

# Mind control using sound waves? We ask a scientist how it works



Oxford University's Antoine Jérusalem explains the art of ultrasound neuromodulation. Image: Craig Whitehead/Unsplash

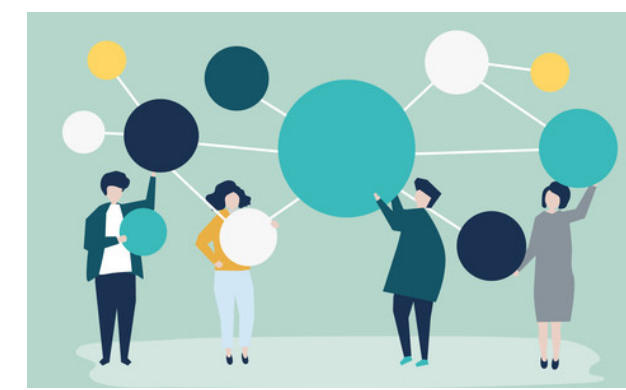
07 Nov 2018

**Antoine Jérusalem**  
Professor, Department of Engineering Science, University of Oxford



## Globalization 4.0

We need your answers to 6 of the most important questions on our shared future



Learn more

## Most Popular

- These are the world's most respected professions**  
Johnny Wood 15 Jan 2019
- These are the most powerful cities in the world**  
Sean Fleming 17 Jan 2019
- A brief history of globalization**  
Peter Vanham 17 Jan 2019

More on the agenda

## Forum in focus

## Outsmarting epidemics



Read more about this project

## Explore context

Neuroscience

Explore the latest strategic trends, research and analysis

This article is part of the **Annual Meeting of the Global Future Councils**

At the moment, non-invasive neuromodulation – changing brain activity without the use of surgery – looks poised to usher in a new era of healthcare. Breakthroughs could include the better management of Parkinson's and Alzheimer's disease, reducing the pain of migraines or even reversing cognitive disorders caused by brain injury

But what happens if this technique for altering our brain waves escapes regulation and falls into the wrong hands? Imagine a dictatorial regime with access to the tricks and tools to change the way its citizens think or behave.

That's the ethical battleground that Antoine Jérusalem, a professor of engineering science at Oxford University, finds himself in as he researches the potential of ultrasound technology to tackle neurological diseases and disorders.

In this interview, conducted as part of the World Economic Forum's **annual gathering in the Middle East of scientists, government and business**, he tells us more about this growing field of research.

### Controlling the brain with sound waves: how does it work?

Well, to get straight to the science, the principle of non-invasive neuromodulation is to focus ultrasound waves into a region in the brain so that they all gather in a small spot. Then hopefully, given the right set of parameters, this can change the activity of the neurons.

If you want to get rid of neurons that have gone wild, for example in epilepsy, then you might want to crank up the energy to essentially kill them. But if you want to selectively promote or block the neuronal activity, you need to fine-tune your ultrasound waves carefully.

In other words, there's a difference between ultrasound stimulation used for removing tissue, and ultrasound neuromodulation, which is aimed at controlling neuronal activity without damaging the tissue.

Ultrasound neuromodulation is something that definitely works, but that we still don't understand.



Antoine Jérusalem is a professor of engineering science at Oxford University

### What social good can come of it?

The current buzzwords are Alzheimer's and Parkinson's disease, as well as traumatic brain injuries. But scientists are also looking at the spinal cord and peripheral nervous systems. As far as I am concerned, since the brain is the de facto centre of decision for so many processes, any of them could be targeted.

### Is it safe?

When attempting to 'control' neuronal activity by providing minute mechanical vibrations to a region of the brain, it's important that the focus of the ultrasound, frequency and amplitude are properly tuned, or the brain can potentially be damaged. The point is that we still don't know how to tune all of this; and if I were to exaggerate a bit, I could say that our current approach is not that far off from fiddling around with the settings on a radio until we hear the right station.

One of the many difficulties is to know for sure that we are indeed *controlling* neurons with these sound waves, as opposed to damaging them. The truth is that we still don't know how the process works. And if you don't know how it works, you don't know how much is "too much".

### Have you read?

- [Researchers have found that procrastinators and doers have different brains](#)
- [This is the surprising link between cataract surgery and your brain health](#)
- [Video games could be a short-term answer to science's gender problem](#)

### What are the biggest ethical challenges?

The potential of this technique is huge - by that I mean the sheer number of applications, as well as the ethical use.

From a biological perspective, it's similar to drugs. It can cure you, it can get you addicted, and it can kill you. It's all about staying within a given set of rules. From an ethical perspective, the world is changing so fast that it's difficult to assess what will be acceptable tomorrow that is not today.

I am also convinced that human nature is such that if something can be done, it will be done. The question is by whom. I would rather have a fair society leading the dance than some rogue state without any respect for human or animal life. If we want to lead that dance 10 years from now, we need to start researching today.

### How dystopian could it get?

I can see the day coming where a scientist will be able to control what a person sees in their mind's eye, by sending the right waves to the right place in their brain. My guess is that most objections will be similar to those we hear today about subliminal messages in advertisements, only much more vehement.

