Study targets 'fingerprint' of human consciousness

October 11 2019, by Jeff Renaud

Paul Mayne. Credit: Western News

Western researchers have moved a step closer to identifying a 'brain fingerprint' for consciousness—a discovery that will unlock further understanding into why some patients, presumed to be vegetative, are

still aware of the world them.

In his landmark 2006 study, Western neuroscientist Adrian Owen and his collaborators showed for the first time that functional neuroimaging can reveal conscious awareness in some patients who appear to be entirely vegetative. This technique even allowed some of these individuals to communicate their thoughts and wishes to the outside world.

But an important question for Owen remained: Why could some patients communicate and not others?

In a new study published today, Owen and his colleagues at the University of Cambridge may have found an answer.

The international research team compared the brain states of patients in a vegetative or minimally conscious state with those of healthy participants anaesthetized with propofol, commonly used to sedate otherwise healthy people when they go for routine surgery.

"We need to understand more about consciousness and the brain. And for this study, we needed to identify a specific brain state associated with consciousness and, conversely, a specific brain state indicative on unconsciousness," said the cognitive neuroscience and imaging professor. "Obviously, we cannot 'control' consciousness in vegetative patients, but we can in healthy study participants if we use an anaesthetic drug like propofol."

Western's role in this international collaboration was to scan a group of participants at the Schulich School of Medicine & Dentistry's Robarts Research Institute, using functional magnetic resonance imaging (fMRI), while they were gradually sedated using the drug propofol. The results were compared to those of a group of patients, either in a vegetative or

minimally conscious state, who were scanned by researchers at Cambridge.

"Remarkably, we saw very similar results in the two groups of participants scanned on opposite sides of the Atlantic. Specifically, loss of consciousness—whether due to propofol anaesthesia or brain injury—was accompanied by reduced functional diversity and integrative capacity in similar brain networks, which may represent a neurobiological marker or 'brain fingerprint' for consciousness," Owen said.

Put simply, functional diversity and integrative capacity are properties of the brain that reveal how much information is being exchanged and integrated between different brain regions.

"It is still early days, but these results are beginning to reveal how our brains generate our conscious experience of the world and what goes wrong when consciousness fails," Owen said. "This is an important piece in our quest to understand why some patients, presumed to be vegetative, are in fact conscious and aware of everything going on around them."

The study, Consciousness-specific dynamic interactions of brain integration and functional diversity, was published today in the journal *Nature Communications*.

More information: Andrea I. Luppi et al. Consciousness-specific dynamic interactions of brain integration and functional diversity, *Nature Communications* (2019). DOI: 10.1038/s41467-019-12658-9

Provided by University of Western Ontario