

## Study shows brain activity associated with phantom limbs

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Geneva, Switzerland - March 25, 2009 - Phantom limbs, often described after amputation, are also experienced as an extra limb in patients who are paralyzed on one side following a stroke. Referred to as supernumerary phantom limb (SPL), patients can usually perceive these limbs as a vivid somatosensory presence of an extra limb, but generally cannot see or intentionally move them. In some unusual cases, however, patients have reported seeing their phantom limb or feeling objects or body parts with it, which indicates that multiple areas of the brain may be involved in SPLs.

A new study on a patient who experienced an SPL which she could feel, see and intentionally move is published in *Annals of Neurology*, the official journal of the American Neurological Association and the Child Neurology Society. It is one of the very few studies to investigate [brain](#) activity connected to SPLs.

The study involved a 64-year-old woman who suffered a stroke and was subsequently paralyzed on her left side. A few days after the stroke, she experienced an SPL starting from the elbow of her paralyzed left arm, which she described as "pale," "milk-white" and "transparent." She claimed she could move, see and even use the SPL to touch parts of her body such as her head and right shoulder, but that she experienced it only when she decided to "trigger" it intentionally. She even claimed to be able to use it to scratch an itch on her head, with an actual sense of relief. She also reported that the [phantom limb](#) could not penetrate solid objects.

Led by Asaid Khateb of Geneva University Hospitals, researchers conducted [functional magnetic resonance imaging](#) scans to analyze the patient's [brain activity](#) during actual and imagined movements of her healthy right hand, imagined movements of her paralyzed left hand and movements of the SPL.

The real movements of the right hand were associated the dominant activation of left areas of the brain associated with movement, perception of stimuli and visual processing, as expected. Similar but less extensive activations were seen with imaginary movements of the right hand. In contrast, imaginary movements of the paralyzed left hand showed dominant activation in areas associated with movement in right side of the brain. When asked to scratch her cheek with the SPL, areas of the brain associated with movement and vision were activated, which confirmed her report that she could see and move her SPL. In addition, a measurable sensory response was also detected when she scratched her left cheek with the SPL.

The authors note that there are probably different types of SPLs that differ in how they are manifested, the extent of motor control, the sensitivity to sensory feedback and patients' mental framework and that it is unlikely that a single explanation will suffice for such clinically complex and diverse conditions. The current study is the first to demonstrate the neural correlates of the multimodal SPL, particularly the visual and somesthetic activation that accompanied the intentional SPL movements.

"Existing evidence from stroke-elicited SPLs convincingly implicates the mismatch between the subject's well-established sensorimotor representations and a suddenly aberrant pattern of communication between the brain and the paralyzed limb," the authors state, adding that the current case may represent a missing link between classical phantom limbs and autoscopic phenomena such as out of body experiences.

"Ultimately, however," they conclude, "these conditions might offer a unique way to understand how the brain constructs a normal experience of bodily awareness and the self."

Source: Wiley ([news](#) : [web](#))

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