure – I had been numbly unresponsive to for months, pierced my heart like a dagger…"

William Styron (in Sacks, 2007, pg.325)

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1. What is Music Therapy?

- The use of music to improve both mental and physical health can be appreciated by most people anecdotally
- Music is often used as a means of **emotion regulation** to influence the way an individual is currently feeling
- For those with mental or physical conditions, music can provide a **means of escape** and can **improve** mental and physical functioning
- Music Therapy is a means of **formalising** these experiences into an **evidence-based** application of music in therapeutic settings

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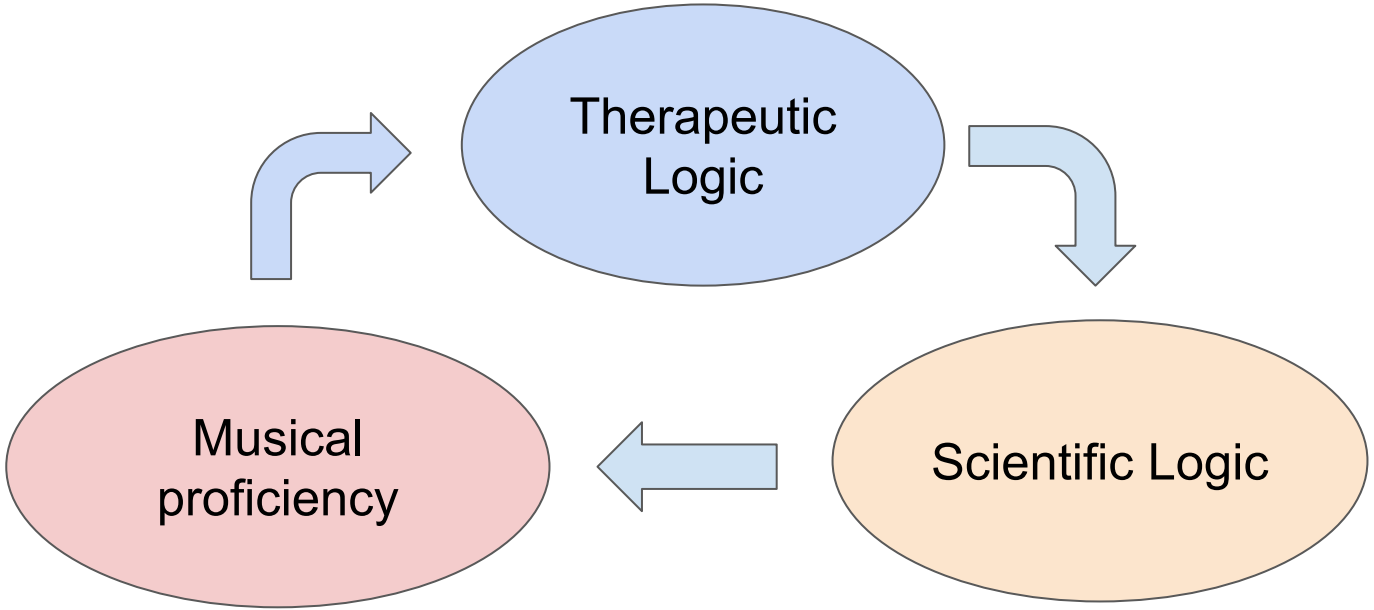
1. What is Music Therapy?

The music therapist requires three core skill sets



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1. What is Music Therapy?

https://www.healthcareers.nhs.uk/explore-roles/allied-health-professionals/roles-allied-health-professions/music-therapist

How to become a music therapist

You need to do an approved Masters degree in music therapy and then register with the Health and Care Professions Council (HCPC).

Entry requirements

You are likely to need a music degree. If you don't, you'll be required to have an undergraduate degree or professional qualification in a relevant field such as social work or teaching. You'll also have to demonstrate your musical proficiency.

It can be helpful to have some pre-training work experience. This does not have to be music-related but you will need to have undertaken a professional role where you have been responsible within a caring profession for the welfare of a vulnerable person.

Degree apprenticeship

A level 7 apprenticeship for arts therapists, including art therapists/art psychotherapists, dramatherapists and music therapists is available but opportunities are currently limited. You'll need to apply for an apprentice position with a health care provider. You can search for vacancies on the NHS Jobs website and Find an Apprenticeship website.

Skills and personal qualities needed

You'll need:

- a high level of musicianship including improvisation skills
- excellent communication skills
- creativity, intuition and imagination
- an ability to relate to people from all backgrounds and to provide a safe environment
- flexibility, adaptability and openness
- resourcefulness
- a non-judgemental approach
- emotional strength and resilience
- sensitivity and maturity and to be able to reflect on their own emotions

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1. What is Music Therapy?

The process is similar to other therapeutic interventions:

Referral	Usually from another healthcare professional, such as a psychologist, therapist or a physician in a hospital
Assessment	Is the client suitable for music therapy? What are their needs? What is their medical history, cognitive abilities, social abilities, physical abilities etc.
Treatment plan	Identify the goals and objectives of the treatment. What are the measurable parameters of the behaviour that needs addressing? What are the criteria for defining improvement?
Documentation of progress	Monitor the quality, efficacy and cost-effectiveness of the treatment whilsts also communicating with other treatment team members.
Evaluation	Has the treatment met its goals?

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1. What is Music Therapy?

The difference with music therapy is that the treatment will involve a variety of different **musical activities**, depending upon the needs of the client:

- *Music listening*
  - Evoking emotions, changing emotional states, focussed attention…
- *Music performance*
  - Self-expression, identification of feelings, appropriate outlets for negative emotions, memory function, self-esteem...
- *Group performance*
  - Socialisation and social participation, non-verbal social interaction…
- *Music and movement*
  - Social interaction, bodily awareness, self-expression, physical exercise…
- *Music and relaxation*
  - Reduction in anxiety, mindfulness, coping skills, focussed attention…

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1. What is Music Therapy?

- It is important to remember that these choices are always **evidence-based** in terms of the latest **scientific understanding** of how music influences **brain** and **behaviour**
- It is still an **open question** about **why** some music therapy interventions are successful, but the important point is that we have **evidence** to suggest they **do work** for some individuals
- Research into music therapy exists in **parallel** with the application of music therapy in clinical settings
- Generally, we want to know (a) if an intervention appears to be successful and (b) what are the mechanisms behind its success in terms of **psychological models** and the **physiology of the brain**

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2. History of Music Therapy

- Evidence for the use of music in health goes back thousands of years, as almost all known societies have used music in connection with healing (Thaut, 2015)
- Music Therapy as we now know it was formalised in the **1940s** after the successful use of music to help rehabilitate veterans from World War II
- The National Association for Music Therapy (NAMT) was established in **1950** and by **1961**, 500 registered music therapists were certified
- In **1964** the *Journal of Music Therapy* was established as an outlet for research into the efficacy and mechanisms behind music therapy
- In **1971** the American Association for Music Therapy (AAMT) was established and later unified with NAMT in **1998** to form the modern American Music Therapy Associated (AMTA)

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3a. Music Therapy and Major Depressive Disorder

- Music has a unique ability to access **affective** and **motivational** systems in the brain (Thaut, 2013)
- Major Depressive Disorder represents changes in **mood**, **motivation** and **pleasure** systems
- Certain depressed patients report using music as a form of **self-medication** to alter mood states (Aselton, 2012) – music is a powerful **coping mechanism**
- Music applied therapeutically may be able to help depressed patients alter the symptoms of their illness and improve their wellbeing

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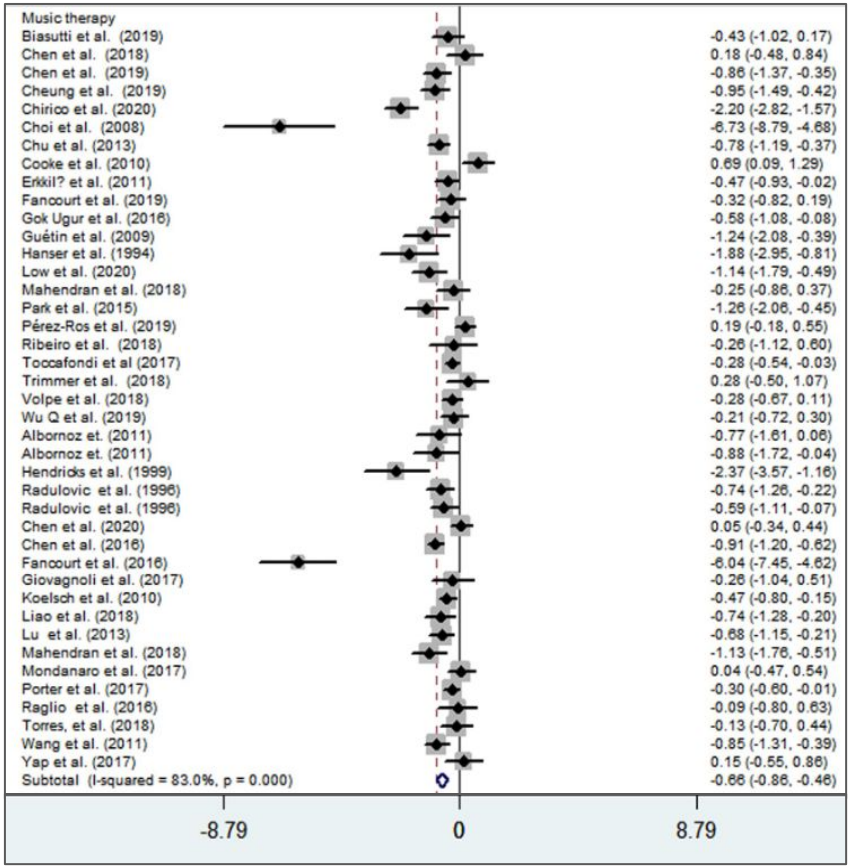
3a. Music Therapy and Major Depressive Disorder

