

Symphonies for the senses

Until recently, music therapy was not mainstream in medicine and only had standing among alternative health practitioners. But thanks to technical and scientific advances, perceptions are changing dramatically and the positive experience of music is increasingly being seen to have medically relevant effects upon brain activity, as **Dr Harry Witchel** explains



“IF I WERE NOT A PHYSICIST, I WOULD PROBABLY
BE A MUSICIAN. I OFTEN THINK IN MUSIC”
ALBERT EINSTEIN

There is no doubt that music affects the brain in extraordinary ways. In September last year, scientists at Harvard University supplied evidence of how the brain uses speech therapy based on music to aid stroke patients in recovering their ability to speak.

Professor Gottfried Schlaug and his group used functional brain scanning to demonstrate that when the main part of the left brain responsible for speaking – the left frontotemporal area – is damaged, the brain can recruit regions of the right brain to learn to sing the words, even though in most people the right brain is not responsible for language processing. “Singing can give entry into a broken system by engaging the right hemisphere,” explained the professor.

It has been known for more than 100 years that patients suffering from severe nonfluent aphasia (the inability to speak despite understanding language) are much better at singing lyrics than they are at speaking the same words. This has led to the development of melodic intonation therapy (MIT), which combines speaking short phrases as if part of a melody while rhythmically tapping the left hand with each syllable.

It was always assumed that MIT would work by ‘recruiting’ the right brain to be active during word production, but the Harvard study was the first to show this actually to be true. This means that music production (as opposed to music listening) has a scientifically verifiable effect on the brain’s ability to rewire itself and to aid recovery.

Such evidence throws down the gauntlet for other scientists, because medical science is rife with conflicting evidence about music therapy. The formula for convincing the academic establishment that a treatment is valid rests on demonstrating two things: a) that there is a statistical association between the remedy and health, and b) that there is an intelligible biological explanation for why it would work.

ALL IN THE MIND?

Until the mid-1990s, research on the therapeutic benefits of music was mostly relegated to alternative health practitioners because finding a biological mechanism for music therapy was seen as impossible; it seemed

to be all in the mind, and so too difficult to warrant serious study in allopathic medicine.

Today, however, advances in cognitive neuroscience and the development of new brain scanning tools such as functional Magnetic Resonance Imaging (fMRI), which tracks the brain’s blood flow in relation to mental activities, mean that physicians and researchers can see with their own eyes – in vivid, computer-coloured images – that music has a definite effect upon the brain.

While music therapists would claim that many clinical situations could be improved by music, doctors are not fond of such ‘universal’ remedies. They not only want evidence, they also want to know specifically when music would be a valid therapy – and when it wouldn’t.

The scepticism of music therapy as a panacea derives from the fact that so

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much of health is really a ‘state of mind’. Subjectively, music can make people feel physically better – for example, it is well known to calm a person during an emergency. Interestingly, it also provides an anaesthetic when trauma actually occurs.

Research has shown that patients recovering from intestinal surgery feel 16% to 40% less pain when listening to relaxing music of their choice than patients recovering in silence.

While reductions in subjective measures of pain are promising, they are not, however, as objective or as clinically relevant as measurements showing that the treatment can reduce the drug dosage needed.

Nevertheless, it has recently been reported that after routine hernia surgery, patients listening to music needed less morphine.

Likewise, listening to certain types of music can even lower blood pressure in patients with high blood pressure.

With all these different types of current experiments, there are two scientific conundrums facing the medical community: a) what medical conditions can music actually treat? And b) what quality of evidence is needed to prove it?

Dr Mark Tramo, director of Harvard Medical School’s Institute of Music and Brain Science, is both optimistic and realistic about using music in medicine: while music has been shown to alleviate some of the fear, anxiety and fatigue in chemotherapy patients, he cautions that one must not combine into one the ‘healing’ powers of music with the curative results of medication. “It’s not going to be that music shrinks your tumour,” he warns.

MUSICAL MYSTERIES

The reality is that the mechanisms for music’s healing qualities remain shrouded in mystery, and the randomised, multi-centre, large-population, statistically sound clinical trials to investigate it are still lacking – although it’s not for a lack of trying, as a report by two researchers revealed recently [in the *Cochrane Database Systematic Review* 15].

In 2009, J Bradt and C Dileo and their team compiled all the results from smaller experiments that added music to the treatment of coronary heart disease and put them together into one giant, statistical meta-analysis. It concluded that music can indeed lower blood pressure, heart rate, breathing rate, anxiety, and pain; however, it also decreed that the quality of the evidence was deemed as not strong and the clinical significance of music was unclear.

It appears that the significance of low-level pain relief through music is more apparent in the context of marathon running: music may seem a good way to deal with the almost unendurable pain the final kilometres bring on, yet Jennifer Goebel was disqualified from winning the 2009 Lakefront Marathon in Milwaukee because she was wearing an iPod. This was no mere act of random boredom, either, because she only wore the portable music device while running from mile 19 to mile 21 – “I wasn’t going to put the music on unless I thought I needed it,” she revealed afterwards. Indeed, music increases exercise ➤

tolerance, she argued: "If you're bored, it pumps you up a little bit. Sometimes on a long training run I'll bring it along for the last half hour. Other times when I run marathons I carry it and never put it on."

