

# Music and Health

*Paul Robertson, Professor*

***“It may be that our survival requires that we understand ourselves better musically”***

Our culture needs to know why we are musical. It may even be that our survival requires that we understand ourselves better musically. We are all increasingly interconnected through the technology of information. We need more and more complex, subtle and beautiful models of thought and experience with which to cope with this process of change and relate to it. Music, I believe, may be our richest language to express complexity, subtlety and emotional insight.

Study of how sound energy creates patterns in form has been going on for centuries, probably millennia. The system most familiar to us in the West is cymatics. As I speak, my voice creates molecular energy. That energy is cross-sectioned by the membranes of the hearer’s ear and the energy patterns are then translated in the brain and recreated into the rich and multidimensional sound world we all inhabit. It is possible to cross-section the sound and make a visual pattern. If you stretch a membrane across a drum skin and put sand on it, then sing or make some other sound near the drum, the molecular energy makes the particles dance on the surface. This is more than a metaphor; it is a different perception of our earliest auditory neural development, the symmetries of energy that play a fundamental role in our perceptual system and our life.

## **Mapping the musical brain**

About 18 years ago I attended a lecture on what was then the brave new world of neurology. The lecturer spoke particularly about the hemispheres of the brain and our extraordinary dual perception system. At the end of the evening I

asked him what, with regard to the functioning of the hemispheres of the brain, could be said about the development of music. His answer created a whole new life for me: ‘I think that’s one of the most important questions that could be asked at this time, so much so that I recommend you go and find the answers for yourself.’

He put me in touch with Dr Peter Fenwick, an eminent neuropsychiatrist. For two years Peter and I attempted to have a conversation, but our domains and our language of skills were so different that we couldn’t communicate. Gradually, however, we began to build up a model of what might be happening in terms of brain function, brain response, and the evolution of musical language and musical response.

Before Peter and I started work it had been discovered that the two halves of the brain pre-



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ferentially process different combinations of sounds. Concordant sounds, which have low frequency ratios and are preferred by all mammals, are preferentially processed in the right side of the brain. Discords are preferentially processed in the left side. We know that the right side of the brain is emotional, spatial and non-verbal whereas the left side is verbal, sequential, and highly involved with the development of language. Peter and I were therefore able to postulate that a composer who, for whatever reason, was drawn to a propensity for left-brain musical language would inevitably use discordant, arrhythmic musical language. Schoenberg was driven by an internal intellectual imperative to an increasingly discordant left-brain musical language. I think he was also driven by verbal language. Much of his music is created around language structures after which the words are thrown away, leaving discordant prosodic shapes.

A composer or indeed a music world that seeks the language of emotion and enhanced meaning without words will tend towards concordance. It is no accident that Western religious music strongly favours such sound because it is associated with the right brain and actually has the effect of enhancing our sense of emotional well-being and coherence.

### **Where music is more powerful than words**

There is a chilling illustration of what happens if the right side of the brain is missing. The doctor of a patient who had had a large part of his right hemisphere removed asked him how he felt. The answer, delivered in a robotic tone, was 'With my hands.' The literal meaning of language was there but not the emotional depth and connotation. Equally significantly, the prosody, the musicality of the voice had gone.

What happens when the left side of the brain is damaged is illustrated powerfully and sadly by my friend Stephen Wade. He suffered a massive stroke of the left hemisphere and now, while his personality is intact, he cannot speak,

read, or write. To make the situation even more poignant, he previously earned his living as a multilingual telephonist, so words were his world and his life. He has lost the use of the right side of his body and has also lost short-term memory. You can no longer ask him 'Would you like a cup of tea or a cup of coffee?' because while he is processing the word 'tea' he loses the word, coffee'. So what can he do?

Stephen had always been an amateur composer and somehow, miraculously, his musical self remains intact. The hand that can no longer write words can still write music. He can also improvise at the piano. With his voice he can make only unintelligible sounds but he can express his feelings through music. He is obviously an intact musician and he comes across as an intact person. He knows exactly what he wants to try to achieve but he cannot communicate anything in words, only in music.