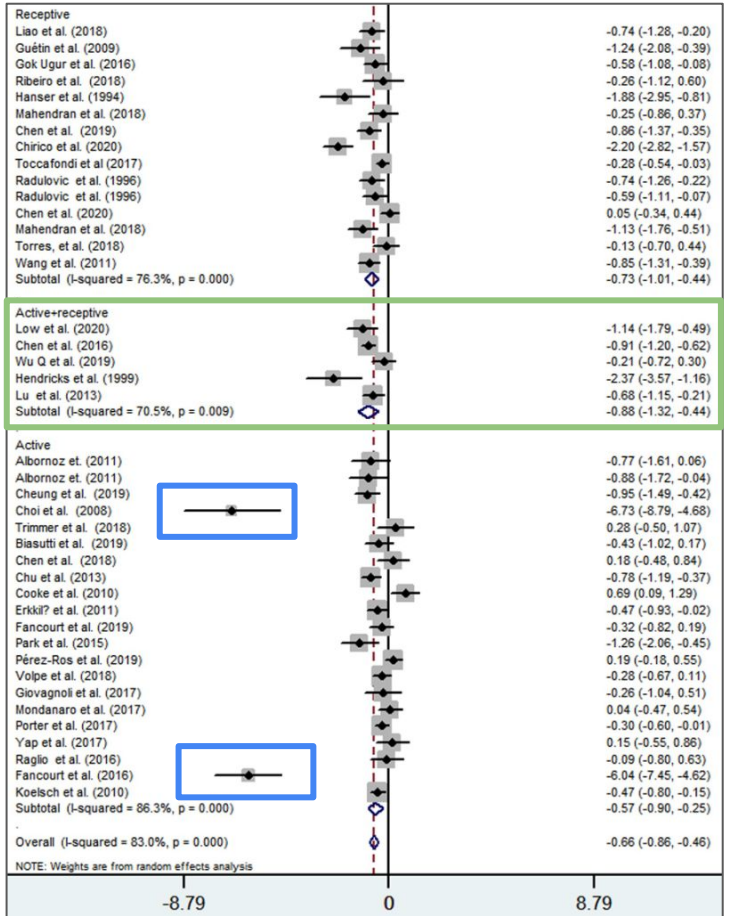
- Music therapy has shown a degree of efficacy in **alleviating** the symptoms of MDD
- Tang et al. (2020) performed a **meta-analysis** of randomised control trials (RCTs) on the effect of music therapy on depression
- They found that across trials music therapy was associated with a **reduction** in depressive symptoms



3a. Music Therapy and Major Depressive Disorder

- The authors also suggested that a combination of **active** (i.e. *creating* music) and **receptive** (i.e. *listening* to music) approaches lead to the **largest** effect with the **lowest** variability

- However:
  - Fewer studies investigated this combination (only 5)
  - The largest individual effects were seen in **active** therapy trials
  - This may suggest that **receptive only** therapies are the least effective



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3a. Music Therapy and Major Depressive Disorder

- The evidence suggests that music therapy is an effective treatment for MDD – almost all trials showed **some reduction** in symptoms compared to controls
- However, what we do not know is the **mechanism of action**
  - This is important so that we can design **more effective** interventions and identify **biomarkers** as a means of understanding what the treatment is doing to the brain
- We have to understand how **music** fits into the modern understanding of **what MDD is**, from a cognitive neuroscientific perspective

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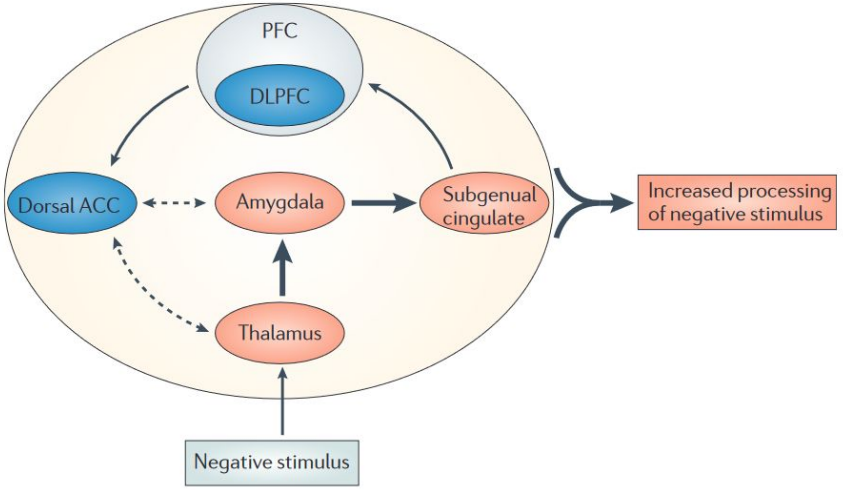
3a. Music Therapy and Major Depressive Disorder

- Disorders such as **Major Depressive Disorder** (MDD) are associated with a **network** of changes in emotion processing regions of the brain
- The model of Disner *et al.* (2011) provides a neurobiological update to Beck's cognitive model of depression
- Several **limbic** and **frontal** regions of the brain are implicated in the biased processing of negative stimuli
- These includes the **amygdala**, **anterior cingulate** (ACC) and regions of the **prefrontal cortex** (PFC)



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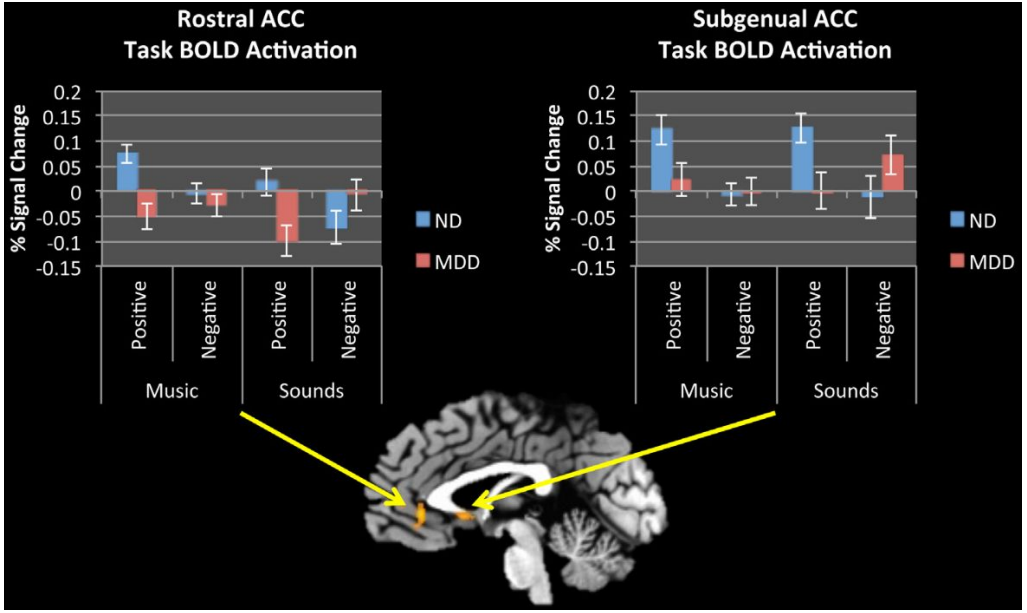
3a. Music Therapy and Major Depressive Disorder

- Neuroimaging studies of those suffering from MDD have demonstrated **differences** in brain responses to music
- Lepping *et al.* (2016) showed differences in the **ACC** between MDD and controls when listening to **positive music**



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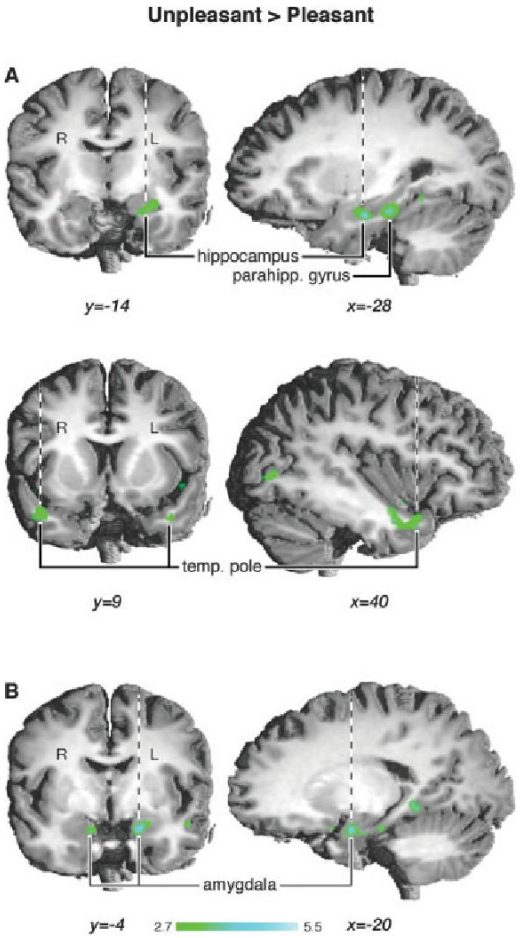
3a. Music Therapy and Major Depressive Disorder

- Neuroimaging studies of those suffering from MDD have demonstrated **differences** in brain responses to music
- A similar picture appears in **remitted** MDD – Aust *et al.* (2013) demonstrate a **reduction** in **ACC activity** when listening to **pleasant music** in remitted MDD versus controls

3a. Music Therapy and Major Depressive Disorder

- Neuroimaging studies have demonstrated that music has effects on virtually **all** emotion processing regions of the brain (Koelsch, Offermanns & Franzke, 2010)
- This includes regions such as the **amygdala**, **hippocampus**, **ACC** and **nucleus accumbens**
- Many interventions to treat MDD aim to **alter the function** of these regions
  - CBT success is associated with changes in the subgenual ACC (sgACC) (Siegle *et al.*, 2006)
  - Deep-brain stimulation for depression targets the sgACC (Mayberg *et al.*, 2005)



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3a. Music Therapy and Major Depressive Disorder

- It is possible that music therapy has a similar effect of “re-training” the brain to respond to emotional stimuli
- A region such as the sgACC is though to provide **top-down** control over affective regions such as the amygdala
  - In non-depressed individuals, this regulates the **preferential response** to **positive** over **negative** stimuli
  - In depression, this is flipped – individuals **over-respond** to **negative** and **under-respond** to **positive**
- Unfortunately, with have little evidence that points to the **precise changes in the brain** that happen after music therapy in MDD

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3b. Music Therapy and Schizophrenia

- Schizophrenia is a serious mental health disorder characterised by **positive**, **negative** and **cognitive** clusters of symptoms
- Positive symptoms:
  - **Excesses** or **distortions** of normal behaviour
    - Psychosis (delusions and hallucinations), paranoia...
- Negative symptoms:
  - An **absence** of normal behaviour
    - Lack of motivation, blunting of emotions, reduced speech…
- Cognitive symptoms:
  - Reduced cognitive capacity
    - Working memory deficits, executive function deficits...

