

## **Guest lecture: Tim Brown (part two)**

[00:00:00.32] Hi, it's Tim again and this time I'm going to be talking to you about stimulating the brain. In particular, moral concerns about deep-brain stimulation. So let's jump in. First things first, let's talk about some of the conditions that deep-brain stimulation treats. So let's, first, talk about essential tremor. This is the most common movement disorder compared to Parkinson's and Dystonia. There are 7.01 million cases in the United States. So it's a pretty common disorder. And the last time I checked, there are about 60,000 new cases every year.

[00:00:42.99] So what characterizes essential tremor? Well, people with essential tremor have involuntary tremor in their hands and feet their head. So they can't really control their hand movements as well as they did before. This makes it really hard for people to-- with essential tremor to pick up glasses with water in them, to walk sometimes. People usually get essential tremor in their 40s or 50s. And it's a progressive disease. And so that means it just gets really much worse as time goes on.

[00:01:20.91] So what do you use to treat essential tremor besides deep-brain stimulation? There's a drug called Propranolol that's a beta blocker and that's a drug that lowers blood pressure. And that helps control some of these tremors that people with essential tremor experience. Another drug is Primadone and it's an anti-convulsant. And that's a drug that people with epilepsy usually use.

[00:01:47.18] But one of the big problems with essential tremor is that we just don't understand how it works. Some people think that it's caused by circuits of neurons in your brain that oscillate-- that go around and around-- and cause these tremors symptoms. But we really don't understand.

[00:02:06.98] Another disease is Parkinson's Disease and this is less common than essential tremor, but still extremely common with one million cases in the United States. And Parkinson's is characterized by four different signs or symptoms. First there's a tremor in the hands and legs and head. But there's also bradykinesia, or slow movement. There's also rigidity and stiffness. And there's also poor balance. And these four symptoms come together to form a pretty difficult disease to overcome. People with-- people usually get Parkinson's Disease in their early 50s to 60s. But there have been cases of people getting Parkinson's Disease in their 40s.

[00:03:02.78] Parkinson's is progressive and often fatal. And so it gets a lot worse as you get older. It's also treated with drugs that produce dopamine in the brain as this is considered the cause of it. And two drugs do this in particular-- Levodopa and Carbidopa. Sometimes these are administered together.

[00:03:29.32] And here we have an example of essential tremor. In this video, a person is drawing a spiral on a piece of paper and this shows you just how severe essential tremor is. And this isn't the most severe case of essential tremor I've ever seen. And now this person is trying to write their name and it's coming out very, very wobbly and scribbly.

[00:03:54.95] One way of treating these disorders is to use deep-brain stimulation. These devices are implanted devices that apply electricity to certain parts of your brain. And these are used to treat essential tremor and Parkinson's and dystonia but they're also being used for a variety of other conditions.

[00:04:16.37] They roughly work by using a set of implanted electrodes-- you can see these on the right-hand side of the top picture on the right-hand side-- that are implanted in certain areas of the brain associated with tremor and the other conditions that come along with Parkinson's and essential tremor. And these electrodes are connected by leads that run under your scalp and under the skin of your neck into a pacemaker-like device that's implanted in your chest. Now while a lot of people call these brain pacemakers, they're not actually pacemakers. This is probably a bad metaphor to use in general. These simulators actually apply electricity for a long period of time in order to treat the symptoms they're supposed to treat.

[00:05:11.49] So what are the benefits of deep-brain stimulation? Well first of all, there are fewer pharmaceutical drugs necessary. So people who use deep-brain stimulation can use fewer of the drugs that they used to. And these drugs usually come with side effects. So it's a much appreciated benefit of using deep-brain stimulation. Also, deep-brain stimulation comes with minimal damage and it might be reversible. I say it might be reversible because there have been cases where people have opted to remove these electrodes from their brains and still had scarring effects in their brains.

[00:05:52.89] So what are the drawbacks of deep-brain stimulation? Some of the people who use deep-brain stimulation experience side effects. So for example, dyskinesias, or tingling sensations in their limbs, slurred speech when the stimulator's voltage is too high, or hypomania. Every person using deep-brain stimulation will require battery changes. And those battery changes require surgery. Fortunately these battery changes only have to happen once every three to five years, but they are surgeries nonetheless and there are always risks that come with surgery. Newer deep-brain stimulators have rechargeable batteries. But just like your cell phone's battery, at some point it will stop holding a charge and that just means that battery changes are inevitable.

[00:06:46.71] And finally, deep-brain stimulation can come with even more personality and behavioral changes. Some people experience manic states-- that is to say they have an elevated mood, exhibit risky behaviors, have rushes of ideas and thoughts. And some of these cases are so severe as to require continued psychiatric care. There have also been cases of people developing sexual urges after receiving deep-brain stimulation, in particular for Parkinson's and epilepsy.

[00:07:35.73] And in this video you can see how much of a difference deep-brain stimulation makes. You can see where this person was having a really tough time drawing the spiral, now they're able to draw it with ease, and they're also able to write their name pretty easily too.

[00:07:53.52] But let's talk more about DBS' psychological and social impact. There was a study done on 29 DBS users who have Parkinson's. And in this study they were asked to describe what their life is like with deep-brain stimulation. Some of them experienced self-image. They say-- they report that they still expect that they'll experience symptoms of Parkinson's at some point. They say, one person says, my body is cured but my mind is still sick. Another person says that

they feel like Robocop, like they're an electronic doll. Another group of people say they feel like they've lost control of themselves. So one person says, I'm under remote control and another person says, I feel like I'm forced to live like a prisoner in an alien body that's out of control. And other people experience these relationship changes. So real changes in their relationships to their friends or family, caretakers. One caretaker says, when he was ill, we were the perfect couple. Since the operation he wants to live like a young man. He wants to go out and wants to meet new people and it's unbearable. I prefer him as he was before, always nice and quiet. Clearly the autonomy that this person who underwent DBS therapy was able to get from the therapy put a wedge between them and their caretaker. And in this case, they were husband and wife. But in other cases, they're not.

