Abnormal brain interactions harm consciousness

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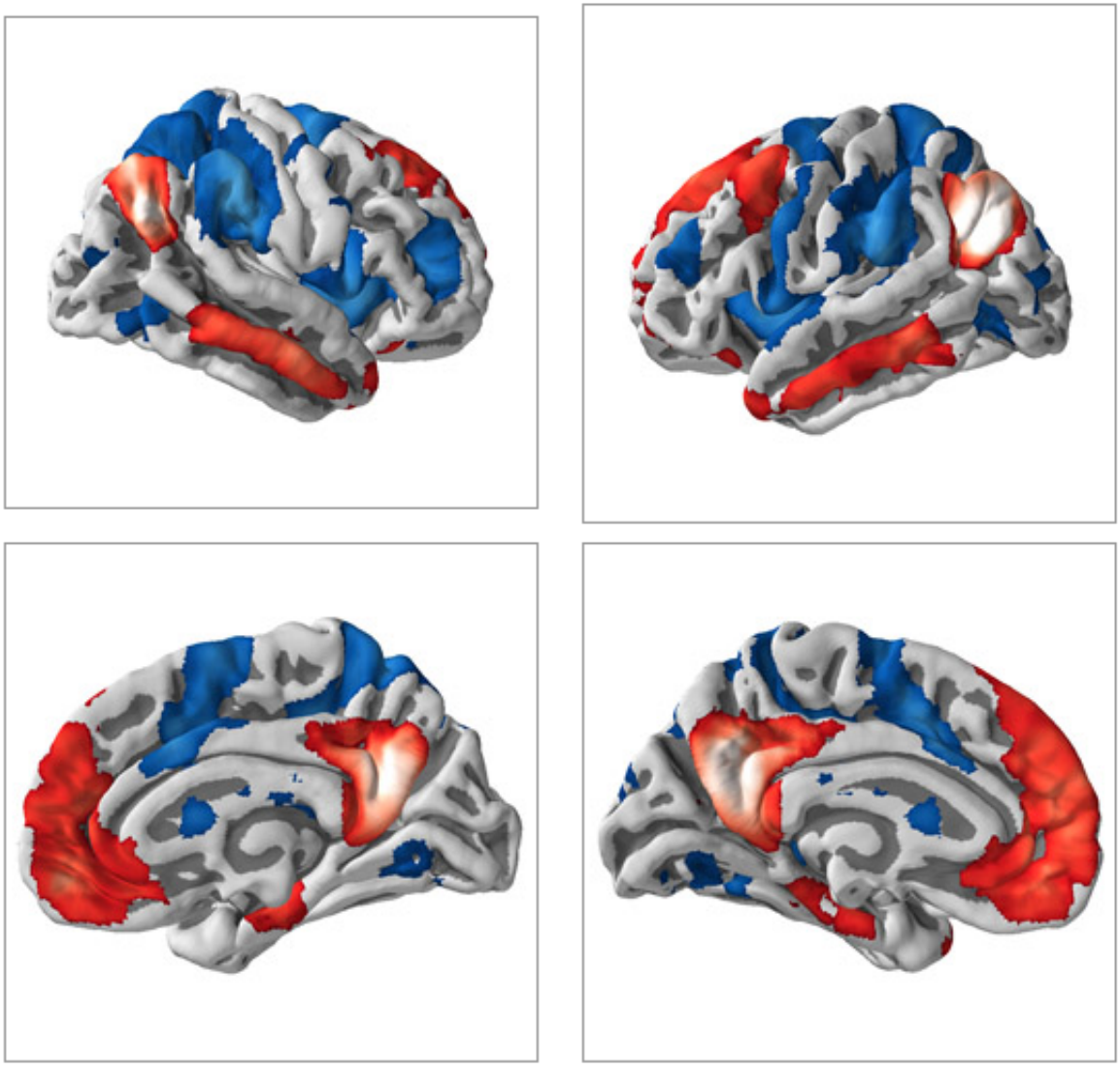

The two networks related to the perception of the external world and internal thoughts (in blue and red respectively) show a pathological communication in disorders of consciousness.

Over the past few years, a great amount of scientific research has shown that even when the brain is "at rest" it still works. The brains of healthy people are organized into regions displaying similar activity, called resting-state networks. There are two networks related to the perception of either the external world or internal thoughts. So far, much research on consciousness has focused on the activity within these networks, rather than how they communicate between each other.

An international research team has now investigated their interactions in different states of consciousness and has discovered that patients with severely impaired consciousness (disorders of consciousness, e.g. vegetative state/unresponsive wakefulness syndrome and minimally conscious state) show a pathological or uncontrolled communication between the two networks. Conversely, in patients who recovered from disorders of consciousness (patients known as emerging from minimally conscious state) the habitual interactions between networks are partially preserved, despite there being no difference in the connectivity within each network.

The study, published by the high-impact journal *The Lancet Neurology*, was led by Carol Di Perri, researcher at the Coma Science Group at Université de Liège (Belgium), and coordinated by Athena Demertzi, Steven Laureys (Coma Science Group) and Andrea Soddu from Western University (London, Ontario, Canada).

"Our findings cast light on the mechanisms underlying neural function necessary to emerge from impaired consciousness states and, more generally, on the importance of these network interactions in the emergence of higher cognitive functions," says Laureys, Director, Coma Science Group and principal investigator at the GIGA (Interdisciplinary Cluster for Applied Geno-proteomics) of Liège. "Such results will have

relevant impact in the clinical setting and may lead to possible new therapeutic options."

According to Di Perri, previous research into disorders of consciousness predominantly focused on the connectivity breakdown within these networks, rather than their functional interactions.

"This study suggests that communication between networks is more important than connectivity within networks for cognitive functions necessary to emerge from disorders of consciousness," says Di Perri.

Soddu, an assistant professor at Western's Department of Physics and Astronomy and a member of the world-renowned Brain and Mind Institute, further explains, "This important discovery shows that the two neural networks interact in a competing ways within the human brain, making patients emerging from minimally conscious state swing between the perception of the external world and their internal thoughts in an integrated manner."

More information: Carol Di Perri et al. Neural correlates of consciousness in patients who have emerged from a minimally conscious state: a cross-sectional multimodal imaging study, *The Lancet Neurology* (2016). DOI: 10.1016/S1474-4422(16)00111-3

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