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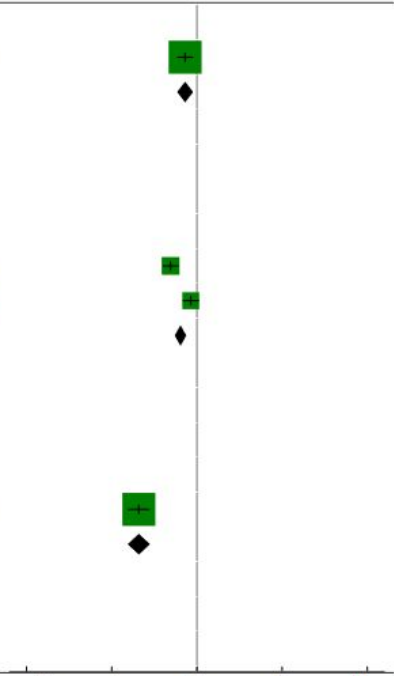
3b. Music Therapy and Schizophrenia

- The **positive** symptoms of Schizophrenia can be readily treated with **antipsychotic** medication
- However, the **negative** and the **cognitive symptoms** do not typical respond to medication
- These symptoms represent the **everyday burden** of living with Schizophrenia – one of the main reasons patients find it difficult to live a normal life
- Like MDD, because some of these symptoms correspond to changes in **affect** and **motivation** – as well as changes in **memory** and **executive function** – it is possible that music therapy could be beneficial

3b. Music Therapy and Schizophrenia

General mental state

Study or subgroup	Music therapy N	Music therapy Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Fixed, 95% CI	Weight	Std. Mean Difference Fixed, 95% CI
1.2.1 short term							
Lu 2013	35	34.5 (8.9)	40	42 (12.1)		100%	-0.69[-1.16,-0.23]
Subtotal ***	**35**		**40**			**100%**	**-0.69[-1.16,-0.23]**
Heterogeneity: Not applicable							
Test for overall effect: Z=2.91(P=0)							
1.2.2 medium term							
Mao 2013	45	39.6 (4.4)	45	48.7 (7)		51.16%	-1.55[-2.02,-1.07]
Talwar 2006	28	63 (13.6)	41	67.9 (13.4)		48.84%	-0.36[-0.84,0.12]
Subtotal ***	**73**		**86**			**100%**	**-0.97[-1.31,-0.63]**
Heterogeneity: $Tau^2=0$; $Chi^2=11.77$, df=1(P=0); $I^2=91.5\%$							
Test for overall effect: Z=5.6(P<0.0001)							
1.2.3 long term							
Mao 2013	45	35.6 (3.2)	45	47.2 (3.5)		100%	-3.41[-4.07,-2.76]
Subtotal ***	**45**		**45**			**100%**	**-3.41[-4.07,-2.76]**
Heterogeneity: Not applicable							
Test for overall effect: Z=10.19(P<0.0001)							
Test for subgroup differences: $Chi^2=49.77$, df=1 (P<0.0001), $I^2=95.98\%$							

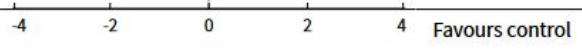


Mössler *et al.* (2011)

3b. Music Therapy and Schizophrenia

Negative symptoms

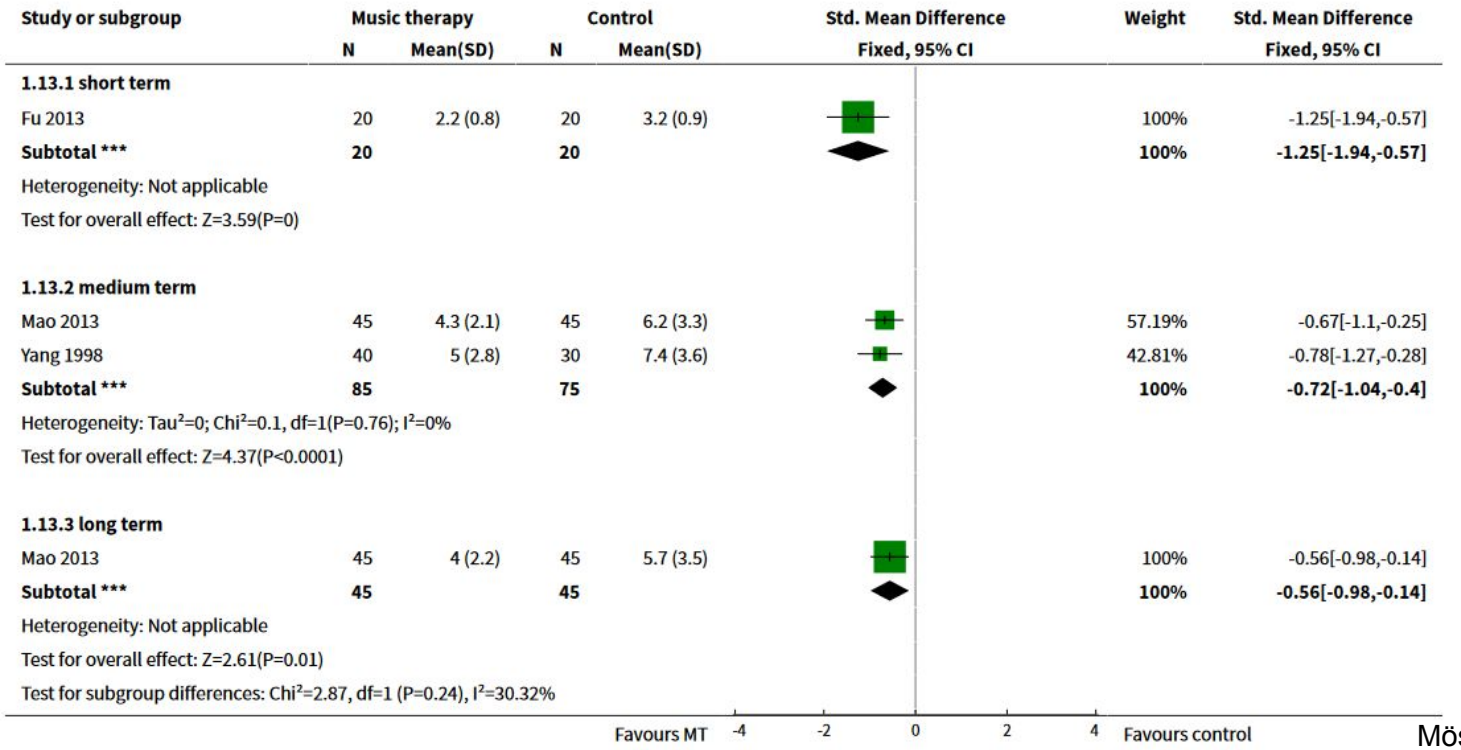
Study or subgroup	Music therapy N	Music therapy Mean(SD)	Control N	Control Mean(SD)	Std. Mean Difference Fixed, 95% CI	Weight	Std. Mean Difference Fixed, 95% CI
1.4.1 short term							
Gold 2013	30	43.7 (21.9)	23	40.1 (20.5)		17.74%	0.17[-0.38,0.71]
He 2005	30	49.5 (24.5)	30	60.4 (29.4)		20.09%	-0.4[-0.91,0.11]
Mohammadi 2012	62	37 (13.4)	34	45.4 (12.9)		28.68%	-0.63[-1.06,-0.2]
Tang 1994	38	27.5 (14.5)	38	46.5 (20.3)		22.59%	-1.07[-1.55,-0.58]
Ulrich 2007	21	-0.5 (0.8)	13	-0.3 (1)		10.9%	-0.23[-0.92,0.47]
Subtotal ***	**181**		**138**			**100%**	**-0.5[-0.73,-0.27]**
Heterogeneity: Tau^2=0; Chi^2=12.15, df=4(P=0.02); I^2=67.07%							
Test for overall effect: Z=4.24(P<0.0001)							
1.4.2 medium term							
Gold 2013	28	43.9 (22)	21	33.1 (22.3)		29.33%	0.48[-0.09,1.05]
Qu 2012	29	69.7 (20)	29	89.9 (20)		32.22%	-1[-1.55,-0.45]
Yang 1998	40	38 (17)	30	56.8 (21.6)		38.45%	-0.97[-1.47,-0.47]
Subtotal ***	**97**		**80**			**100%**	**-0.55[-0.87,-0.24]**
Heterogeneity: Tau^2=0; Chi^2=17.66, df=2(P=0); I^2=88.67%							
Test for overall effect: Z=3.5(P=0)							
Test for subgroup differences: Chi^2=0.09, df=1 (P=0.77), I^2=0%							



Mössler *et al.* (2011)