This technology is not without its risks of misuse. It could be a revolutionary healthcare technology for the sick, or a perfect controlling tool with which the ruthless control the weak. This time though, the control would be literal.

### What can we do to safeguard its potential?

I am not going to argue that scientists are all wise and knowledgeable when it comes to what should and should not be done. Some of us will go as far as we can get away with. But that's human nature, and not unique to scientists.

Either way, our job is to find something that is beneficial to humanity. And if you find a way to make somebody better, then you most likely also know how to do the contrary. The goal is to make sure that regulation prevents the latter, without impeding the former. I believe that this is the role of regulators. And I think that the European Union, where I work, is quite good at this.

Another role of politicians should be to provide a communication platform to explain the long vision of any given area of research. And it can be too early, or not a good idea, and the final decision might very well be to stop it. But in the long term, the public should have the potential benefits of a new technology explained to them in plain words, which is something that scientists are not necessarily good at.

Politicians should remember that if we don't do it, then somebody somewhere will do it anyway...potentially unregulated.

Share



Written by [Antoine Jérusalem](#), Professor, Department of Engineering Science, University of Oxford  
The views expressed in this article are those of the author alone and not the World Economic Forum.

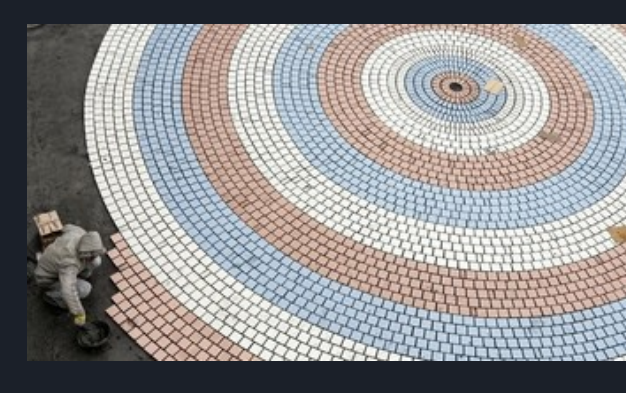
### Subscribe for updates

A weekly update of what's on the Global Agenda

Subscribe

## Featured: Neuroscience

View all >



### It's time to end the stigma surrounding mental health

Bernard J. Tyson · Project Syndicate  
21 Jan 2019

### Enjoy seeing others fail? You're only human

Shenaheng Wang · The Conversation  
11 Jan 2019

### Your brain has more in common with an ant colony than you realised

Deborah M. Gordon · Big Think 10 Jan 2019

### The science behind your decision-making

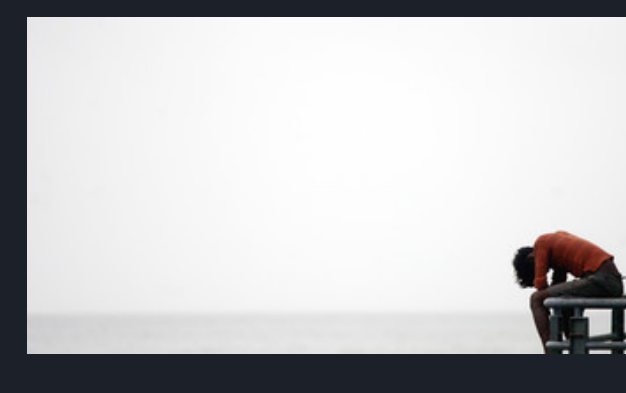
Fanny Gazeilles · The Conversation  
07 Jan 2019

### The number of people with dementia has doubled in just 26 years

Futurity 04 Jan 2019

### A treatment to reverse the symptoms of Alzheimer's is moving to human trials

Kristin Houser · Futurism 02 Jan 2019



### This is the world's biggest mental health problem - and you might not have heard of it

Sean Fleming 14 Jan 2019

### Subscribe for updates

A weekly update of what's on the Global Agenda

Subscribe

Follow Us



About	Media	Members & Partners	Global sites
<ul style="list-style-type: none"> <li>Our Mission</li> <li>Leadership and Governance</li> <li>Our Members and Partners</li> <li>Globalization 4.0</li> <li>The Fourth Industrial Revolution</li> <li>Centre for the Fourth Industrial Revolution</li> <li>Communities</li> <li>History</li> <li>Klaus Schwab</li> <li>Our Impact</li> <li>Media</li> <li>Pictures</li> <li>Mapping Global Transformations</li> <li>Contact Us</li> <li>Careers</li> <li>Open Forum</li> <li>World Economic Forum LLC</li> <li>Code of Conduct</li> <li>Sustainability</li> <li>World Economic Forum Privacy Policy</li> </ul>	<ul style="list-style-type: none"> <li>News</li> <li>Accreditation</li> <li>Subscribe to our news</li> </ul>	<ul style="list-style-type: none"> <li>Member login to TopLink</li> <li>Strategic Partners' area</li> <li>Partner Institutes' area</li> </ul>	<ul style="list-style-type: none"> <li>Centre for the Fourth Industrial Revolution</li> <li>Centre for Cybersecurity</li> <li>Open Forum</li> <li>Global Shapers</li> <li>Schwab Foundation for Social Entrepreneurship</li> <li>EN   ES   FR   日本語   中文</li> </ul>