[00:09:33.06] So how do we explain these changes? And first of all, what do we call these changes? Do we say they're maladaptations? Is it just a case of people not being able to adapt to the technology the right way? Are they changes in authenticity? So do people who get deep-brain stimulation just feel less like themselves because they have been pushed away from who they really are? Or are these changes in self-narratives or the stories that we tell about ourselves? So, when a person gets deep-brain stimulation, are they just inclined to tell different kinds of stories about themselves? And are these changes, changes in their identities or something like that?

[00:10:21.73] Another way of asking these questions is to ask is DBS a threat to the people who use it? And if so, what what's being threatened? Is it the person's identity? Is it their autonomy? Or is it their agency? So if it's a threat to a person's agency, then they might ask, am I the same person I was before surgery? And if it's a threat to their autonomy, they can ask, is the implant coercing me? And this is a really difficult way of thinking about the device because it might seem like the device is a person, almost, or a coercing factor. And if you think the DBS is a threat to your agency, you might ask is it me acting or is it the implant? This goes even further than the autonomy question.

[00:11:24.33] So let's think about what we've learned through a real-life case. So there's a man who cannot walk or talk because of their Parkinson's Disease. And drugs aren't helping them anymore. He decides to try deep-brain stimulation as a last resort. And he finds that it's a really big help. He can walk and talk the way he used to. But he has a problem. He has a side effect--severe mania. And that just means that his personality is not what it was before. But his tremor was so severe that he had to be hospitalized. But suppose that his mania is so severe that he has to be admitted into a psychiatric care facility. So he has to make a decision-- get his mobility back or undergo this severe personality change.

[00:12:29.31] So let's ask some questions about this. What would you decide to do if you were met with the same kind of choice? Would you decide to use this technology and be able to walk, but you're only able to walk in your psychiatric care facility? Or would you just decide to live with your tremor? Is this a personality change or is it an identity change? So that's to say, is the person who gets DBS and experiences mania or manic symptoms, are they a different person entirely or are they just the same person with a different personality? Should the person make their decision about whether or not to use the technology with the stimulator on or off? So if you think that deep-brain stimulation is causing an identity change, then he might say, well, the person using the deep-brain stimulator is completely different than the person not using the deep-

brain stimulator. Which is just to say a person with mania will make completely different decisions than a person without mania.

[00:13:46.57] So how should this patient make their decision? Should they make their decision with the stimulator on in the manic state? Or should they make the decision with the stimulator off in their previous state? Or should they make the decision in both states and compare them, or something like that? And how much of a say should his family members get? Clearly this is a difficulty in deciding who the person is when they're making a decision and whether or not he is a different person when he has the stimulator on. So maybe his family should be able to say which version of him they like more. Or maybe they should have say in the first place because they have to live with him. But also you might say that, perhaps, they shouldn't have a say. Maybe it should be his decision to make on his own without his family's influence. And it only gets more complicated from here because researchers want to use deep-brain stimulation to treat mental illness now. And people have already started to try deep-brain stimulation for the treatment of major depressive disorder, obsessive compulsive disorder, generalized anxiety disorder, and drug addiction.

[00:15:03.15] So are the moral problems worse when we use these devices for psychiatry? And what are the limits? Are there just some things we shouldn't use DBS to treat?

[00:15:17.93] Let's think about this through another real-life case. Now this time suppose that you're a neurosurgeon and you have a patient that has OCD and anxiety. And you find that drugs aren't helping. Your patient decides to try deep-brain stimulation as a last resort. But when she uses it, she finds that it doesn't help with her obsessions or her compulsions. Instead, it just makes her feel happy when she turns the thing on-- she feels euphoria. And, of course, she wants to keep the stimulator on even though it doesn't treat her OCD or her anxiety. She thinks that it will help her deal with her situation. So what are some of the questions that we can ask about this? Is it OK to keep using deep brain stimulation this way? What would you tell your patient to do?

[00:16:19.88] So one might think that using deep-brain stimulation this way is no different than using some kind of recreational drug-- like marijuana or cocaine. The only real purpose it's serving here is to give her happy feelings. So is it OK to use drugs to give yourself happy feelings if those happy feelings will help you deal with some other condition or disorder? Would it be different if the patient's condition were different? What if she had depression? You might think that happy feelings are the direct counteraction to depression. So maybe if she had depression, feelings of euphoria might be the right tool for the job to make her feel better, to keep her in counseling session. But she's dealing with obsession-compulsion. And if that the system is not helping her with her obsessions and compulsions, what will she be left with? Happy feelings and obsessions and compulsions? Would it be OK if the treatment were less invasive? So if, for example, she could wear a cap and receive treatment instead of having a fully-implanted system that applies electricity to some part of her brain. Would it make it more or less permissible? And finally, is there any difference between recreational drugs and DBS here?

[00:17:57.36] There's an entire slew of devices, nowadays, that are meant to attach to your head and stimulate your brain noninvasively. And these are meant to give you feelings of euphoria the same way. In one review of a device called Think, the reviewer said that using that device was the equivalent of smoking one joint of marijuana. So what's the difference between devices that stimulate your brain and marijuana? And do some of the moral concerns about marijuana and drugs like those carry over to deep-brain stimulation?