3b. Music Therapy and Schizophrenia

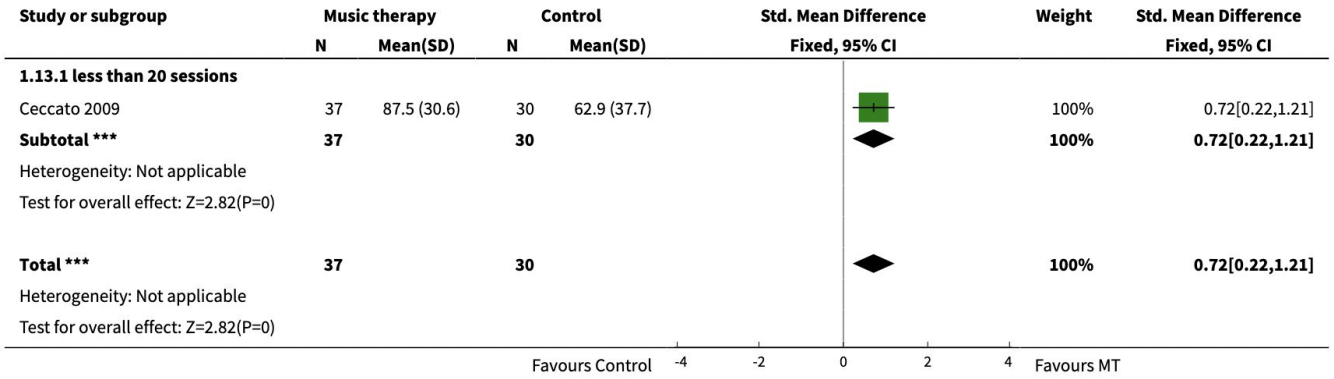
Social functioning



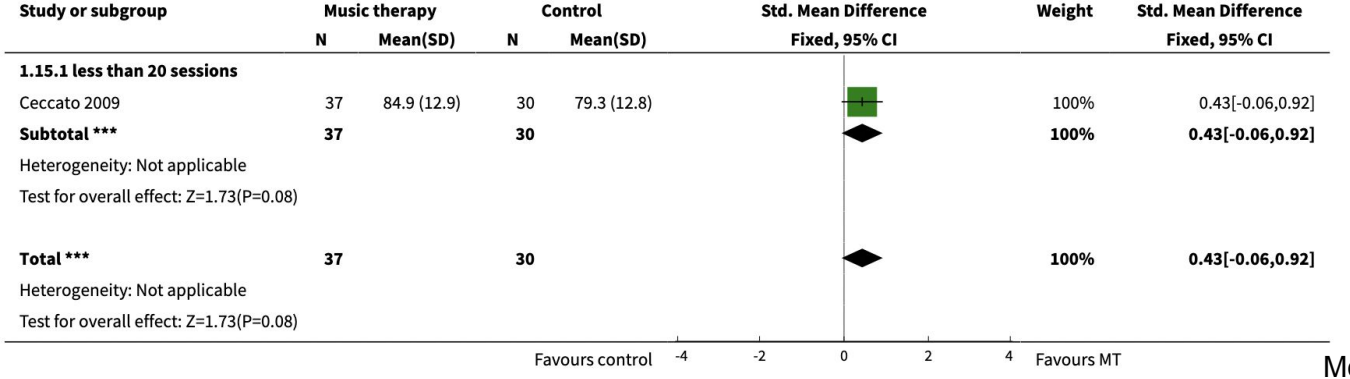
Mössler *et al.* (2011)

3b. Music Therapy and Schizophrenia

Attention



Memory



Mössler *et al.* (2011)

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3b. Music Therapy and Schizophrenia

- The evidence suggests that music therapy may be effective at helping with symptoms of Schizophrenia – particularly the **negative** and **cognitive** symptoms that are hard to treat
- As with MDD, the mechanism by which this is achieved remains uncertain
- Neurocognitive models are **less certain** in Schizophrenia - in part because it is difficult to study symptoms like **hallucinations** and **delusions** using neuroimaging methods
- The most consist imaging evidence is for a **reduction** in grey matter in Schizophrenia

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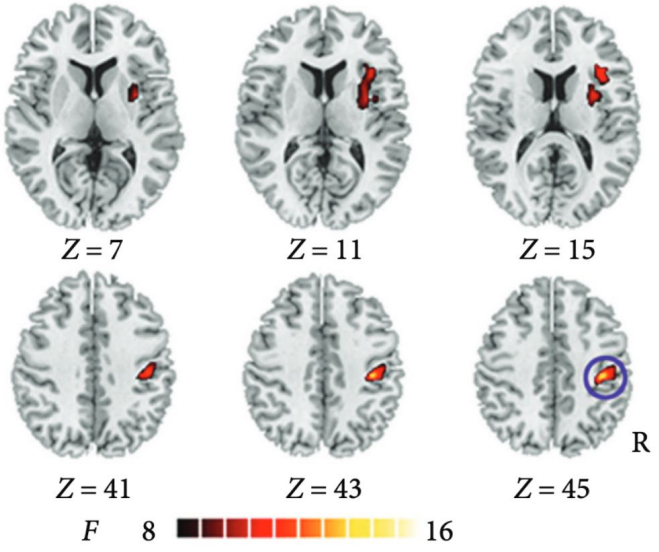
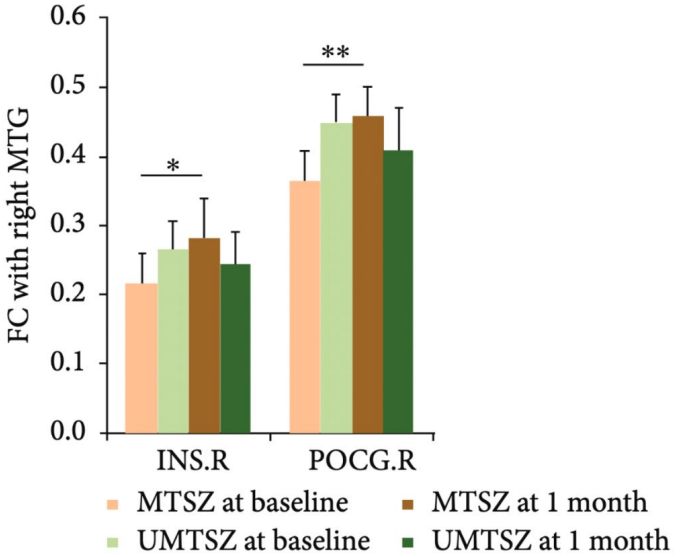
3b. Music Therapy and Schizophrenia

- In terms of **cognitive symptoms**, neuroimaging studies have implicated dysfunction in both **frontal** and **temporal** cortices (Aleman, 2014)
- In terms of hallucinations, the **superior temporal gyrus** has been implicated, as well as regions such as the **ACC** and the **inferior frontal gyrus** (Aleman, 2014)
- In terms of **emotional blunting**, similar regions to those in MDD have been implicated, such as the **amygdala**, although some meta-analyses have suggested that the **amygdala** does not respond differently in patients with Schizophrenia (Anticevic *et al.*, 2012)

3b. Music Therapy and Schizophrenia

- An fMRI study investigating music therapy in Schizophrenia revealed improved connectivity between the **middle temporal gyrus -> precentral gyrus**, and **middle temporal gyrus -> insula** (Yang *et al.*, 2018)





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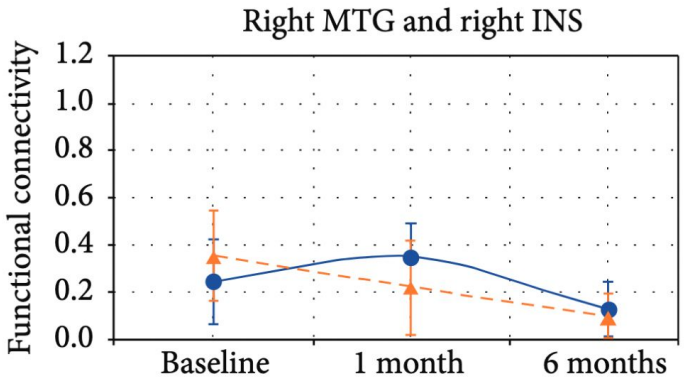
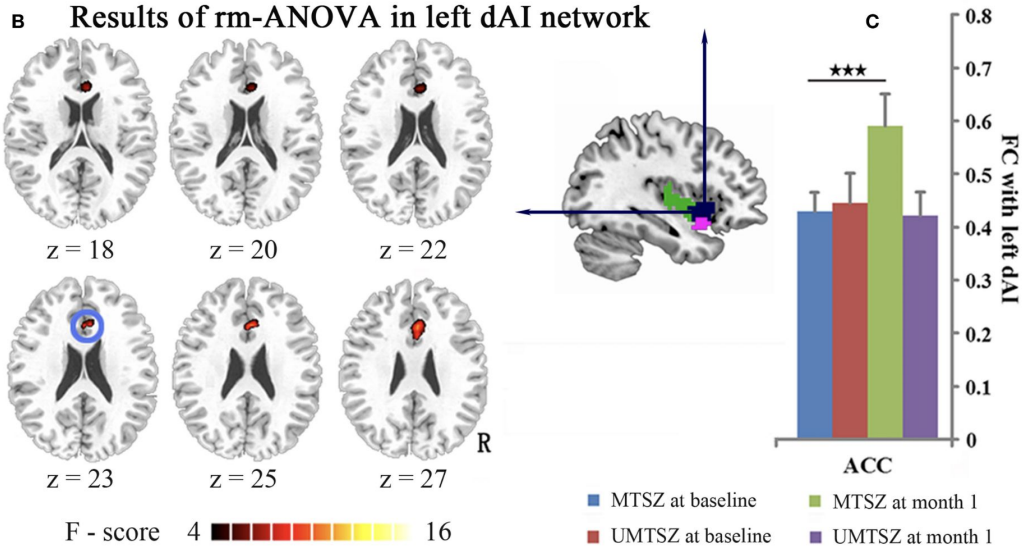
3b. Music Therapy and Schizophrenia

- An fMRI study investigating music therapy in Schizophrenia revealed improved connectivity between the **middle temporal gyrus -> precentral gyrus**, and **middle temporal gyrus -> insula** (Yang *et al.*, 2018)
- The authors suggest this may indicate an improvement in the **coupling** between **attention** and **emotion** processing regions of the brain
- Interestingly, this effect was stable for **1 month** after the intervention, but had **disappeared** by **6 months**



3b. Music Therapy and Schizophrenia

- Similar results were reported by He *et al.* (2018) in terms of improved connectivity between the **insula** and the **ACC** after a music therapy intervention
- This fits with the idea of Schizophrenia as a **dysconnection** disorder (Friston *et al.*, 2016)
- Music therapy may help by re-establishing connections between key regions of the brain



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3b. Music Therapy and Schizophrenia

- Much like MDD, we have evidence that music therapy is **effective** for **Schizophrenia**, but the neural mechanisms remain **speculative** at best
- Music therapy appears to work best for **negative** and **cognitive** symptoms and so could be considered as an **adjunct** to normal treatment
- Some preliminary evidence suggests that music therapy may help be **strengthening** and **improving connections** between certain brain regions involved in **attention** and **emotional** processing
- However, the evidence is currently **very limited**

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3c. Music Therapy and Dementia

