

Your brain hallucinates your conscious reality Anil Seth 2017

<https://www.youtube.com/watch?v=lyu7v7nWzfo> Edited to fit in the character limit!

Just over a year ago, for the third time in my life, I ceased to exist. I was having a small operation, and my brain was filling with anesthetic. I remember a sense of detachment and falling apart and a coldness. And then I was back, drowsy and disoriented, but definitely there.

When you wake from a deep sleep, you might feel confused about the time or anxious about oversleeping, but there's always a basic sense of time having passed, of a continuity between then and now.

Coming round from anesthesia is very different. I could have been under for five minutes, five hours, five years or even 50 years. I simply wasn't there. It was total oblivion.

Anesthesia is a modern kind of magic. It turns people into objects, and then back again into people. And in this process is one of the greatest remaining mysteries in science and philosophy. How does consciousness happen? Somehow, within each of our brains, the combined activity of many billions of neurons, each one a tiny biological machine, is generating a conscious experience. And not just any conscious experience - your conscious experience right here and right now.

How does this happen?

Answering this question is so important because consciousness for each of us is all there is. Without it there's no world, there's no self, there's nothing at all. When we suffer, we suffer consciously whether it's through mental illness or pain. And if we can experience joy and suffering, what about other animals? Might they be conscious, too? Do they also have a sense of self? And as computers get faster and smarter, maybe there will come a point when my phone develops a sense of its own existence. I actually think the prospects for a conscious AI are pretty remote because my research is telling me that consciousness has less to do with pure intelligence and more to do with our nature as living and breathing organisms.

Consciousness and intelligence are very different things. You don't have to be smart to suffer, but you probably have to be alive. In the story I'm going to tell you, our conscious experiences of the world around us, and of ourselves within it, are kinds of controlled hallucinations that happen with, through and because of our living bodies.

My lab has scientists from all different disciplines and sometimes even philosophers. We're trying to understand how consciousness happens and what happens when it goes wrong. Once we start explaining its properties in terms of things happening inside brains and bodies, the mystery of what consciousness is starts to fade away.

What are the properties of consciousness? What should a science of consciousness try to explain? For today I'd like to think of consciousness in two different ways. There are experiences of the world around us, full of sights, sounds and smells, there's multisensory, panoramic, 3D, fully immersive inner movie. And then there's conscious self. The specific experience of being you or being me. The lead character in this inner movie, and probably the aspect of consciousness we all cling to most tightly.

Let's start with experiences of the world around us, and with the important idea of the brain as a prediction engine.

Imagine being a brain. You're locked inside a bony skull, trying to figure what's out there in the world. There's no light inside the skull. There's no sound either. All you've got to go on is streams of electrical impulses which are only indirectly related to things in the world, whatever they may be. So perception - figuring out what's there - has to be a process of informed guesswork in which the brain combines these sensory signals with its prior expectations or beliefs about the way the world is to form its best guess of what caused those signals.

Let me give you a couple of examples of all this. (The optical illusion is of squares on a checker board. The squares appear to be different shades of gray. One is just a grey square and the other should be a white square, but it's in the shade of an object, so it looks grey...but it seems like it should be a lighter grey.)

This isn't any kind of magic trick. It's the same shade of gray, but take the 'grey bar' away and it looks different. So what's happening? The brain is using its prior expectations built deeply into the circuits of the visual cortex that a cast shadow dims the appearance of a surface, so that we see the shaded square as lighter than it really is.

Here's one more example, which shows just how quickly the brain can use new predictions to change what we consciously experience.

Have a listen to this. (Distorted voice) Sounded strange, right?

Have a listen again and see if you can get anything. (Distorted voice) Still strange.

Now listen to this: "I think Brexit is a really terrible idea." (Laughter)

So you heard some words there. Now listen to the first sound again. (Distorted voice) Now you can hear the hear words.

So what's going on here? The remarkable thing is the sensory information coming into the brain hasn't changed at all. All that's changed is your brain's best guess of the causes of that sensory information. And that changes what you consciously hear. All this puts the brain basis of perception in a bit of a different light. Instead of perception depending largely on signals coming into the brain from the outside world, it depends as much, if not more, on perceptual predictions flowing in the opposite direction. We don't just passively perceive the world, we actively generate it.

Think about this for a minute: If hallucination is a kind of uncontrolled perception, your experience of being yourself - your perception right here and right now - is also a kind of hallucination, but a controlled hallucination in which the brain's predictions are being reined in by sensory information from the world. In fact, we're all hallucinating all the time, including right now. When we agree about our hallucinations, we call that reality. (Laughter)

Now I'm going to tell you that your experience of being a self, the specific experience of being you, is also a controlled hallucination generated by the brain. This seems a very strange idea. Yes, visual illusions might deceive my eyes, but how could I be deceived about what it means to be me?