NO PAIN, NO GAIN

But how does music "pump you up" to such an extent that your endurance is increased? One answer comes from spinning classes. Spinning is the name of a structured, indoor exercise class – similar to aerobics but based on pedalling a stationary exercise bicycle. It is well established that music has effects on how much exercise can be tolerated and how it feels, but there remains a question as to how.

In medical studies on pain and exercise endurance, music is often claimed to act as merely an auditory distraction, although the evidence doesn't support this. For example, in one study – entitled "Effect of distractive auditory stimuli on exercise tolerance in patients with COPD" – when lung patients with breathing difficulties were asked to pedal an exercise bicycle for as long as possible, their subjective exertion was measured, and so was the objective total amount of physical work done.

It transpired that music resulted in a higher exercise tolerance compared to silence, as well as less subjective unpleasantness; however, when patients were asked to do the same exercise with a non-musical auditory distraction (grey noise), grey noise decreased the subjective unpleasantness but did not increase the amount of exercise done. The implication is that although distraction may decrease your discomfort, it will not make you stronger – music, however, has qualitatively different effects from pure distraction.

This fits with what the famous neurologist and author Oliver Sacks's experience shows: that music has the power to evoke movement without the necessity of conscious will. He noted the healing ability of music on Frances D, an intelligent and personable woman who suffered from post-encephalitic Parkinson's disease. "One minute would see Miss D compressed, clenched and blocked, or jerking, ticking and jabbering – like a sort of human bomb," he wrote. Yet, when music was played to her, Miss D's symptoms would vanish and, with a "blissful ease", she would smilingly "conduct" the music with her fingers or dance to it.

Music, therefore, appears to touch something primordial, bypassing the complications of higher cognitive functioning. Research has shown that listening to music can dramatically reduce some symptoms of Alzheimer's disease. As the disease progresses, a disturbing consequence is a gradual loss of the ability to understand verbal communication. This leads to confusion, which induces stress and, in severe cases, can lead to agitation.



MUSIC AND THE MEMORY

One way to reduce confusion in Alzheimer's patients, however, is to help them reconnect with their largely intact, positive memories, which are not only more coherent but also reassuringly familiar. Studies show that music is more effective at triggering these past memories than verbal communication. In fact, the ability to understand and produce music typically remains long after the ability to understand language is gone.

In 1999, the Veterans Administration Center at the University of Arkansas conducted a study on the effects of music upon Alzheimer's patients. It was shown that familiar songs were much more effective at reducing the patients' disruptive and agitated behaviour than either silence or a generic selection of the happy-sounding classical music of Grieg, Beethoven or Schubert.

One subject in this study was a 75-year-old widow residing in a special care unit. Although English was her mother tongue, she also spoke German and had previously lived

in a German ethnic neighbourhood. The patient's daughter had informed the caretakers that she enjoyed listening to German polka music, her favourite songs being *Do Do Liest Mier Inbansen* and the catchy tune *Tante Anna*.

One day, she became extremely agitated, asking for her parents and siblings. She even became verbally abusive towards her roommate, repeatedly telling her to "shut up!". Breaking down into tears, she prayed to God to call her to Heaven. When her caretakers switched on her favourite polka music she quickly calmed down, smiled and murmured, "My, isn't this nice music we are blessed with... It's so beautiful, I could listen to this all day and night."

By tapping into music she could identify with, the music lowered her level of arousal from being agitated to being content. Music is often a part of our personal identity; that is what enables music to sustain us as opposed to simply distracting us. When Einstein claimed he "thinks in music", he is talking specifically about music he identifies with – his own music. Not only can your own music establish safety and comfort but also more importantly it can reinforce determination. Every teenager who has ever slammed their bedroom door shut and turned his or her music to full volume unconsciously knows this. ■

Dr Harry Witchel is the award-winning module leader of Neuroscience and Behaviour at Brighton and Sussex Medical School in the UK. His new book, *You Are What You Hear*, was published in January.

The need for music therapy funding

Research on music therapy has come of age scientifically in recent years but now it needs to be funded to determine how it works, what works best, and when it will and will not work.

Currently, music therapists are generally positive about nearly all possible approaches, and this is important for supporting new methods under trial but it is not an ideal scientific approach for determining a therapy's efficacy. In science, a fair test must allow for

failure in order to give meaning to the successes.

New clinical trials with standardised outcomes and highly specified entry criteria must be funded and performed to solidify the current scientific literature, which remains inconsistent.

The most direct musical approaches still focus on pain reduction via distraction, which can be used in anaesthetics and peri-operative care. This involves inexpensive sound design of the hospital environment, but

it does not usually match the music to the patient, which may be critical – as seen in numerous projects to calm groups of school children.

The future of healthcare sound design research will require the funding of studies to consolidate evidence that shows music's beneficial effects via mechanisms other than distraction. These developments to relate music and medicine would dovetail with the EBC's plans for 2014 to be European Year of the Brain.

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