- Dementia is a general term for diseases and conditions characterised by **progressive impairment** of certain cognitive functions, such as **memory** and **language**
  - *Alzheimer's disease*, *frontotemporal dementia*, *vascular dementia*…
- There are **no cures** for dementia and very **limited** treatment options – generally just managing symptoms
- Several studies have shown that people with dementia **enjoy music**, and their ability to respond to music is **preserved** even when verbal communication is lost
  - Music processing regions appear to be **spared** from the same degree of decline as other regions in dementia
- This suggests that music may be of benefit in treating dementia

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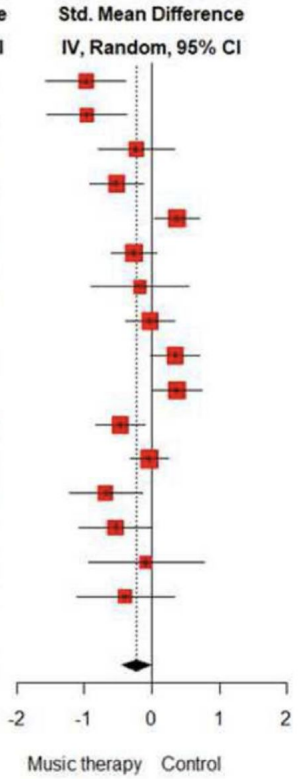
3c. Music Therapy and Dementia

Cognitive function

	Music therapy			Control				Std. Mean Difference
Study	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Ceccato et al 2012 (listen to music)MPD	-1.23	1.6700	27	0.22	1.1700	23	5.4%	-0.98 [-1.57; -0.39]
Ceccato et al 2012 (listent to music) MPI	-1.07	1.4100	27	0.35	1.5000	23	5.4%	-0.96 [-1.55; -0.37]
Ceccato et al. 2012 (listen to music) MMSE	-0.67	2.2700	27	0.00	3.4000	23	5.6%	-0.23 [-0.79; 0.33]
Chu et al 2014 (play,sing,listen to music)	-2.92	6.5300	49	-0.01	4.3600	51	7.0%	-0.52 [-0.92; -0.12]
Doi et al. 2017 (play music)	0.46	2.1000	67	-0.36	2.3000	67	7.5%	0.37 [0.03; 0.71]
Doi et al. 2017 (dance)	-0.29	2.6000	67	0.36	2.3000	67	7.5%	-0.26 [-0.60; 0.08]
Guétin et al. 2009 (listen to music)	0.20	4.4000	15	0.90	3.3000	15	4.5%	-0.18 [-0.89; 0.54]
Han et al 2017 (RMBPC-R)	0.53	6.2900	60	0.70	6.2200	60	7.4%	-0.03 [-0.38; 0.33]
Han et al 2017 MCET (ADAS-Cog)	1.95	3.6830	60	0.64	3.8500	60	7.3%	0.35 [-0.02; 0.71]
Han et al 2017 MCET (RMBPC-F)	1.73	7.0000	60	-0.93	7.1200	60	7.3%	0.37 [0.01; 0.74]
Han et al. 2017 MCET (MMSE)	-0.85	2.0200	60	0.17	2.3200	60	7.3%	-0.47 [-0.83; -0.10]
Lyu et al 2018 (singing)	0.11	4.0000	97	0.24	4.1500	95	8.0%	-0.03 [-0.31; 0.25]
Särkämö et al. 2014 (listen to music)	-0.50	2.2600	29	1.20	2.6400	28	5.8%	-0.68 [-1.22; -0.15]
Särkämö et al. 2014 (sing)	-0.20	2.5000	27	1.20	2.6400	28	5.8%	-0.54 [-1.08; 0.00]
Särkämö et al. 2016a (listen to music)	1.00	4.6000	8	1.40	4.8000	16	3.7%	-0.08 [-0.93; 0.77]
Särkämö et al. 2016a (sing)	-0.30	3.4000	14	1.40	4.8000	16	4.4%	-0.39 [-1.12; 0.33]
Total (95% CI)			**694**			**692**	**100.0%**	**-0.23 [-0.44; -0.02]**

Heterogeneity: $Tau^2 = 0.1234$; $Chi^2 = 53.21$, df = 15 ($P < 0.01$); $I^2 = 72\%$

Z = -2.15 (P = 0.03)



Moreno-Morales *et al.* (2020)

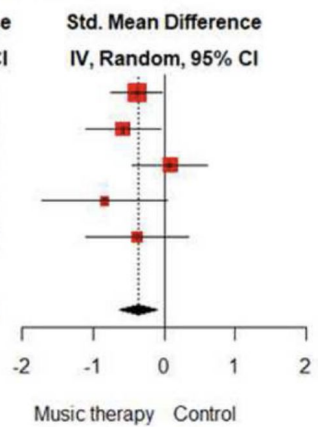
3c. Music Therapy and Dementia

Quality of Life

Study	Music therapy Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Han et al 2017 (MCET)	-1.47	5.5300	60	0.38	3.9700	60	38.9%	-0.38 [-0.74; -0.02]
Särkämö et al. 2014 (listen to music)	-3.00	4.8000	29	0.00	5.4000	28	20.6%	-0.58 [-1.11; -0.05]
Särkämö et al. 2014 (sing)	0.50	5.9000	27	0.00	5.4000	28	20.7%	0.09 [-0.44; 0.62]
Särkämö et al. 2016a (listen to music)	-1.40	3.8000	8	1.60	3.3000	16	8.0%	-0.84 [-1.72; 0.05]
Särkämö et al. 2016a (sing)	0.10	4.5000	14	1.60	3.3000	16	11.7%	-0.37 [-1.10; 0.35]
Total (95% CI)			**138**			**148**	**100.0%**	**-0.36 [-0.62; -0.10]**

Heterogeneity: $Tau^2 = 0.0105$; $Chi^2 = 4.52$, df = 4 (P = 0.34); $I^2 = 12\%$

Z = -2.74 (P < 0.01)

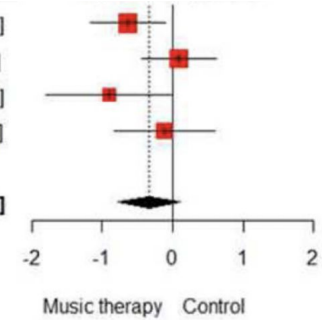


Quality of Life (6 months after treatment)

Särkämö et al. 2014 (listen to music)	-2.00	3.7700	29	1.00	5.4600	28	30.4%	-0.63 [-1.17; -0.10]
Särkämö et al. 2014 (sing)	1.50	5.3600	27	1.00	5.4600	28	30.6%	0.09 [-0.44; 0.62]
Särkämö et al. 2016a (listen to music)	-2.40	2.9000	8	1.60	4.8000	16	16.8%	-0.90 [-1.79; -0.01]
Särkämö et al. 2016a (sing)	1.00	5.6000	14	1.60	4.8000	16	22.3%	-0.11 [-0.83; 0.61]
Total (95% CI)			**78**			**88**	**100.0%**	**-0.34 [-0.78; 0.10]**

Heterogeneity: $Tau^2 = 0.0919$; $Chi^2 = 5.59$, df = 3 (P = 0.13); $I^2 = 46\%$

Z = -1.52 (P = 0.13)



Moreno-Morales *et al.* (2020)

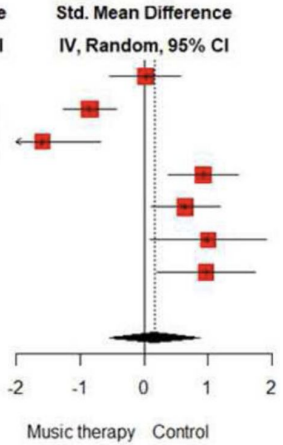
3c. Music Therapy and Dementia

Depression

Study	Music therapy Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Ceccato et al 2012 (listen to music)	-0.86	3.3400	27	-0.95	4.9400	23	14.9%	0.02 [-0.53; 0.58]
Chu et al 2014 (play,sing,listen to music)	-9.17	7.1200	49	-1.92	9.5900	51	15.6%	-0.85 [-1.26; -0.44]
Guétin et al. 2009 (listen to music)	-7.80	4.6000	14	-0.40	4.4000	12	12.9%	-1.59 [-2.49; -0.69]
Särkämö et al. 2014 (listen to music)	5.30	8.1000	29	-2.50	8.5000	28	14.9%	0.93 [0.38; 1.48]
Särkämö et al. 2014 (sing)	2.50	6.5000	27	-2.50	8.5000	28	15.0%	0.65 [0.11; 1.19]
Särkämö et al. 2016a (listen to music)	5.50	12.0000	8	-4.20	7.8000	16	12.9%	1.00 [0.10; 1.91]
Särkämö et al. 2016a (sing)	2.90	6.9000	14	-4.50	7.8000	16	13.8%	0.97 [0.21; 1.74]
Total (95% CI)			**168**			**174**	**100.0%**	**0.16 [-0.54; 0.87]**

Heterogeneity: $Tau^2 = 0.7885$; $Chi^2 = 55.53$, df = 6 (P < 0.01); $I^2 = 89\%$

Z = 0.46 (P = 0.65)

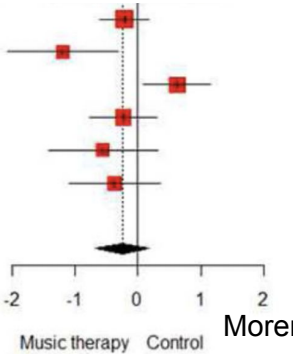


Depression (6 months after treatment)

Study	Music therapy Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Chu et al 2014 (play,sing,listen to music)	-6.23	8.6400	49	-4.27	9.7200	51	21.7%	-0.21 [-0.60; 0.18]
Guétin et al. 2009 (listen to music)	-4.00	4.6000	13	1.30	3.9000	11	12.5%	-1.19 [-2.07; -0.31]
Särkämö et al. 2014 (listen to music)	5.00	10.3200	29	-1.00	8.4800	28	18.9%	0.63 [0.09; 1.16]
Särkämö et al. 2014 (sing)	-1.00	8.6000	27	1.00	8.4800	28	18.9%	-0.23 [-0.76; 0.30]
Särkämö et al. 2016a (listen to music)	-4.70	10.8000	8	1.00	9.5000	16	12.8%	-0.55 [-1.42; 0.31]
Särkämö et al. 2016a (sing)	-1.90	5.2000	14	1.00	9.5000	16	15.2%	-0.36 [-1.09; 0.36]
Total (95% CI)			**140**			**150**	**100.0%**	**-0.25 [-0.68; 0.18]**

