How does anesthesia disturb self-perception?

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An Inserm research team in Toulouse, led by Dr Stein Silva, working with the "Modelling tissue and nociceptive stress" Host Team (MATN IFR 150), were interested in studying the illusions described by many patients under regional anaesthetic. In their work, to be published in the journal *Anesthesiology*, the researchers demonstrated that anaesthetising an arm affects brain activity and rapidly impairs body perception.

The ultimate aim of the work is to understand how neuronal circuits are reorganised at this exact moment in time and to take advantage of anaesthesia to reconfigure them correctly following trauma. This would allow anaesthetic techniques to be used in the future to treat pain described by amputated patients in what are known as "phantom limbs".

Neuroscience research in recent years has shown that the brain is a dynamic structure. Phenomena such as learning, memorising or recovery from stroke are made possible by the brain's plastic properties. Brain plasticity does not, however, always have a beneficial effect.

For example, some amputated patients suffering from chronic pain (known as phantom limb pain) feel as though their missing limb were "still there". Such "phantom limb" illusions are related to the appearance in the brain of incorrect representations of the missing body part.

Persons under regional anaesthetic describe these very same false images.

Based on these observations, Inserm's researchers wished to discover

whether anaesthesia could, in addition to fulfilling its primary function, induce comparable phenomena in the brain. If this were so, anaesthetics could be used as new therapeutic tools capable of modulating brain activity.

With this in mind, a team headed by Dr Stein Silva monitored 20 patients who were to have one of their arms anaesthetised before surgery. The patients were shown 3D images of the hand, shot from different angles, and their ability to distinguish the right hand from the left was assessed. Results showed how anaesthesia affected the patients' ability to perceive their body correctly.

The researchers observed three phenomena based on these tests:

- All the patients described false sensations in their arm (swelling, difference in size and shape, imagined posture).
- In general, patients under anaesthetic took longer to distinguish between a left and right hand and made far more mistakes than persons not under anaesthetic.
- The best results were obtained when the anaesthetised limb was visible.

In other words, anaesthetising the hand (peripheral deafferentation) modifies brain activity and rapidly changes the way we perceive the outside world and our own body.
The teams are now using functional brain imaging to characterise the regions concerned in the brain. They also hope that it will be possible to use anaesthesia for therapeutic purposes in the future by modulating post-lesional plasticity (chronic pain in amputated patients, improved recovery in those suffering from brain lesions).

Inserm researcher Stein Silva, an anaesthetist and the chief author of the study, believes that it will no doubt be necessary to develop new anaesthetic techniques to inhibit or directly stimulate the brain images associated with painful phenomena.

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