Mind

Theory of consciousness branded 'pseudoscience' by neuroscientists

Integrated information theory is seen by some people as a leading theory of consciousness, but now over 100 neuroscientists have signed an open letter calling it untestable pseudoscience

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We don't know where consciousness comes from
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One of the leading theories of consciousness, known as integrated information theory or IIT, has been branded a pseudoscience in an open letter by 124 neuroscientists, including some of the field's biggest names.

The letter, which was posted online last week and has been submitted to a peer-reviewed journal, says that the most recent experimental evidence claimed to support IIT did not, in fact, test the core ideas of the theory, and that it is not even possible to do so.

The authors ...

of the letter include Adrian Owen at Western University in Canada, who has demonstrated awareness in people in a vegetative state, Chris Frith at University College London, who led pioneering brain imaging work, and Joseph LeDoux at New York University, who studies how the brain processes fear.

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Consciousness is one of science's deepest mysteries; it is considered so difficult to explain how physical entities like brain cells produce subjective sensory experiences, such as the sensation of seeing the colour red, that this is sometimes called "the hard problem" of science.

While the question has long been investigated by studying the brain, IIT came from considering the mathematical structure of information-processing networks and could also apply to animals or artificial intelligence.

It says that a network or system has a higher level of consciousness if it is more densely interconnected, such that the interactions between its connection points or nodes yield more information than if it is reduced to its component parts.

IIT predicts that it is theoretically possible to calculate a value for the level of consciousness, termed phi, of any network with known structure and functioning. But as the number of nodes within a network grows, the sums involved get exponentially bigger, meaning that it is practically impossible to calculate phi for the human brain – or indeed any information-processing network with more than about 10 nodes.

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Scepticism has been expressed before about whether IIT is a helpful way to think about consciousness, but the latest salvo was triggered by a presentation at the June meeting of the Association for the Scientific Study of Consciousness.

This work investigated if brain scans offered support for IIT, for instance, by looking at whether more densely connected brain regions at the back of the head – which should have a higher value of phi – had more activity when people carried out certain cognitive tasks.

The study also considered a rival theory of consciousness called global neuronal workspace, which says that unconscious and locally processed

signals reach consciousness when they are broadcast more widely through the brain.

At the conference, the experimenters said the results offered partial support for . However, regarding IIT, last week's letter claims that "the studies only tested some idiosyncratic predictions made by certain theorists, which are not really logically related to the core ideas of IIT… The findings therefore do not support the claims that the theory itself was actually meaningfully tested".

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"This [experiment] is nothing to do with the theory, and yet it was advertised as a test of the theory," says at the RIKEN Center for Brain Science in Wako, Japan, who helped organise the letter.

Lau says some IIT supporters have overhyped these and other findings and so the public now believes IIT has more scientific support than it really has. This matters, because some interpret IIT to mean that fetuses and animals have some level of consciousness, which could affect policies on abortion and animal rights, he says.

at the University of Wisconsin–Madison, who first developed IIT and took part in the recent testing, did not respond to *New Scientist*'s requests for comment. But at VU Amsterdam in the Netherlands**,** who was not involved in the recent study**,** says the letter went too far. "There isn't a lot of empirical support for IIT. But that doesn't warrant calling it pseudoscience."

Complicating matters, there is no single definition of pseudoscience. But ITT is not in the same league as astrology or homeopathy, says at the University of Bristol in the UK. "It looks like a serious attempt to understand consciousness. It doesn't make it a theory pseudoscience just because some people are making exaggerated claims."

at the University of Sussex in the UK, who is not a supporter of IIT, says: "There is valuable work going on under the banner of IIT. But there are some legitimate questions about how different theories are presented to the public."

Reference: *PsyArXiv*