Heterogeneity: $Tau^2 = 0.1827$; $Chi^2 = 14.81$, df = 5 (P = 0.01); $I^2 = 66\%$

Z = -1.12 (P = 0.26)



Moreno-Morales *et al.* (2020)

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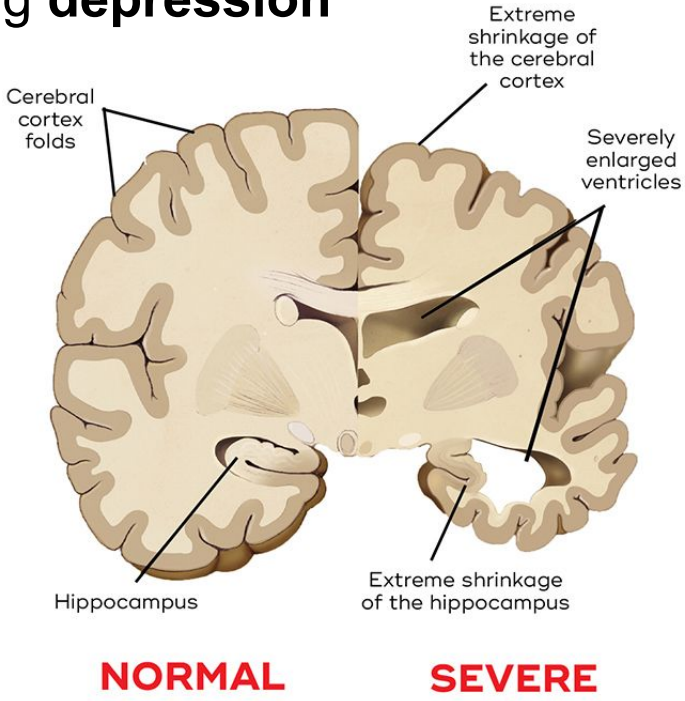
3c. Music Therapy and Dementia

- The evidence suggests that music therapy is effective as a treatment for dementia in terms of **improving cognitive function** and **quality of life** – much more **uncertain** in terms of improving **depression**
- Why this works is, again, not certain
- Different dementias have differing neurological profiles, but all represent some form of **progressive brain damage**
  - Neuronal and synaptic loss, cortical atrophy, plaques, neurofibrillary tangles…



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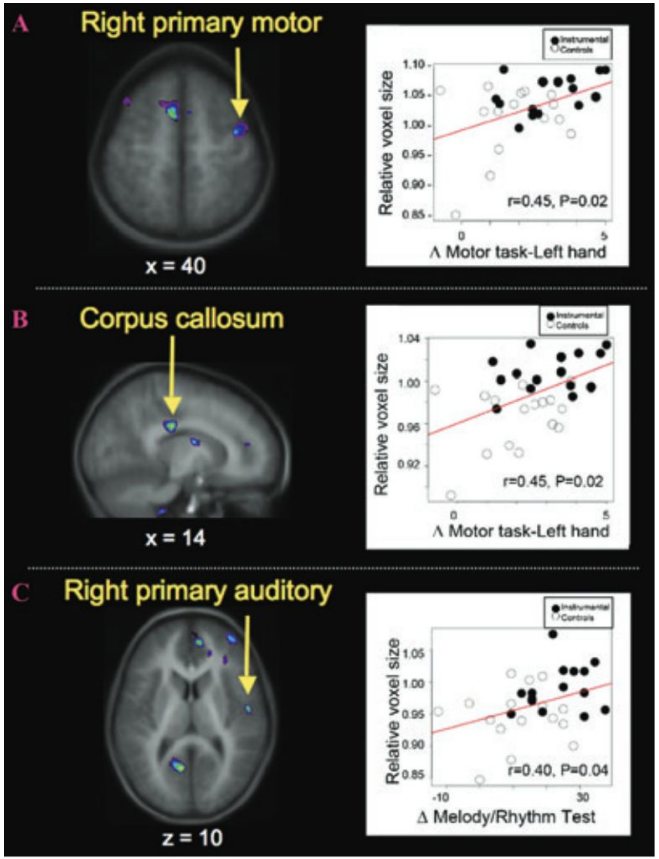
3c. Music Therapy and Dementia

- One of the means by which the brain has resilience to damage is through the creation of new neuronal connections – known as **plasticity**
- Music training is known to **facilitate plasticity** in many regions of the brain
- Satoh *et al.* (2015) showed changed in the angular and lingual gyrus associated with **increased psychomotor speed** after a singing intervention in Alzheimer's disease



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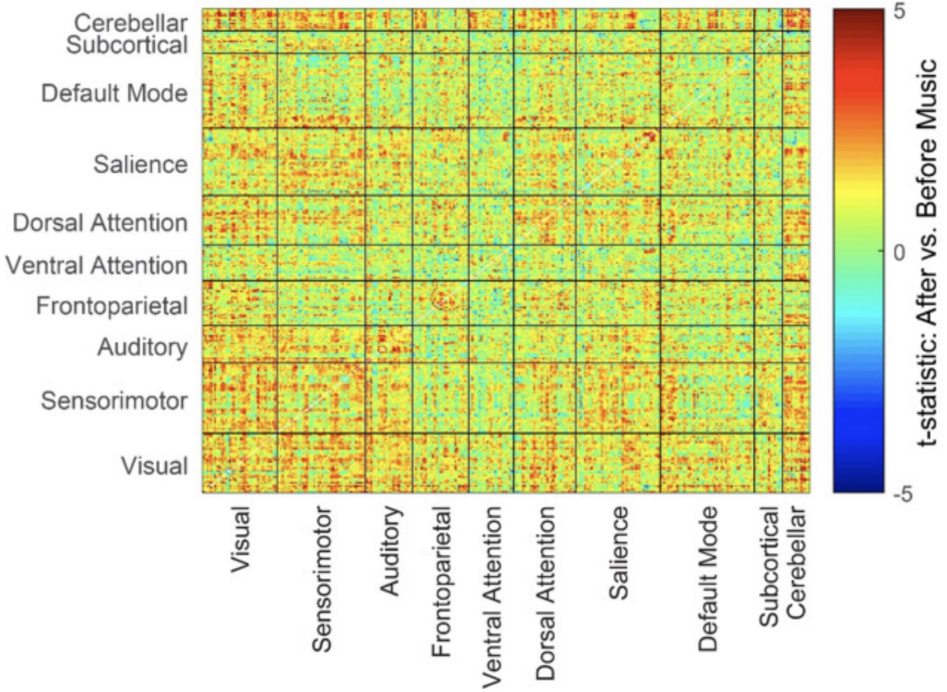
3c. Music Therapy and Dementia

- Even after only **listening** to music, King *et al.* (2018) demonstrated that there are changes in the degree of connectivity between different brain regions
- Engaging with music requires **integration** of information across **many brain systems**
- It could be that **listening** alone is enough to **stimulate** the **enhancement of connections** and slow the progression of dementia



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3c. Music Therapy and Dementia

- The evidence for the efficacy of music therapy in dementia is quite limited – best evidence is for improvements in **quality of life** with some evidence for improvements in **cognitive function**
- The mechanisms require further study, but may relate to the stimulation of **connections** and the promotion of **plasticity** in the brain, as a **compensation** for the decline in dementia
- Responding to music is **preserved** for longer in dementia, even after verbal and other communication has ceased – music may provide a means of **strengthening connections** in brain regions that are less affected by the disease

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3d. Music Therapy and Stroke Rehabilitation

- Stroke refers to a condition where **brain damage** is caused by poor blood flow to the brain, either by **blockage** (*ischemic*) or **bleeding** (*hemorrhagic*)
- Disability after stroke is **very common** and includes:
  - Physical (*muscle weakness*, *numbness*, *speech loss*, *vision loss*…)
  - Cognitive (*aphasia*, *attention*, *memory*…)
  - Emotional (*depression*, *anxiety*, *panic attacks*…)
- Symptom variability depends upon **where** in the brain the lesion occurs
- Rehabilitation after stroke involves trying to help patients live a normal life, either by trying to **regain lost skills** or to **manage new disabilities**
  - This comes back to the ideas of **plasticity** and indicates where music therapy may be beneficial

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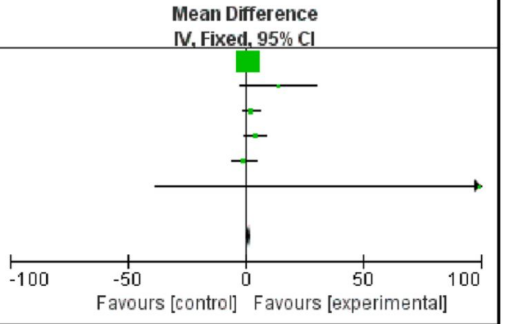
3d. Music Therapy and Stroke Rehabilitation

Liu *et al.* (2022) conducted a meta-analysis on music therapy in **aphasia** after stroke

Communication

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Conklyn 2012	0.9	2.4	14	-0.2	0.9	10	77.2%	1.10 [-0.28, 2.48]
Haro-Martínez 2019	19	20.93	10	5	16.49	10	0.5%	14.00 [-2.51, 30.51]
Lim 2013	6.1	5.21	12	3.66	3.53	9	10.4%	2.44 [-1.30, 6.18]
van der Meulen 2014	6.6	6.9	16	2.3	5.4	11	6.8%	4.30 [-0.35, 8.95]
Van Der Meulen2016	0.4	5.76	10	1	5.35	7	5.1%	-0.60 [-5.93, 4.73]
Yang 2019	107.33	122.16	3	7.67	4.19	3	0.0%	99.66 [-38.66, 237.98]
Total (95% CI)			65			50	100.0%	**1.45 [0.24, 2.65]**

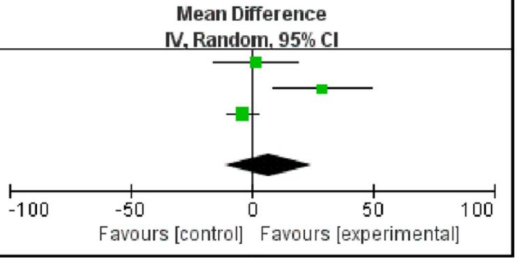
Heterogeneity: Chi² = 6.68, df = 5 (P = 0.25); I² = 25%
Test for overall effect: Z = 2.34 (P = 0.02)



