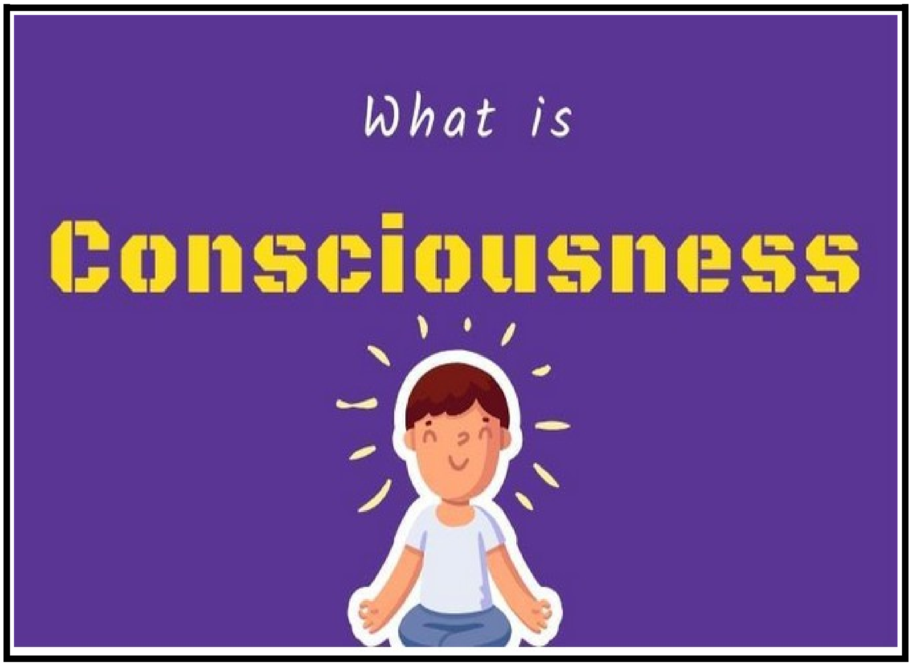
TedEd-11

What is Consciousness?



Here are two images of a house. There's one obvious difference, but to this patient, P.S., they looked completely identical.

P.S. had suffered a stroke that damaged the right side of her brain, leaving her unaware of everything on her left side. But though she could discern no difference between the houses, when researchers asked her which she would prefer to live in, she chose the house that wasn't burning — not once, but again and again. P.S.'s brain was still processing information from her whole field of vision. She could see both images and tell the difference between them, she just didn't know it. If someone threw a ball at her left side, she might duck. But she wouldn't have any awareness of the ball, or any idea why she ducked. P.S.'s condition, known as hemispatial neglect, reveals an important distinction between the brain's processing of information and our experience of that processing. That experience is what we call consciousness. We are conscious of both the external

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world and our internal selves — we are aware of an image in much the same way we are aware of ourselves looking at an image, or our inner thoughts and emotions.

But where does consciousness come from? Scientists, theologians, and philosophers have been trying to get to the bottom of this question for centuries — without reaching any consensus. One recent theory is that consciousness is the brain's imperfect picture of its own activity. To understand this theory, it helps to have a clear idea of one important way the brain processes information from our senses. Based on sensory input, it builds models, which are continuously updating, simplified descriptions of objects and events in the world. Everything we know is based on these models. They never capture every detail of the things they describe, just enough for the brain to determine appropriate responses. For instance, one model built deep into the visual system codes white light as brightness without color. In reality, white light includes wavelengths that correspond to all the different colors we can see. Our perception of white light is wrong and oversimplified, but good enough for us to function. Likewise, the brain's model of the physical body keeps track of the configuration of our limbs, but not of individual cells or even muscles, because that level of information isn't needed to plan movement. If it didn't have the model keeping track of the body's size, shape, and how it is moving at any moment, we would quickly injure ourselves.

The brain also needs models of itself. For example, the brain has the ability to pay attention to specific objects and events. It also controls that focus, shifting it from one thing to another, internal and external, according to our needs. Without the ability to direct our focus, we wouldn't be able to assess threats, finish a meal, or function at all. To control focus effectively, the brain has to construct a model of its own attention. With 86 billion neurons constantly interacting with each other, there's no way the brain's model of its own information processing can be perfectly self-descriptive. But like the model of the body, or our conception of white light, it doesn't have to be. Our certainty

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that we have a metaphysical, subjective experience may come from one of the brain's models, a cut-corner description of what it means to process information in a focused and deep manner.

Scientists have already begun trying to figure out how the brain creates that self model. MRI studies are a promising avenue for pinpointing the networks involved. These studies compare patterns of neural activation when someone is and isn't conscious of a sensory stimulus, like an image. The results show that the areas needed for visual processing are activated whether or not the participant is aware of the image, but a whole additional network lights up only when they are conscious of seeing the image. Patients with hemispatial neglect, like P.S., typically have damage to one particular part of this network. More extensive damage to the network can sometimes lead to a vegetative state, with no sign of consciousness.

Evidence like this brings us closer to understanding how consciousness is built into the brain, but there's still much more to learn. For instance, the way neurons in the networks related to consciousness compute specific pieces of information is outside the scope of our current technology. As we approach questions of consciousness with science, we'll open new lines of inquiry into human identity.