Split brain does not lead to split consciousness

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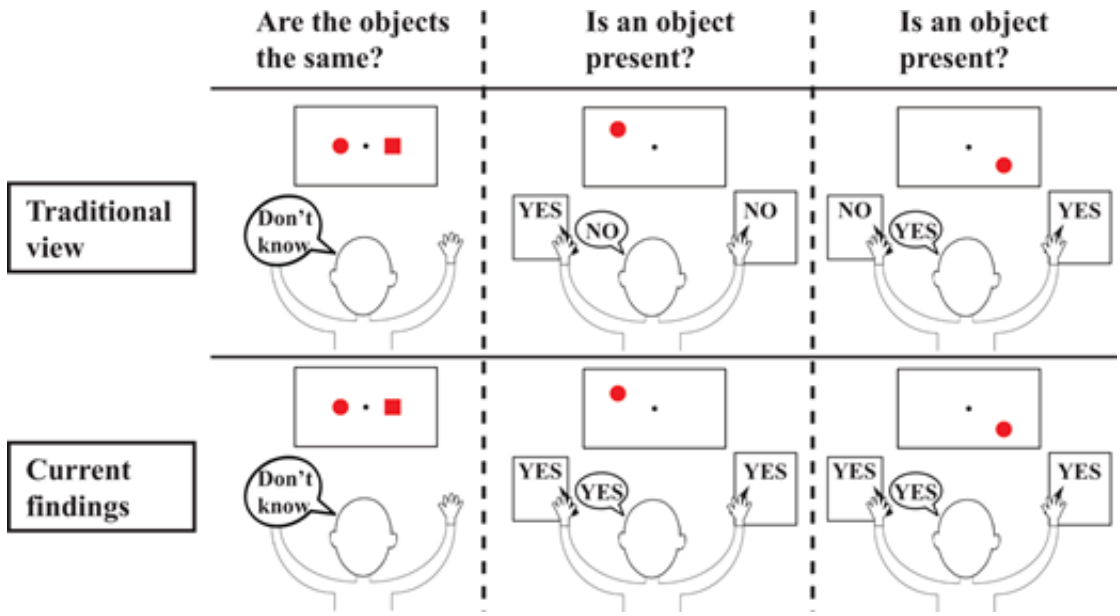

A depiction of the traditional view of the split brain syndrome (top) versus what the researchers actually found in two split-brain patients across a wide variety of tasks (bottom). Credit: Yair Pinto

A new research study contradicts the established view that so-called split-brain patients have a split consciousness. Instead, the researchers behind the study, led by UvA psychologist Yair Pinto, have found strong evidence showing that despite being characterised by little to no communication between the right and left brain hemispheres, split brain does not cause two independent conscious perceivers in one brain. Their results are published in the latest edition of the journal *Brain*.

Split brain is a lay term to describe the result of a corpus callosotomy, a surgical procedure first performed in the 1940s to alleviate severe epilepsy among patients. During this procedure, the corpus callosum, a bundle of neural fibres connecting the left and right cerebral hemispheres, is severed to prevent the spread of epileptic activity between the two brain halves. While mostly successful in relieving epilepsy, the procedure also virtually eliminates all communication between the cerebral hemispheres, thereby resulting in a 'split brain.'

This condition was made famous by the work of Nobel laureate Roger Sperry and Michael Gazzaniga. In their canonical work, Sperry and Gazzaniga discovered that split-brain patients can only respond to stimuli in the right visual field with their right hand and vice versa. This was taken as evidence that severing the corpus callosum causes each hemisphere to gain its own consciousness.

For their study, Pinto and his fellow researchers conducted a series of tests on two patients who had undergone a full callosotomy. In one of the tests, the patients were placed in front of a screen and shown various objects displayed in several locations. The patients were then asked to confirm whether an object appeared and to indicate its location. In another test, they had to correctly name the object they had seen, a notorious difficulty among spit-brain patients. 'Our main aim was to determine whether the patients performed better when responding to the left visual field with their left hand instead of their right hand and vice versa,' says Pinto, assistant professor of Cognitive Psychology. 'This question was based on the textbook notion of two independent conscious agents: one experiencing the left visual field and controlling the left hand, and one experiencing the right visual field and controlling the right hand.'

To the researchers' surprise, the patients were able to respond to stimuli throughout the entire visual field with all the response types: left hand,

right hand and verbally. Pinto: 'The patients could accurately indicate whether an object was present in the left visual field and pinpoint its location, even when they responded with the right hand or verbally. This despite the fact that their cerebral hemispheres can hardly communicate with each other and do so at perhaps 1 bit per second, which is less than a normal conversation. I was so surprised that I decide repeat the experiments several more times with all types of control.'

According to Pinto, the results present clear evidence for unity of consciousness in split-brain patients. 'The established view of split-brain patients implies that physical connections transmitting massive amounts of information are indispensable for unified consciousness, i.e. one conscious agent in one brain. Our findings, however, reveal that although the two hemispheres are completely insulated from each other, the brain as a whole is still able to produce only one conscious agent. This directly contradicts current orthodoxy and highlights the complexity of unified consciousness.'

In the coming period, Pinto plans to conduct research on more split-brain patients to see whether his findings can be replicated. 'These patients, who are rapidly decreasing in numbers, are our only way to find out what happens when large subsystems in the brain no longer communicate with each other. This phenomenon raises important questions that cannot be investigated in healthy adults because we have no technique to isolate large subsystems in healthy brains.'

More information: Yair Pinto et al. Split brain: divided perception but undivided consciousness, *Brain* (2017). DOI: 10.1093/brain/aww358

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