

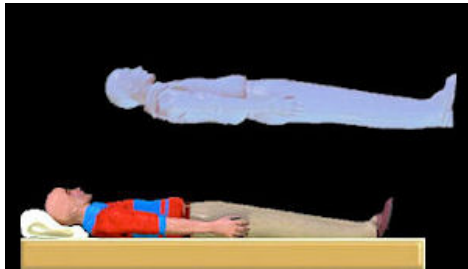
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Brain Region Associated With Self-Consciousness

SciMed - Neuroscience

TS-SI NEWS SERVICE

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Lausanne, Switzerland. Scientists have identified the [brain](#) region associated with one of the most fundamental of subjective human feelings: our self-consciousness.

The brain's **temporo-parietal junction** (TPJ) is critical for our feeling of being located at a particular position in space and for perceiving the world from this position and perspective.

Recent theories of self-consciousness highlight the importance of integrating many different sensory and motor signals, but it is not clear how this type of integration induces subjective states such as self-location (*Where am I in space?*) and the first-person perspective (*From where do I perceive the world?*).

Studies of neurological patients reporting out-of-body experiences have provided some evidence that brain damage can interfere with the integration of multisensory body information. That, in turn, may lead to pathological changes of the first-person perspective and self-location.

However, it is still not known how to examine brain mechanisms associated with self-consciousness. "Recent behavioral and physiological work, using video-projection and various visuo-tactile conflicts showed that self-location can be manipulated in healthy participants," explains senior study author, Dr. Olaf Blanke, from the École Polytechnique Fédérale de Lausanne (EPFL).

"However, so far these experimental findings and techniques do not allow for the induction of changes in the first-person perspective and have not been integrated with neuroimaging, probably because the experimental set-ups require participants to sit, stand, or move. This makes it very difficult to apply and film the visuo-tactile conflicts on the participant's body during standard brain imaging techniques."

The research team used creative engineering to develop the findings reported in the journal *Neuron*. Inventive neuroimaging-compatible robotic technology was developed by Dr. Gassert's group at the Swiss Federal Institute of Technology in Zurich. Blanke and colleagues studied healthy subjects and employed specific bodily conflicts that induced changes in self-location and first-person perspective while simultaneously monitoring brain activity with functional magnetic resonance imaging. They observed that TPJ activity reflected experimental changes in self-location and first-person perspective.

The researchers also completed a large study of neurological patients with out-of-body experiences and found that brain damage was localized to the TPJ. "Our results illustrate the power of merging technologies from engineering with those of neuroimaging and cognitive science for the understanding of the nature of one of the greatest mysteries of the human mind: self-consciousness and its neural mechanisms," concludes Dr. Blanke.

"Our findings on experimentally and pathologically induced altered states of self-consciousness present a powerful new research technology and reveal that TPJ activity reflects one of the most fundamental subjective feelings of humans: the feeling that 'I' am an entity that is localized at a position in space and that 'I' perceive the world from here."

Citation

Multisensory Mechanisms in Temporo-Parietal Cortex Support Self-Location and First-Person Perspective. Silvio Ionta, Lukas Heydrich, Bigna Lenggenhager, Michael Mouthon, Eleonora Fornari, Dominique Chapuis, Roger Gassert, Olaf Blanke. *Neuron* 2011; 70(2): 363-374. doi:10.1016/j.neuron.2011.03.009

Highlights

- [Neuroscience](#) robotics handles self-location and first-person perspective in fMRI
- fMRI reveals the central role of TPJ in self-location and first-person perspective
- Lesion analysis confirms the role of TPJ and suggests a right lateralization

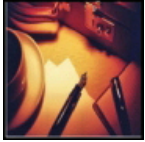


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ABSTRACT

Self-consciousness has mostly been approached by philosophical enquiry and not by empirical neuroscientific study, leading to an overabundance of diverging theories and an absence of data-driven theories. Using robotic technology, we achieved specific bodily conflicts and induced predictable changes in a fundamental aspect of self-consciousness by altering where healthy subjects experienced themselves to be (self-location). Functional magnetic resonance imaging revealed that temporo-parietal junction (TPJ) activity reflected experimental changes in self-location that also depended on the first-person perspective due to visuo-tactile and visuo-vestibular conflicts. Moreover, in a large lesion analysis study of neurological patients with a well-defined state of abnormal self-location, brain damage was also localized at TPJ, providing causal evidence that TPJ encodes self-location. Our findings reveal that multisensory integration at the TPJ reflects one of the most fundamental subjective feelings of humans: the feeling of being an entity localized at a position in space and perceiving the world from this position and perspective.



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