For most of us, the experience of being a person is so familiar, so unified and so continuous that it's difficult not to take it for granted. But we shouldn't take it for granted. There are in fact many different ways we experience being a self. There's the experience of having a body and of being a body. There are experiences of perceiving the world from a first person point of view. There are experiences of intending to do things and of being the cause of things that happen in the world. And there are experiences of being a continuous and distinctive person over time, built from a rich set of memories and social interactions. Many experiments show, and psychiatrists and neurologists know very well, that these different ways in which we experience being a self can all come apart. What this means is the basic background experience of being a unified self is a rather fragile construction of the brain. Another experience that requires explanation!

Let's return to the bodily self. How does the brain generate the experience of being a body and of having a body? The brain makes its best guess about what is and what is not part of its body. There's a beautiful experiment in neuroscience to illustrate this and, unlike most neuroscience experiments, this is one you can do at home. All you need is one of these. (a rubber hand) And a couple of paintbrushes.

In the rubber hand illusion, a person's real hand is hidden from view, and that fake rubber hand is placed in front of them. Then both hands are simultaneously stroked with a paintbrush while the person stares at the fake hand.

For most people, after a while, this leads to the very uncanny sensation that the fake hand is in fact part of their body. And the idea is that the congruence between seeing touch and feeling touch on an object that looks like hand and is roughly where a hand should be, is enough evidence for the brain to make its best guess that the fake hand is in fact part of the body.

This means that even experiences of what our body is is a kind of best guessing - a kind of controlled hallucination. There's one more thing. We don't just experience our bodies as objects in the world from the outside, we also experience them from within.

We all experience the sense of being a body from the inside. And sensory signals coming from the inside of the body are continually telling the brain about the state of the internal organs, how the heart is doing, what the blood pressure is like, lots of things. This kind of perception, which we call interoception, is rather overlooked. But it's critically important because perception and regulation of the internal state of the body is what keeps us alive.

Experiences of having a body are deeply grounded in perceiving our bodies from within.

There's one last thing I want to draw your attention to, which is that experiences of the body from the inside are very different from experiences of the world around us. When I look around me, the world seems full of objects - tables, chairs, rubber hands, people, you - even my own body in the world - I can perceive it as an object from the outside. But my experiences of the body from within, they're not like that at all. I don't perceive my kidneys here, my liver here, my spleen ... I don't know where my spleen is, but it's somewhere. I don't perceive my insides as objects.

In fact, I don't experience them much at all unless they go wrong. And this is important.

Perception of the internal state of the body isn't about figuring out what's there, it's about control and regulation - keeping the physiological variables within the tight bounds that are compatible with survival. When the brain uses predictions to figure out what's there, we perceive objects as the causes of sensations.

When the brain uses predictions to control and regulate things, we experience how well or how badly that control is going - so our most basic experiences of being a self, of being an embodied organism, are deeply grounded in the biological mechanisms that keep us alive.

When we follow this idea all the way through, we start to see that all of our conscious experiences stem from predictive perception to stay alive. We experience the world and ourselves with, through and because of our living bodies.

Let me bring things together step-by-step.

What we consciously see depends on the brain's best guess of what's out there.

Our experienced world comes from the inside out, not just the outside in.

The rubber hand illusion shows that this applies to our experiences of what is and what is not our body.

And these self-related predictions depend critically on sensory signals coming from deep inside the body.

Finally, experiences of being an embodied self are more about control and regulation than figuring out what's there. So our experiences of the world around us and ourselves within it are kinds of controlled hallucinations that have been shaped over millions of years of evolution to keep us alive in worlds full of danger and opportunity. We predict ourselves into existence.

Now, I leave you with three implications of all this.

First, just as we can misperceive the world, we can misperceive ourselves when the mechanisms of prediction go wrong. Understanding this opens many new opportunities in psychiatry and neurology, because we can finally get at the mechanisms rather than just treating the symptoms in conditions like depression and schizophrenia.

Second: what it means to be me cannot be reduced to or uploaded to a software program running on a robot, however smart or sophisticated. We are biological, flesh-and-blood animals whose conscious experiences are shaped at all levels by the biological mechanisms that keep us alive.

Finally, our own individual inner universe, our way of being conscious, is just one possible way of being conscious. And even human consciousness generally - is just a tiny region in a vast space of possible consciousnesses.

Our individual self and worlds are unique to each of us, but they're all grounded in biological mechanisms shared with many other living creatures. These are fundamental changes in how we understand ourselves. With

a greater sense of understanding comes a greater sense of wonder, and a greater realization that we are part of
- and not apart from - the rest of nature.

And when the end of consciousness comes, there's nothing to be afraid of. Nothing at all.

All the best! Ubuntu! ~ sue