

Mind over matter... training the brain to function better

Neurofeedback is a groundbreaking, non-invasive technique that trains the brain to function more efficiently. But does it offer hope to those that suffer from depression, anxiety and ADHD?



Katie Byrne of the Irish Independent

It's 11.30am on a Friday and a 3D map of my brain is being examined on a computer screen.

"We've got some overactivity here," says neuroscientist Dr Michael Keane as he points to a conspicuous red area. "And a little bit of tension at the left jaw muscle... how's your sense of direction?"

The brain fascinates and frightens me in equal parts. The inquisitive side of me wants to see inside all the nooks and crannies of the master organ. The apprehensive side of me is worried that Dr Keane is about to discover a ticking time bomb. "And you're absolutely sure that's not a tumour?" I ask him for the second time...

I've come to the Actualise Neurofeedback Clinic, which is positioned in the Healthy Living Centre in Dublin City University, to trial their 'brain training' technology. A device called an electroencephalogram (EEG) measures and records brain activity and neurofeedback equipment is used to help the brain learn how to work in a more efficient and effective way.

I should add that Dr Keane ordinarily treats patients with symptoms as opposed to those that want to take a guided tour of the process. He's made an exception today.

The consultation begins with a few questions after which the cap is fitted, conductive gel is applied to specific areas of my scalp and a number of non-invasive sensors are attached.

Immediately my brain waves appear as a series of black squiggles on the screen in front of me. It's highly sensitive equipment, and it records everything from a blink to a sneeze... to the sudden realisation that I didn't turn off the immersion...

Dr Keane has to glean one minute of "clean data" from my brain before we proceed. This can only be achieved when I'm relaxed, comfortable and avoiding large movements and verbal responses. Most of Dr Keane's clients are children and teenagers diagnosed with ADHD, so I imagine this part can prove difficult.

He tells me to relax my shoulders and take a number of long, deep breaths. The effect is instantaneous on the screen in front of me.

The data allows Dr Keane to create a 3D map of my brain on which blue areas denote underactivity and red areas denote overactivity. This information provides all sorts of metrics which are then fed into a comparative database based on averages for my age group (similar to an IQ test).

Do you ever feel anxious?

"You have what is known as a 'hot cingulate'," continues Dr Keane. "Do you ever get anxious?" he asks. "Not really," I tell him. "Maybe a few times a year, but nothing too troubling."

"What about over-thinking?" he asks. Well, that's a different story. Over analysis is an understatement. I think 'quantum-analysis' is the correct term.

"If you have a busy mind, that's probably what it is," he reasons. "If you said anxiety was an issue, we could train it down a bit. But if you don't have a symptom, it's nothing to worry about."

So blue and red patches on the brain map aren't always an issue ?

"There is a debate (within the industry) about 'good' and 'bad' deviants," he explains. And some people in the know think they aren't all bad - they think they are what makes us who we are."

Still, I'm compelled to research what shows up as underactivity in my right prefrontal cortex when I get home. It transpires that the right prefrontal cortex is more active when people feel sad. This makes me feel better.

I also discover that the part of my brain responsible for spatial mapping has a deviance of 2.53, which only proves what I've always known: I will never master parallel parking. Well, unless I book in with Dr Keane...

We move on to the brain training. Dr Keane decides to work on my 'executive function', which includes working memory, reasoning and problem solving. Clients can either choose a video game or a movie. The objective is to move a car around a track or make the movie play using only your brain.

Children particularly enjoy the games, as well as the rewards-based programme which includes contracts, stickers and prizes.

"Kids buy into the whole system," he laughs. "They have Xboxes and iPads but they'll do anything for two Bob the Builder stickers!"

"This reinforcement is engaging frontal lobe activation which teaches them to delay gratification and reduce impulsivity," he adds.

I choose to watch *The Little Mermaid* and I soon understand why one of Dr Keane's clients describes neurofeedback as "weight training for the brain". The movie stops and starts and I have no idea how I'm supposed to control it.

"The only way you can make it play is by making your brain work more efficiently," explains Dr Keane. "It happens by accident at first and then it gets harder and harder."

His clients eventually work out what it is they have to do to make the movie play. However, they can't explain what it is that they are doing. The analogy Dr Keane uses is "try to explain to your granny on the phone how to ride a bicycle".

"We know the physics, the physiology, the logistics, the mechanics... but the feeling of balancing on a bicycle is actually a difficult one to explain, and yet your brain knows exactly what it is doing."

In my case, the less I thought about the movie I was watching, the more it played. When my mind drifted off - I wonder when this cartoon was made?... Is the mermaid an archetype?... I wish I lived under the sea - the film faded out. It played when I relaxed to the same level as when I'm lying on my yoga mat in shavasana.