For me it is increasingly self-evident that what is true for the individual is true for groups and for society itself just as someone who has suffered a stroke can no longer speak but can communicate through music, groups which are prevented from speaking by political repression will carry on their tradition in music, song and dance. I believe that metaphor offers a great deal to us.

There is an extraordinarily subtle and yet-to-be-explored relationship between music and language. Our understanding so far leads us to believe that musical expression, like verbal language, is based on the communication between mother and child. This tends to be prosodic, billing and cooing, and it requires extraordinary and beautiful brain structures. There is no point in crying to express distress if your parent does not have the brain system to connect the sound with an emotion. The structures that allow this connection are absolutely fundamental, built in to each of us as part of our birthright, our evolution. I believe that those structures of sound and emotion go on to create a musical language, what might be called the development of prosody, the exquisite exploration of communication of

emotion through sound. They also underlie spoken language, which is another form of communication through sound.

We get glimpses of the syntax of such communications. The notorious tritone, the musical interval consisting of three whole tones, was outlawed in medieval music because it was believed to be the devil's interval. We now know that we inevitably hear tritone connection according to where we learned our mother tongue. An English-speaking American will come up with a subjective interpretation, which is distinctly and predictably different from that of someone brought up in the southern counties of England. The researcher who discovered this, Diana Deutsch, was disturbed because there was one aberrant individual in the study which otherwise confirmed the finding. Eventually he admitted that he was an illegal immigrant and had lied about his place of origin. For us the important thing about this finding is that subtle musical codes, musical recognitions and responses, are built in to us as part of our ability to communicate before we have language skills. They are the syntax of emotional communication and that is why we need to understand music better.

### The universal 'mummy'

Another example, observed across cultures, is the little falling phrase known as the mummy interval. It is familiar to all parents, usually in the middle of the night: 'Mummy,' and famously, 'I want a drink of Wa-ter.' It appears to be universal, another glimpse of why and perhaps how music speaks to us even when we don't know it's happening.

Haydn was a deeply religious man and when he came to set *Christ's Seven Last Words from the Cross* (available in both Choral and Quartet versions) he delved as deeply as he could into his personal emotional experience. In Christ's words to Mary and St John, 'Mother, behold thy son. Son, behold thy mother', we hear the mummy interval. Another example of music expressing deep feeling is found in Brahms, who was brought up –

more or less dragged up – in a brothel. In the bars and brothels of Hamburg there was always a gypsy orchestra, and in Brahms' last work, the Clarinet Quintet, he makes an allusion to that music, a single glimpse of his childhood. *Recording available with Jack Brymer and the Medici Quartet on Whitehall Records and also illustrated in KOCH records' 'Music and the Mind'*

This touches on the whole gamut of the immense therapeutic and emotional potential of music. One of its great gifts is that it allows us a complete experience of ourselves, often without words. Sometimes words are too painful or too clumsy to carry the completeness of who and what we are. This aspect of music is too big for me to explore here.

For most of us, our auditory and musical development took place before birth and in the early months of life. We have a remarkable gift. Let me give a personal example.

The telephone rings, I answer it, and the voice at the other end says, in a certain tone, 'Hello.' I reply, 'Hello, mum. What's wrong?' That is an impressive transaction. I have recognised the meaning of the word 'hello', in itself no mean feat; as far as I know, no other animal can do it. I have recognised the individual voice, and this on an instrument that gives only a limited cross-section of sound frequency. Most significantly of all, I have recognised in an instant the emotional tonality of the person speaking to me.

### The musical world of autistics

The development that allowed me to do all that is often halted in people who have suffered specific brain damage. They may have great gifts but, through no fault of their own, they are incapable of either generating or recognising emotional signals, or at least limited in their ability to do so. None the less, music can give these autistic individuals an opportunity to build up a greater gamut of emotional connection and inner coherence.