Comprehension

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Haro-Martínez 2019	1.8	16.95	10	0	22.62	10	30.9%	1.80 [-15.72, 19.32]
Lim 2013	37.6	34.47	12	8.33	8.79	9	28.1%	29.27 [8.94, 49.60]
Van Der Meulen2016	-2.2	7.22	10	1.6	6.65	7	41.1%	-3.80 [-10.46, 2.86]
Total (95% CI)			32			26	100.0%	**7.21 [-10.88, 25.29]**

Heterogeneity: Tau² = 195.79; Chi² = 9.24, df = 2 (P = 0.010); I² = 78%
Test for overall effect: Z = 0.78 (P = 0.43)



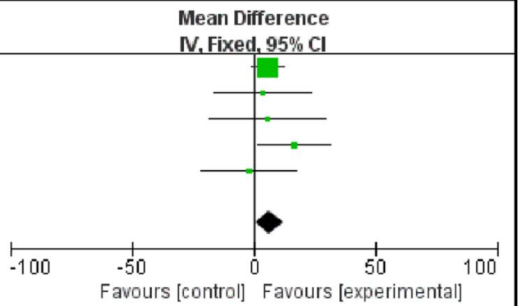
3d. Music Therapy and Stroke Rehabilitation

Liu *et al.* (2022) conducted a meta-analysis on music therapy in **aphasia** after stroke

Repetition

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Conklyn 2012	4.7	11.11	14	-1	5.8	10	65.1%	5.70 [-1.14, 12.54]
Haro-Martínez 2019	10.5	24.57	10	6.8	20.81	10	7.6%	3.70 [-16.26, 23.66]
Lim 2013	24.6	28.36	12	18.78	27.17	9	5.3%	5.82 [-18.11, 29.75]
van der Meulen 2014	28.5	21.6	16	11.8	17.4	11	14.0%	16.70 [1.94, 31.46]
Van Der Meulen2016	6.1	23.71	10	8	17.39	7	8.0%	-1.90 [-21.44, 17.64]
Total (95% CI)			**62**			**47**	**100.0%**	**6.49 [0.97, 12.00]**

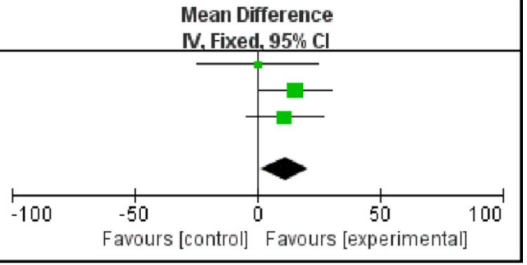
Heterogeneity: Chi² = 2.68, df = 4 (P = 0.61); I² = 0%
Test for overall effect: Z = 2.30 (P = 0.02)



Naming

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Van Der Meulen2016	3.2	21	10	2.8	28.68	7	15.5%	0.40 [-24.52, 25.32]
van der Meulen 2014	20.5	20.1	16	5	18.7	11	44.0%	15.50 [0.70, 30.30]
Lim 2013	19.6	20.09	12	8.33	15.96	9	40.5%	11.27 [-4.15, 26.69]
Total (95% CI)			**38**			**27**	**100.0%**	**11.44 [1.63, 21.26]**

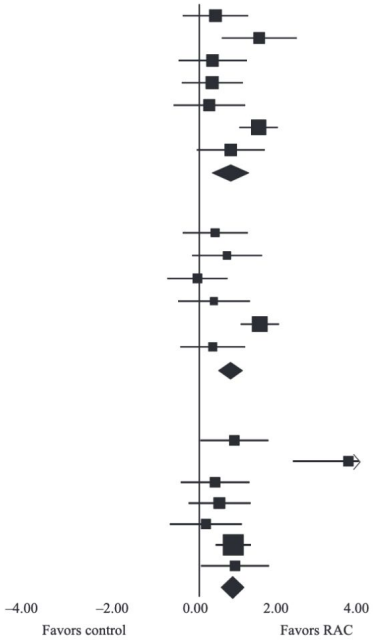
Heterogeneity: Chi² = 1.04, df = 2 (P = 0.59); I² = 0%
Test for overall effect: Z = 2.28 (P = 0.02)



3d. Music Therapy and Stroke Rehabilitation

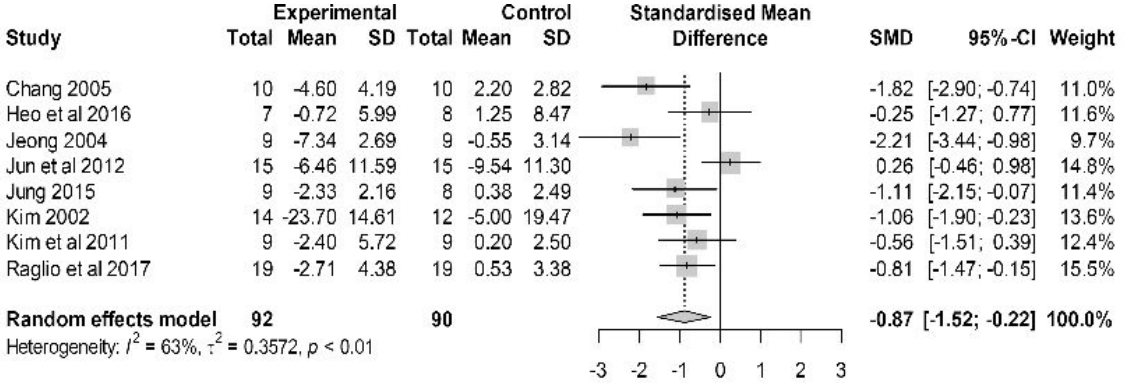
Kim & Song (2022) conducted a meta-analysis on music therapy for **motor function** after stroke

Study	Hedges's *g*	SE	95% CI
Velocity			
Cha, Kim, Hwang, & Chung, 2014	0.500	0.436	–0.354 to 1.354
Kim & Oh, 2012	1.626	0.500	0.647 to 2.605
Kim et al., 2012	0.429	0.455	–0.462 to 1.321
Schauer & Mauritz, 2003	0.418	0.407	–0.380 to 1.216
Suh et al., 2014	0.344	0.477	–0.590 to 1.278
Thaut et al., 2007	1.613	0.260	1.104 to 2.122
Thaut et al., 1997	0.895	0.451	0.011 to 1.779
Total	0.984	0.150	0.689 to 1.278
Cadence			
Cha, Kim, Hwang, & Chung, 2014	0.469	0.435	–0.383 to 1.321
Kim et al., 2012	0.771	0.467	–0.145 to 1.686
Schauer & Mauritz, 2003	0.012	0.402	–0.777 to 0.800
Suh et al., 2014	0.438	0.479	–0.500 to 1.377
Thaut et al., 2007	1.614	0.260	1.105 to 2.213
Thaut et al., 1997	0.406	0.433	–0.443 to 1.255
Total	0.840	0.157	0.532 to 1.148
Stride length			
Cha, Kim, Hwang, & Chung, 2014	0.822	0.448	–0.055 to 1.699
Kim & Oh, 2012	3.725	0.728	2.297 to 5.152
Kim et al., 2012	0.332	0.452	–0.555 to 1.219
Schauer & Mauritz, 2003	0.445	0.408	–0.354 to 1.244
Suh et al., 2014	0.100	0.473	–0.827 to 1.027
Thaut et al., 2007	0.796	0.234	0.337 to 1.255
Thaut et al., 1997	1.068	0.460	0.166 to 1.970
Total	0.760	0.148	0.470 to 1.051



3d. Music Therapy and Stroke Rehabilitation

Yoo & Kim (2022) conducted a meta-analysis on music therapy for **depression** after stroke



A. The effect size of music therapy on depression.

As with other disorders, there is a degree of evidence to suggest that music therapy may be an **effective** treatment option to improve some symptoms of stroke

Particularly improvements in certain elements of **language** in aphasic patients, **motor skills** and **mood**

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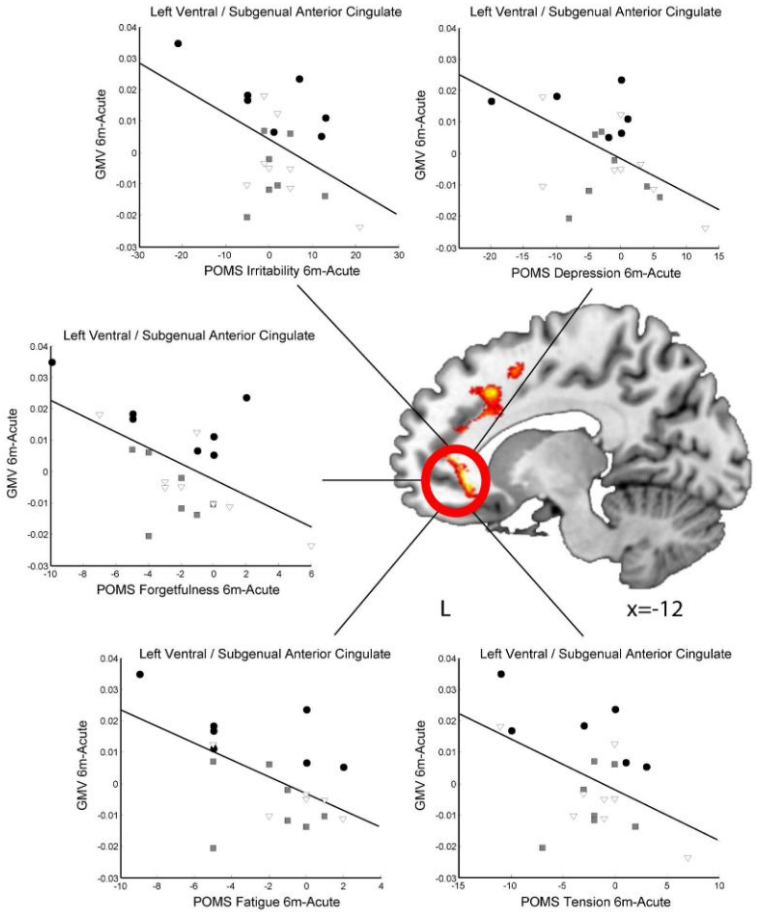
3d. Music Therapy and Stroke Rehabilitation