I wonder if people suffering from depression ever get close to describing what it is that they do to make the movie play. "No, they just know what it feels like. But thinking happy thoughts is not going to make it play - it doesn't work like that."

The aim, he explains, is to give people the neural function to control the areas of the brain that create or maintain depression. "We don't want people to be emotionally numb - we just want them to be able to switch it off."

Neurofeedback is part of the neuroplasticity movement, which Norman Doidge detailed in *The Brain That Changes Itself* (2012). Research is telling us that therapies like CBT, modalities like meditation and, of course, neurofeedback, can rewire the brain.

Enter the critics

But neurofeedback still has its critics. Some say the scientific research is lacking. Others argue that it's not new or groundbreaking and has in fact been around since the 1960s under the previous guise of 'biofeedback'. This is true, but it's also akin to comparing the iPad with the Apple 1 that Steve Jobs crafted in his garage.

The most promising proven results so far have been in the treatment ADHD - one suspects that this is because children find it easier to rewire their brains. It's also being trialled in the US as a treatment for PTSD military veterans and it's covered by health insurance in Belgium. Neurofeedback is not just for mental disorders, though. Clients use it for peak performance too. Olympians, professional poker players and entrepreneurs embrace it to gain that elusive extra 1pc. Chelsea Football Club has been using it since 2009 and NASA has used it as part of its space training programme since the 1960s.

Closer to home, six players at Connacht Rugby recently trialled the technique by booking in for weekly appointments with Dr Keane. Coach Pat Lam was impressed. "We believe they have helped these players to take their performance to the next level."

While out-half Jack Carty says it stopped him making "erratic and silly decisions on the field".

These are fantastic testimonials but Dr Keane is proudest of the results he's obtained with younger clients. One teenager was able to wean off Concerta XL, a medication for ADHD, while he was working with Dr Keane. Another went from being violent on the football field to getting Man of the Match.

"These children have attention problems in school and problems getting out to school in morning. They are ingenious with coming up with excuses for not doing their homework.

"They also have a lot of anxiety as they feel a little different," he explains. "They have a tendency to skip the queue when they're playing and then their friends don't want to play with them so they get worried."

Dr Keane believes that correcting the issue now can prevent future issues in later life. While younger people make up the majority of his client base, he has worked with people from six to 60. He tells me about a woman that suffered from panic disorders. "She had given up her job, her marriage had broken up and she had undergone numerous surgeries for digestive disorders. After 12 sessions she's learned how to turn off the panic centres in her brain and she's since gone on holiday, made a group presentation as part of her new job and survived a surprise party."

Dr Keane, who is a chartered psychologist and a former post-doctoral researcher in the TCD Institute of Neuroscience, wants to make neurofeedback a first line of defence in Ireland, especially for children. "It should be part of mental healthcare, coinciding with CBT, counselling and psychology."

However, he is quick to add that he's not in the business of "selling hope".

"Generally speaking, by the time a parent comes to us, they are at the end of their tether. They will have tried everything and now they'll try anything, so people have a tendency to exploit them. I want to quietly build up a reputation for evidence-based stuff. I don't want to sound like the Shopping Channel. In saying that, I genuinely feel that I've stumbled on something quite unique."

I like Dr Keane. He is deeply passionate about his work and doesn't seem overly motivated by the financial rewards of what clearly has the potential to be a lucrative business.

He's motivated by the research and palpably excited about the future of neurofeedback. In fact, I wouldn't be at all surprised if some of his own findings went on to break new ground. After all, he's the only board-certified neurofeedback provider in the Republic of Ireland and he set up the first EEG laboratory at NUIG while still in his 20s.

Neuroscience is in many ways still a frontier science, which means neurofeedback is even further out in the hinterland. Most would shy away from something so radical but Dr Keane is more than up for the challenge.

Neurofeedback has been used to treat mental disorders including ADHD, anxiety and depression. It is being trialled for treating PTSD patients and some substance abuse problems.

It is also used in peak performance training and can help people become more focused and decisive, and correct cognitive weaknesses and negative thought patterns.

It is still in the early research stages but it is thought that the range of cognitive disorders it can treat will increase in the near future.

* Initial consultations cost between €250 and €300, depending on what is required. Neurofeedback sessions cost €120 each, and people do an average of 15-20.

What is Neurofeedback?

Neurofeedback is a non-invasive technique that trains the brain to function more efficiently and effectively. Patients learn to better control the way their brain works.

An electroencephalogram (EEG) device measures and records the electrical activity of the brain. This data is used to link complaints and symptoms to areas of the brain where there is underactivity or overactivity (based on statistical data).

The findings form the foundations of a personalised reward-based game that teaches patients to correct these deviancies – when their brain functions more efficiently, they receive feedback.