

## Peripersonal space as the interface between the Self and the environment.

*Andrea Serino*

Laboratory of Cognitive Neuroscience,  
BMI Institute and Center for Neuroprosthetics,  
Ecole Polytechnique Fédérale de Lausanne

Any physical interaction between our self and the external environment is mediated by our body and usually occurs in a limited sector of space surrounding the body, termed Peripersonal Space (PPS). Our brain has developed a specific machinery to represent PPS, by integrating somatosensory inputs on the body, with visual or auditory stimuli occurring close to the body. My research focuses on the functional and neural mechanisms of PPS representation in humans.

I have developed behavioural methods to measure the extent and the properties of PPS representation, and I have found that it can be conceived as a multisensory integrative “bubble” all around us (1,2). By using different neuroimaging techniques, I have identified specific fronto-parietal areas dedicated to represent PPS in humans (3-5).

Interestingly, PPS representation is plastic, as its boundaries shape as a function of the way we interact with the environment. The PPS “bubble” extends after using a tool to reach the far space (6), shrinks in case of amputation (7) or prolonged immobilization (8), can incorporate prosthesis and even electronic devices (9).

Finally, PPS mediates not only physical interaction with objects, but it is involved also in more abstract interaction between self and others, since PPS boundaries are sensitive to the presence of and interaction with other people (10).

Based on these results, I argue that PPS is multi-sensory-motor interface, mediating interactions between the Self and the environment.



**Keywords:**

Multisensory integration  
Sensorimotor processing  
Body representation  
Neural plasticity

## References

1. Serino A, Noel JP, Galli G, Canzoneri E, Marmaroli P, Lissek E, Blanke O. Body part-centered and full body-centered peripersonal space representations. Under revision, *Journal of Neurophysiology*,
2. Noel JP, Pfeiffer C, Blanke O, Serino A. Peripersonal Space as the space of the Bodily Self. Under revision, *Cognition*.
3. **Serino A**, Canzoneri E, Avenanti A. Fronto-parietal areas necessary for a multisensory representation of peripersonal space in humans: an rTMS study. *Journal of Cognitive Neuroscience*. 2011. 23(10):2956-67.
4. Annella A, Avenanti A, **Serino A**. Suppression of ventral premotor cortex disrupts motor coding of peripersonal space". *Neuroimage*, 15;63(1):281-8. 29.
5. Cardini F, Costantini M, Galati G, Romani GL, Làdavas E, Serino A. Viewing one's own face being touched modulates tactile perception: an fMRI study. *Journal of Cognitive Neuroscience*. 2011. 23(3):503-13
6. **Serino A**, Bassolino M, Farnè A, Làdavas E. Extended multisensory space in blind cane users. *Psychological Science*. 2007. 18(7):642-8.
7. Canzoneri E, Amoresano A, Marzolla M, Verni G, **Serino A**. Amputation and prosthesis implantation shape body and peripersonal space representations. *Scientific reports*, 2013. 3:2844.
8. Bassolino B, Finisguerra A, Canzoneri E, Serino A, Pozzo T. Dissociating effect of upper limb non-use and overuse on space and body representations. In press, *Neuropsychologia*.
9. Bassolino M, **Serino A**, Ubaldi S, Làdavas E. Everyday use of the computer mouse extends peripersonal space representation. *Neuropsychologia*. 2010. 48(3):803-11.
10. Teneggi C, Canzoneri E, di Pellegrino G, **Serino A**. The space between us: social modulation of Peripersonal space boundaries. *Current Biology*, 2013. 23(5):406-11.