Tony de Blois suffered significant brain damage during his birth and was born blind. At the

age of two he still wasn't sitting up. His mother, a piano teacher, almost in desperation gave him a little electronic keyboard and guided his hands towards it – in itself a long-winded business. Little Tony discovered that if he moved his arms up and down, sound was elicited. Already that is significant. The great gift of human intelligence is that we can recognise events in the outside world and create change by will and design and anticipation. Such a gift is not easily found by a blind, autistic child, unable to sit up, but Tony discovered the keyboard. For three weeks all he did was bang it. Then, to her amazement, his mother heard the first few notes of *Twinkle, twinkle, little star*. Tony is now grown up and, whilst still unable to tie his own shoelaces, has a repertoire of more than 8,000 pieces.

One theory of brain development is that within broad bands of biologically dictated opportunities for growth, stages of development within the brain, the neurones themselves are relatively random. According to this hypothesis there is a kind of Darwinian evolution within the neurones and in the connections between them. That is why a newborn baby moves randomly and gradually, by self-observation and trial and error, refines its movements until it has precise control. It could be that 'Tony de Blois' development is just such a refining process of the memory.

Tony's mother believes that music has helped him to express himself in ordinary language. 'When he was little,' she said, 'we used to sing *Autumn leaves* and we'd go out there and we'd play in the leaves and we'd talk about autumn leaves. When I taught him how to swim I'd have him put his head on my shoulder and we'd sing *Put your head on my shoulder...* I was trying to give him meaning from the words that were in the songs because I felt that the music was the key to Tony and how to work with him.'

Tony himself can describe how, after hearing a tune once, he can pick it out on the piano. He can play the classics and improvise jazz. He can imitate birdsong, trains, and the sirens of emergency vehicles on the piano. He can use it to ex-

press his own feelings at any particular time and maintains there is nothing he couldn't say in music. When asked to express what he felt about his mother he played a lyrical, ornamented version of *Twinkle, twinkle, little star*.

### The greatest human gift

One aspect of the arts – for me, of music in particular – is that they offer an opportunity to discover and refine particular emotions. This ability to recognise, express, and then, in high art perhaps, synthesise emotions is one of the highest if not the single highest medium we have. Virtually all the great musical repertoire consists of paradoxical emotions, emotions that almost cannot exist in ordinary life, drawn together. It happens in Mozart and in Schoenberg. In *Opus 131* (available by *Medic Quartet complete Beethoven recording, Nimbus Records*) Beethoven takes four notes etched in pain and creates a mighty fugue with them. What greater gift could there be for a human being?

When we explore sound in terms of frequency we can play tricks with it. When white light is passed through a prism a spectrum of colour comes out at the other side. Each colour has a frequency, which can be translated into sound. By translating the frequencies of red, white and blue one can play the French flag. That is the playful end of the process but such relationships are extremely powerful. The ancient Greeks formalised frequencies of sound into pattern and mathematical aesthetics. A harmonic series of notes can be mathematically analysed into something that formalises into musical scales and these scales become the seven ages of man or the seven days of the week or the seven deadly sins. If you continue mathematically applying divisions into a 12-step you end up with the 12 hours on the clock or the 12 months of the year.

We are informed by musical pattern more than we know and such information carries on into immensely subtle structures. Throughout history it has been understood, as part of our

human gift, that music is closely connected with our sense of being and of wellbeing. The healing bow 'Goma' is a single structure with the string down the side and it makes one great complex package of sound. Prof Nigel Osborne took one second of the sound of the healing bow and expanded it into a three-minute piece which can be played by a string quartet. (*A recording will be available shortly – details not yet current*). When we hear it we are climbing inside the music, just as a microscope climbs inside the structure of a piece of matter. That is the musical mind beginning to move towards a scientific, objective exploration of itself and of emotion.

