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Free your mind: a scientific approach to unleashing creativity

A neuroscientist claims he can unleash creativity by boosting low-frequency brainwaves - and he's tested the theory on 100 students at the Royal College of Music. Genevieve Roberts reports

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How can musicians improve their performance skills without even picking up their instruments? It's not a trick question; in fact, neuroscience may have hit upon the answer. According to an exhibition at the Science Museum in London, the brain can be trained to slow itself down and, by doing so, lift musicians' performances by at least one grade.

And it's not just scientists who are convinced of this. The award-winning pianist Cassie Yukawa, 25, was introduced to the technique - known as neurofeedback treatment - at the Royal College of Music. "I was introduced to Professor John Gruzelier [a psychologist then at Imperial College], and he said he was going to change my brain, which sounded very exciting - like *The Matrix*," she says.

Seven years on, she is in no doubt that the theory works. "It has had a wonderful impact on my life, enhancing my general feeling of wellbeing," she says. "And I have no doubt that it has had a positive effect on my performances. It is about a state of mind; I am now far more willing to be flexible in my playing. It enabled me to think about and explore performance."

During treatment, sensors are placed on the scalp and ears to monitor the electrical activity in the brain - or brainwaves. High-frequency brainwaves occur when you are very alert and agitated, whereas lower-frequency brainwaves dominate during relaxation or sleep. The sensors are hooked up to a computer, producing a graph that looks not unlike a heartbeat pattern.

The aim is to push the brain into a state of near-sleep to produce the slow rhythms, known as theta waves, associated with this state. It's the kind of relaxed state in which ideas often come to you. It occurs naturally if, say, you are driving on a motorway and realise that you don't remember the previous few minutes.

"Lying down with my eyes closed, I was trying to reach a state almost like sleep," Yukawa says. "I was deeply relaxed, almost at the doorway to dreamworld, aware only of sounds that I could hear on headphones."

The sound of a babbling brook was played constantly during the training, and whenever she began to produce theta waves in the parietal lobe at the back of the brain, she would be "rewarded" with the sound of a musical gong. After several sessions, her theta waves were elevated through this almost unconscious controlling of brain activity. And (although longer-term studies are needed) it

seems this increase in production of theta waves never reverses.

Interest in similar creative states is not new. Thomas Edison would solve problems by falling asleep with ball bearings clutched in his hands and metal plates positioned below. As his hands relaxed, he would be awakened by the clatter and would jot down the ideas that came to him in his drowsiness.

Yukawa now plays in a duo with Rosey Chan. The pair practise pieces of music at different tempos, but they never decide how they will play the piece until the night. "We take a lot of risks in our performance," Yukawa says. "Things can go wrong, which can be distressing. But now I am more able to let go and respond, so I don't spend time just trying to get through to the end of the piece, but can transform those blips into something positive."

John Gruzelier, an expert in the field of EEG (electroencephalogram, or the measurement of electrical activity in the brain) neurofeedback treatment and a psychology fellow at Goldsmiths University, has tested the treatment on more than 100 Royal College of Music students. Before and after the 10-session training programme, students gave a musical performance in front of a video camera. These were sent to expert musicians who rated the performances, unaware of whether each clip was filmed before or after the treatment. They also did not know which were "control" students who'd received no treatment.

The results were consistent: students who had learnt to increase their theta brainwaves improved at least the equivalent of one musical grade, while there was no significant improvement in the control students.

And Gruzelier has found that it's not just musicians who benefit from the treatment. It had such a positive effect on dancers that first-year students at Laban Contemporary Dance in Deptford, south-east London, now have theta training in their courses. And it was found to improve ability and confidence in eye surgeons.

"Professionally, improvements in dance are seen within five weeks," Gruzelier says. "It is similar to a fast track to meditation, but more directed. Socially anxious students become more confident and outgoing."

Joseph Leach, a researcher in EEG neurofeedback treatment, says it is a similar state to meditation, and this encourages creativity. "We try to bring about the early stages of sleep without losing consciousness," he says. "This state makes it easier for people to remember things that happened a long time ago, and musicians use memory to trigger emotions when composing and performing."

The treatment, which boosts feelings of wellbeing, has been used in the United States to treat alcoholism. Studies have run in the UK to test the effects on crack-cocaine users.

The best-known application of neurofeedback treatment is for people with attention deficit and hyperactivity disorder. But ADHD sufferers have an excess of low-frequency theta waves in the front of the brain, which shows up in a difficulty to concentrate and a propensity to daydream. So the treatment for them is the reverse, with patients trained to inhibit these waves.

Now Gruzelier, who has set up a society to stimulate research on neurofeedback treatment, is about to start work with computer programmers to find out if the training can make them more creative in finding solutions.

But should people fear this self-manipulation of the brain? No, says Gruzelier: "It's not an invasive treatment, just readjusting what is already in the head. Of course, I have had it done to myself before letting it loose on participants. I was in New Orleans, and had flown from the West Coast to

the East Coast to hold a seminar. I was in a sleep-deprived state, and it was a very powerful experience. People saw the difference; I suddenly appeared totally refreshed."

So, in future, will we all be able to unleash the full creative powers of our brains? "I cannot see what could possibly go against this becoming accessible to everyone," he says.

Joseph Leach, who likens neurofeedback for the mind to physiotherapy for the body, agrees. "It is a self-driven process, rather than artificial intervention. At the moment, the treatment is given in clinics and laboratories, with an operator controlling the 'rewards' to the brain," he says. "But the technology exists to use this equipment anywhere. I hope there will come a time when everybody benefits from this."

NEURObotics: the future of thinking?, at the Science Museum, London W7, to 10 April 2007 (08708 704 868; www.sciencemuseum.org.uk). Cassie Yukawa and Rosey Chan play at the Wigmore Hall, London W1 on 20 October (020-7258 8200; www.wigmore-hall.org.uk), where they will premiere a piece composed for them by Michael Nyman

The different types of brainwave

*** Delta (0.5-4Hz)**

The lowest-frequency brainwaves, signifying a dreamless sleep, unconsciousness or a trance. Deep relaxation occurs with delta brainwaves.

*** Theta (4-8Hz)**

These are low-frequency brainwaves, associated with creativity, internal thoughts and memory consolidation. Dreamlike precursor and sequel to sleep.

*** Alpha (8-12Hz)**

Medium level brainwaves, characterising a relaxed, waking state with no drowsiness. Alpha brainwaves in the right-hand side of the brain should occur 10 to 15 per cent more than in the left-hand side in order to ensure a sense of wellbeing. Training left alpha levels down can be a way to treat depression.

*** Low beta/sensorimotor rhythm (12-14Hz)**

These brainwaves are characterised by a state of being relaxed but alert, focused and attentive. They occur most often when the body is inactive, and they reduce the urge to move. It is believed that sufferers of attention deficit and hyperactivity disorder (ADHD) and epilepsy can be helped by increasing these brainwaves.

*** Beta (16-30Hz)**

These high-level brainwaves are suggestive of alertness or agitation. A person is aware of self and surroundings, alert and active, with increased mental ability and focus.