

Scientists create illusion of having 3 arms

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Arvid Guterstam conducting an experiment.

(PhysOrg.com) -- How we experience our own bodies is a classical question in psychology and neuroscience. It has long been believed that our body image is limited by our innate body plan – in other words that we cannot experience having more than one head, two arms and two legs. However, brain scientists at the Swedish medical university Karolinska Institutet have now shown that it is possible to make healthy volunteers experience having three arms at the same time.

In a novel paper published in the online scientific journal *PLoS ONE* they describe how it is possible to create an illusion of owning three arms, under controlled conditions in a laboratory. The experiment involves the participant sitting at a table and having a realistic prosthetic arm placed next to their right arm. The subject then sees her two real arms and the extra prosthetic arm, made out of rubber. To produce the

feeling of owning the rubber arm, the scientist touches the subject's right hand and the rubber hand with two small brushes at corresponding location – synchronizing the strokes as perfectly as possible.

"What happens then is that a conflict arises in the brain concerning which of the right hands belongs to the participant's body", says Arvid Guterstam, one of the scientists behind the study. "What one could expect is that only one of the hands is experienced as one's own, presumably the real arm. But what we found, surprisingly, is that the brain solves this conflict by accepting both right hands as part of the [body image](#), and the subjects experience having an extra third arm."

The study consists of a series of experiments; in total 154 healthy volunteers were tested.

To prove that the prosthetic arm was truly experienced as a third arm, the scientist 'threatened' either the prosthetic hand or the real hand with a kitchen knife, and measuring the degree of sweating of the palm as a physiological response to this provocation. The results demonstrated that the subjects had the same stress response when the prosthetic hand was threatened as when the real [hand](#) was, but only during the periods when they experienced the third arm illusion. For instance, there was no stress reaction when the prosthetic right arm was replaced with a left arm or a prosthetic foot.

The results of the study may benefit patients by creating new applications in prosthetics research.

"It may be possible in the future to offer a stroke patient, who has become paralysed on one side of the body, a [prosthetic arm](#) that can be used and experienced as his own, while the paralysed arm remains within the patient's body image", says Henrik Ehrsson, who has led the study at the Department of Neuroscience. "It is also conceivable that people with

demanding work situations could benefit of an extra arm, such as firemen during rescue operations, or paramedics in the field".

More information: Guterstam A, Petkova VI, Ehrsson HH (2011) The Illusion of Owning a Third Arm. PLoS ONE 6(2): e17208.

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