### Measuring emotion

As musicians move towards scientific explanations we find scientists moving towards a music experience. Manfred Clynes is probably the most exceptional of them. He was a top-class professional pianist who moved into psychology and neurology and then into artificial intelligence. He has found a way of measuring the physiology of affect – in other words, how we are physically when we are feeling something specific. We know that anger, joy, and love have their own language, both body language and tone of voice. They are interconnected. If we measure them in terms of brain chemistry or muscle tonality or tone of voice, we will find conformity. You can't have the emotion of anger without the whole of its expression, and if that is a predictable change it can be measured.

Clynes chose to measure muscle changes in the most passive finger of the passive left hand. He invited people to emote – something we can do easily by visualising or even evoking words – and this caused muscle tonality to change predictably in everyone. A little button measured pressure up and down, away and towards. For example, thinking of love involves a gesture that both releases pressure and draws towards, while anger presses down and away. That gives two pieces of information that can be put into two algorithms. Clynes made measurements in

different cultures all over the world and found that human beings tend to emote the same way. If we did not, we would not be human. It's almost a tautology. Then the brilliance came in. Klein took a computer which played music – which tends not to be pleasing, computers being a little literal in their reading – and created an interactive program which allowed cursors to make subtle rhythmic pulse changes in the computer playing. He was looking at what happened between different affective languages. He discovered not only that emotions have their own contours but that specific individuals have their own contours too. Klein has created what might be called archetypal forms for each major composer, and even non-musicians will tend to find the right form for the appropriate composer. There is a rightness, a justness about it. I believe that these things are recognisable in the way we walk, perhaps in our handwriting. They are certainly implicated in music.

As human beings we are driven, controlled, affected by pulse and rhythm. That is certain from our earliest days, even before we have a pulse of our own, when our mother's pulse is informing us. Changes in pulse are deeply significant to us and communicate emotion. In *Opus 50 No. 2* (*Available by Medici Quartet, Nimbus Records*) Beethoven uses a pulse identical to a foetal heartbeat. There is also a breathing melody. That is part of how we respond, It is what creates musical language. Breathing, walking, even the natural span of our arms, our movements, are all rhythmically defined and the connection between motion and emotion is no accident. We emote through movement and we change our emotion by changing our movements.

### Music to control pain

Ralf Spintge, a German anaesthetist, uses music to control pain. 'The first thing we see,' he reported, 'is that we can save sedative drugs for premedication. In anaesthesia and even in my pain clinic I can work without any sedative drugs nowadays. A group of patients who are going to

get central nerve blocks, which is an unpleasant procedure, don't get a sedative drug for this procedure because they get music. This is an important thing for a doctor, but there's something more. You can obviously enhance the motivation of the patients for post-operative rehabilitation exercises. The cooperation, the compliance between patient and therapist is much improved.'

Dr Spintge described how the music therapist designs programmes which control the level of patients' activity. 'We start with a simple melody done by a single instrument. Then we add voices, thus increasing the dynamic range of the piece of music, and this helps the patient to get up, to be more active. We keep it on a certain level and then we go back. We take away one voice after the other until we have again the single instrument with the simple melody, and it runs out. We have even designed it so that it follows exactly the time schedule of that procedure. It's 12 minutes and that's it. And it works nicely.'

The obvious question is whether the music is merely distracting the patient or whether it is tying in to a more fundamental system. Dr Spintge believes that two factors are involved. 'One is that it's a distraction. When you ask, especially young people, "What do you feel when you listen to that music?" they say "I'm going away from this situation to my discotheque" or something like that. At the same time we have seen that we can significantly reduce the amount of pain experienced by the patient and we can significantly decrease the level of stress hormones in the blood. And not only with our European patients. I did the same research with Japanese, which is a completely different cultural background, but it worked the same way.'

But what is it in music that works the magic? 'This is the decisive question,' said Dr Spintge. 'My feeling is, from all my experience, that it might be rhythm which is the main stimulus or the most important parameter. We are running a research programme where we are trying to combine the knowledge in neurophysiology about the rhythmic control of all vital functions with music and rhythm.'

