

## Response: Phantoms in the Brain

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In 1996, my grandfather came to visit my family in Chicago. He seemed the same wonderful grandfather I had always known, yet he wasn't. We would be sitting together talking about Venezuela when suddenly he would get mad and frustrated and start talking about the noisy children playing on the swings. This was not the grandpa I knew, especially because there were no children on the swings. We would be watching television when suddenly he would start talking to an empty chair and just as suddenly continue the normal conversation with my parents. He told my mother he was going crazy. He scared me. He had Alzheimer's disease, and he died four years later.

Although Alzheimer's is a common neurodegenerative disorder, there are a number of other disorders society is unaware of, and scientists have been digging deep into the mysteries of such syndromes. Amputees know they have no arm or leg, imagine the despair and frustration when they still feel all the sensation in them including intolerable pain. Imagine being able to walk, dance, and jump when in reality one of your legs is paralyzed. Imagine a day when you are partially blind but are entertained by cartoons that dance around in your blindness, or the day you mistake your parents for impostors or have no recollection of them at all. It is patients like these with rare and challenging neurological disorders who have given scientists and the world a blueprint into the complexity of the brain.

Many of the aforementioned symptoms are best understood by taking a magnified look into the brain, which contains the specialized wiring which controls our existence. Neurologist Dr. V.S. Ramachandran, author of *Phantoms in the Brain*, has focused much of his career on uncovering the mysteries of the organ that makes us human, the brain. After conducting many examinations and simple experiments on patients who suffer from an inexplicable pain on a missing limb, commonly known as a phantom limb, Ramachandran was finally able to reveal the brain processes which fooled patients into feeling the phantom pain. Results from phantom patient experiments informed the scientific world that the brain, composed of evolutionarily perfected connections between neurons, is capable of rewiring itself.

When a hand is amputated the neurons that feel sensations in that hand can no longer feel them. However, it does not take long for adjacent neurons, which "feel" sensations of different body parts, to invade the area corresponding to the amputated hand. In the case of the hand, the body part adjacently represented in the brain is the face, thus after the remapping of neuronal connections patients feel sensation on their invisible hand when their face is touched. Rewiring of the brain in instances like these may not be fool proof; although your face "feels" a form of touch, the sensation is sometimes translated into pain, which is "felt" by the amputated hand giving origin to the phantom pain. Imagine these patients clenching their hands tightly, digging their nails into their flesh, yet unlike us they are unable to see their nails digging into the palms of their hands. Thus, their brains continue to signal the fist

clenching. Once again the patient suffers due to the brain's foolishness. The phantom pain is felt but there is no control over it since the visual cue warning the brain to stop the nail digging is missing (Ramachandran 1998).

This foolishness can also make patients who still have an immobilized member believe that they can control its every movement. This perception of movement in their paralyzed hand was quite puzzling to Dr. Ramachandran. Individuals who believe that they can see and feel movement in their paralyzed hand have shed light on specialized differences between the left and right hemisphere of our brains. After imaging techniques it was discovered that awareness of inconsistencies is controlled by a region in our right temporal lobe. Patients thinking they can move their paralyzed limbs are in denial. An error has most likely occurred in their discrepancy seeking right lobe but instead the brain is ruled by their left temporal lobe, which finds excuses to avoid the obvious. Disagreement exists between the movement the brain thinks the limb is doing and the visual input of the paralyzed hand. The left hemisphere is such a conformist that it can trick the patient into thinking that the paralyzed hand belongs to somebody else (ibid).

Humans depend on the brain not only for movement and sensation but also for awareness, reasoning, language and emotions or qualities that make us human. Recognizing faces of loved ones is an unconscious ability our brain engages in daily. When we recognize a person, place, or object our brains unlock an emotion that is directly associated with whatever it is that we are seeing. Imagine a son who believes his parents are impostors. He can clearly recognize them and acknowledge that these impostors look just like his parents; however, he believes they are not the real thing. Ramachandran, again baffled by this perception, took a look at what circuit break could have occurred to cause this reaction. By using a series of galvanic skin response tests Dr. Ramachandran realized that those afflicted by Capgras delusion have an intact recognition circuit but lack wiring to the emotional center in our brain, the limbic system. Thus, every time a parent recognizes the patient, he or she does not perceive the emotions that a normal person feels, consequently the patient's only logical reasoning is thinking that his/her parents must be impostors.

It is important to realize that not only patients but also family, friends, and caregivers are immensely affected by these syndromes. Movies, television, and the media are providing a clear picture of what it means to suffer a neurological disorder. *The Diving Bell and the Butterfly*, a 2007 French film, is a perfect example of how filmmakers portray the plight of the patient, family, and caregivers; their daily ordeals to tackle the disorder, life, and society. This devastating story of a man who suffers from locked-in syndrome after a stroke and learned how to communicate by blinking one of his eyes is quite an inspiration. It shows how a man who is completely aware of his surroundings and his memories is trapped in his own body. His frustration and hopelessness is also seen in his loved ones who are unable to fix the situation, unable to accept this reality, but nevertheless mask these feelings of devastation with strength and support. Even the nurses, speech therapists, and doctors serve as a support system. Their undivided attention and persistence help channel the patient's emotions, allowing him not only to communicate to those in his own room but to communicate with the world through a book that he accomplished just a couple months before he passed away. It is movies like this along with others such as *Away from her*, *Iris*, and *Awakenings* that are capable of

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portraying not only the scientific aspect of the disorder but the human aspect as well.

It is amazing how examining patients with extreme cases can emphasize the role of each structure in the brain. Whether it is a stroke, the rewiring in the phantom brain, denial, memory, or a missing connection between recognition and emotion, each error in these patients' brains has only reinforced how our brains should be and the effectiveness of our healthy brains. Movement, sensation, memory and cognition, each and every connection in our brains has survived the test of evolution. The entirety of our brain has been constructed through natural selection. Each structure of the brain plays a specific role but when it works as a whole, it allows us to function as humans and only time has been able to perfect the intertwine-ness of it all. Patients have shown us that evolution has produced the adequate connections for our survival, the "normal brain." The infinite mysteries behind the normal functioning of the human brain are glimpsed and sometimes even understood when scientists study its myriad dysfunctions. Neurological disorders pose a baffling conundrum to scientists. Yet their study has helped us not only understand the disorders themselves, but ironically, they have given us insight to the networking of a normal brain.

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#### **References**

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