- In terms of **mechanisms**, the thinking is similar to **dementia** in terms of stimulating connections in the brain and promoting plasticity
- There is an obvious connection here with improving **motor function** through the use of **active music therapies** – *dance*, *learning an instrument*, *rhythm exercises*…
- It is likely that improvements in mood may have similar mechanisms to MDD – may also relate to **quality of life** improvements simply by engaging with a pleasurable activity
- Music as a method of **communication** may also interact with certain regions of the brain to improve language skills

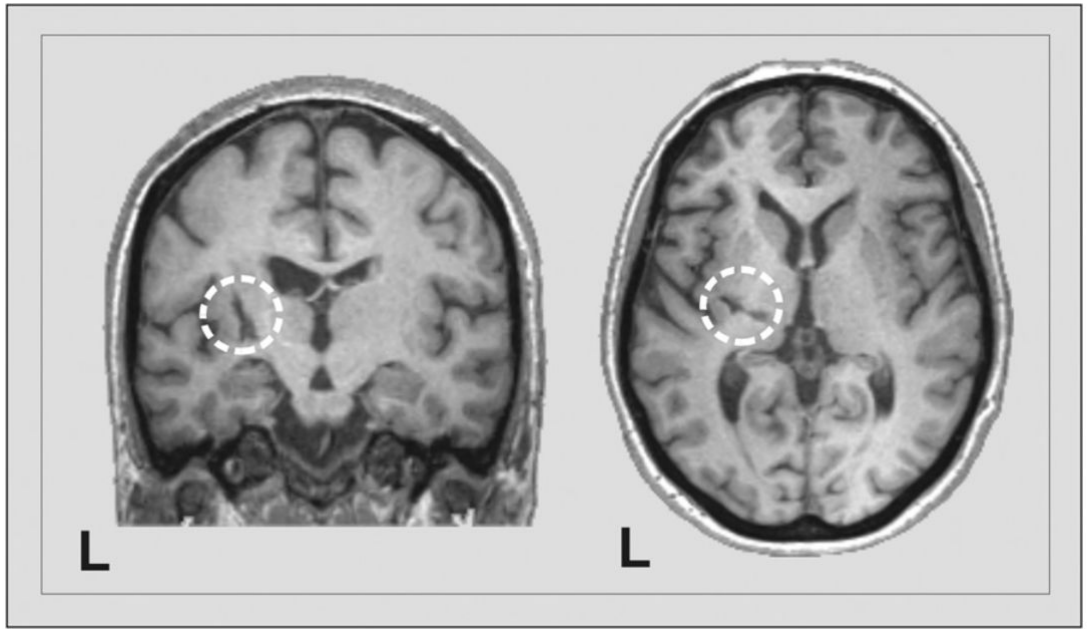
3d. Music Therapy and Stroke Rehabilitation

- A study by Sarkarmo *et al.* (2014) showed that in stroke patients:
  - Daily music listening (black circles) was associated with **increased grey matter** in the sgACC
  - Poorer mood over time was associated with **reduced grey matter** in the sgACC
- Indicative that music listening can alter the **structure** of the brain in key regions associated with mood – could be relevant for MDD as well



3d. Music Therapy and Stroke Rehabilitation

- Similarly, Rojo *et al.* (2011) report results from a **case study** of a woman with a **left hemisphere lesion** after a stroke that results in **motor problems**

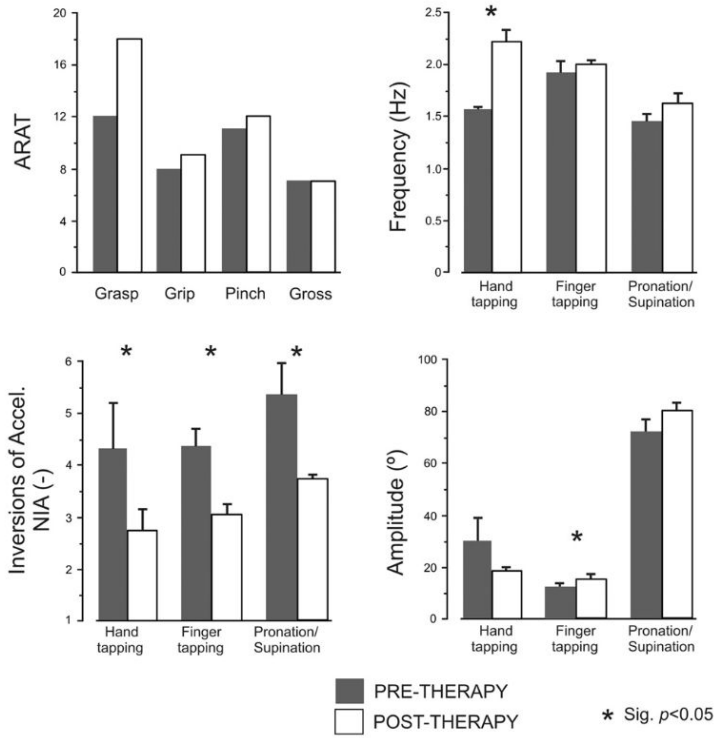


3d. Music Therapy and Stroke Rehabilitation

- Over **4 weeks** the patient engaged in music therapy where they were taught to play **simple melodies** using a
  - MIDI Keyboard for **fine motor skills**
  - Drum pads for **gross motor skills**

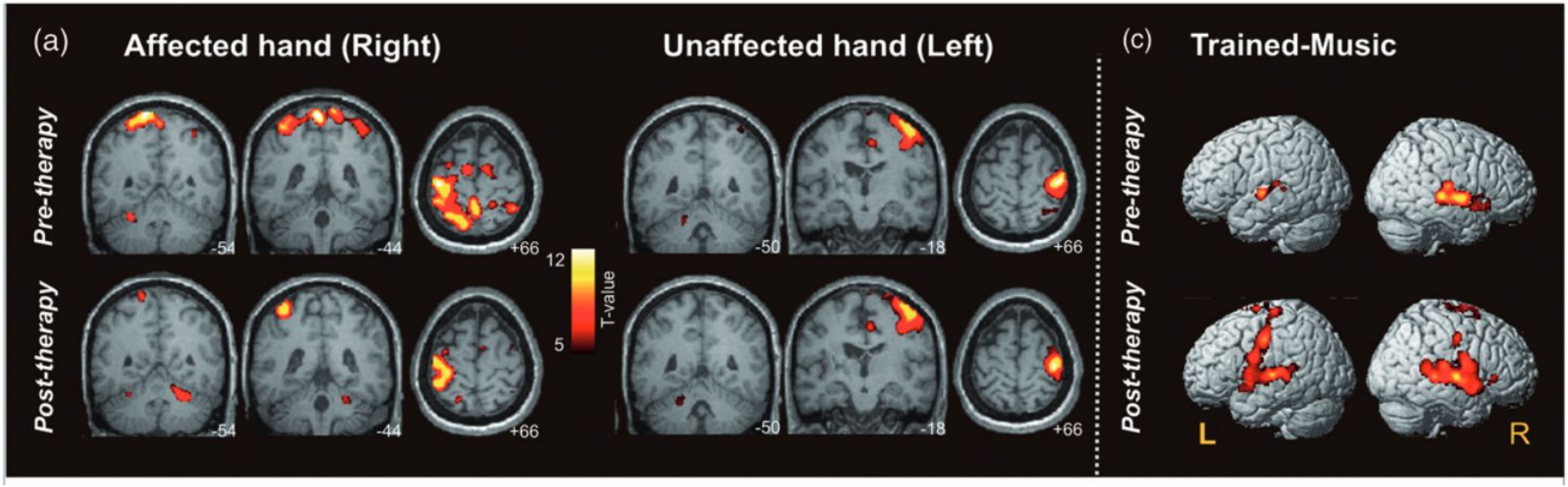
- After the 4 weeks, **significant improvements** were seen on several standardised tests of motor skills

- This included both **fine** (finger tapping) and **gross** (hand tapping) motor skills



3d. Music Therapy and Stroke Rehabilitation

- fMRI scans revealed **large differences** in activation patterns in both a **motor task** and a **music task** (listening to the melodies taught during the therapy)



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3d. Music Therapy and Stroke Rehabilitation

- fMRI scans revealed **large differences** in activation patterns in both a **motor task** and a **music task** (listening to the melodies taught during the therapy)
- Although this is only **one patient**, it does suggest that music therapy has aided the improvement of motor function through changes in the **plasticity** of the brain
  - However, there was no **control**, so we do not know what changes would have occurred naturally over the course of 4 weeks, irrespective of whether they received music therapy or not

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3d. Music Therapy and Stroke Rehabilitation

- The story with music therapy and stroke is much the same as other disorders:
  - Meta-analyses do suggest some utility for **language**, **motor function** and **mood** improvements in stroke after music therapy
  - The mechanisms remain uncertain, but may relate to changes in **plasticity** that encourage the brain to “work around” the stroke lesions to regain lost functionality
  - For mood, the mechanism may relate to connectivity changes in regions such as the **sgACC**, which has implications for MDD (in the absence of stroke)

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4. Summary

- Music therapy uses music as a **therapeutic medium** to enact changes in **physical**, **cognitive** and **emotional** domains across a variety of disorders
- This can involve both **active** and **non-active** musical exercises including **music listening**, **appreciation**, **creation** and **performance**
- Music has been used for **thousands of years** to improve health – modern music therapy dates back to the **1940s**
- Across disorders such as **MDD**, **schizophrenia**, **dementia** and **stroke**, music therapy has shown **some degree of efficacy** in improving certain symptoms

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4. Summary

- However, the **mechanisms** behind these changes remain **uncertain**
- Neuroimaging has provided evidence across disorders of **changes** in **brain function**, **connectivity** and **plasticity** in response to music and music therapy
- It is possible that the precise mechanism differs for each disorder, but generally relates to the ability of music to promote brain plasticity in regions related to **emotions**, **cognition**, **language** and **motor skills**
- Music is a **unique medium** in terms of its ability to engage **multiple brain systems at once** – this may explain some of its efficacy
- However, this all remains **speculative** until more research is done and more **concrete evidence** is available

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