### **Persistence of the musical response**

That level of change is possible only because there are universal templates of response that are shared cross-culturally by all of us. It may be that our survival requires that we understand ourselves better musically. We are designed to be musically responsive and when we lose the music we lose a great part of ourselves. It is almost certain that one in four of us will suffer Alzheimer's disease in our later years. As people lose themselves, along with the ability to recognise their nearest and dearest, finally not knowing who or where they are, it is common that the musical response remains. I met a lady who was deeply demented and could not even speak. She had been a piano teacher, and if she was in a room with a piano and someone began to sing, she would shamble across to the piano and begin playing, always in the right key. Suddenly a fully intact person was there, a laughing and happy person. Sadly, as soon as the music went, that person was lost.

Such things occur all the time. When my father was on his death bed he was not demented but his body had given up long before the rest of him. It was Christmas time and all we could think to do was to go in with the kids and play Christmas carols. My father was fiercely anti-religious and hadn't been to church for 70 years or more but he sat up in bed, despite the fact that he was in a desperate state, and for half an hour he sang carols, all the words of every verse from memory. They were deeply embedded in him with emotional connections.

This can happen with musical hallucinations, which we know are associated with precise areas of the brain. There was a man who got in his car to drive to see his family and found, to his delight, that in the car there was an uninterrupted medley of brass band music, which he loved. However, he was a bit disturbed when he got to the end of his journey because the brass band music followed him into the house and continued day and night. It turned out that he had a fairly discrete lesion in the area of the brain that evokes specific musical memory. Interestingly, it

would appear that those complete musical memories always belong to the ages between eight and twelve. We are locked in to these extraordinarily precise musical developments. We need to know that individually and we need to know it culturally.

If we are losing our integrity as a person, for whatever reason, and music offers a way of re-integrating ourselves, that must be equally true of cultures. A culture can be cancerous, autistic or in a condition of terrible self destruction, an act of madness. We know the human race is highly gifted to do this. Ordinary people with ordinary lives and ordinary aspirations can be caught up in it. Friends of mine went to Sarajevo during the siege and followed two young girls through streets where snipers were firing to an underground car park they called 'Our Place'. All those who went there risked their lives to do so. Why? Because the Sarajevo Philharmonic Orchestra was playing there.

It is now culturally possible to share the information I have been describing and for people to listen. It is also possible to explore much of this work in the language and the terms that our culture recognises; at present this means scientific language. A number of groups want to go forward and make a musical brain map. There are groups working with music therapy and music healing in war-torn areas. Nigel Osborne and I hope to set running the notion of a pan-European collaborative research project to map the musical brain. There is collaborative research on the use of music with dementia and Parkinson's disease. I am involved with groups which wish to further work on chronic pain.

### **Making things happen**

All this needs to happen but unless there is active change at every level, personal, political, financial, these things cannot happen. The time is clearly right for these things to occur within the medical domain and the world of teaching. We live in a world which is beginning to focus not on morbid processes but on wellbeing. You cannot have

wellbeing unless you are exploring yourself fully, and that includes an aesthetic experience of yourself, an emotional fulfilment.

I will end with a description of what is likely to remain the single most beautiful expression of anything I would seek to express about music, about how music is deeply implicated in what we are, how we become what we are as human beings, and our potential. We do not exist in isolation but know ourselves by means of a greater communication and a greater community. We can have a full exploration of ourselves not only through our minds and bodies but through our emotions too. Anything less and we are less than human.

My closing illustration concerns the inspired music therapist Paul Nordoff working with a child who was inhabiting his own personal Sarajevo. They had meetings of 10 to 15 minutes and on the first occasion the child could respond to human contact only by fighting, screaming, and kicking. The music therapist simply played a simple tune repeatedly. At the third meeting the therapist was playing a simple melody followed by repeated chords. The child screamed less frequently and the therapist sang with the music. The ninth time they met, the child and the therapist repeated sounds and sung words made by each other. There was no screaming, only laughter.