

Measuring the Self: Behavioural and neural correlates of bodily awareness

ABSTRACT:

Aim of the study

The project aimed to investigate the contribution of brain visuo-motor areas and sensorimotor plasticity following the manipulation of subjective experience of body ownership by means of visual manipulation of body continuity.

Method

We collected subjective and physiological (skin conductance responses, motor evoked potentials) answers in healthy participants immersed in a virtual reality environment and explored whether visual discontinuity between the hand and limb of an avatar could reduce a person's sense of ownership of the virtual body.

Results

We observed that placing different amounts of visual discontinuity between a virtual hand and limb differently modulate the perceived sense of ownership and control over observed virtual bodies and actions. Crucially autonomic reactivity but not motor evoked potentials were modulated by the felt ownership over the virtual body. Indeed only high amplitudes of SCRs were found during the observation of both a normal hand-limb connection and a non-natural connection by means of a rigid wire. On the other hand, the analysis of subjective ratings revealed that only the observation of natural full connected virtual limb elicited high levels of ownership in all studies.

Discussion

Our data show that mere observation of limb discontinuity can change a person's ownership and agency over a virtual body observed from a first-person perspective, even in the absence of any multisensory stimulation of the real body.

Importantly different measures of physiological activity were differently modulated by subjective body ownership sensations suggesting that different methods to elicit body ownership illusions may differently affect indirect indexes of body representation.

Keywords

Body ownership, TMS, Virtual reality, Skin conductance, Motor evoked potentials

Published Work:

Fusco, G., Tidoni, E., Barone, N., Pilati, C., & Aglioti, S. M. (2016). Illusion of arm movement evoked by tendon vibration in patients with spinal cord injury. *Restorative Neurology and Neuroscience*, 34(5), 815-826. doi: 10.3233/RNN-160660

Tidoni, E., Abu-Alqumsan, M., Leonardis, D., Kapeller, C., Fusco, G., ... Aglioti, S. M. (2017). Local and Remote Cooperation with Virtual and Robotic Agents: a P300 BCI Study in Healthy and People Living with Spinal Cord Injury. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*. doi: 10.1109/TNSRE.2016.2626391

Tidoni, E., Gergondet, P., Fusco, G., Kheddar, A., & Aglioti, S. (2016). The role of audiovisual feedback in a thought-based control of a humanoid robot: a BCI study in healthy and spinal cord injured people. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*. doi: 10.1109/TNSRE.2016.2597863

Tidoni, E., Scandola, M., Orvalho, V., & Candidi, M. (2016). Apparent Biological Motion in First and Third Person Perspective. *I-Perception*, 7(5), 2041669516669156. doi: 10.1177/2041669516669156

Tidoni, E., Tieri, G., & Aglioti, S. M. (2015). Re-establishing the disrupted sensorimotor loop in deafferented and deafferented people: The case of spinal cord injuries. *Neuropsychologia*, 79(Pt B), 301-309. doi: 10.1016/j.neuropsychologia.2015.06.029

Tieri, G., Tidoni, E., Pavone, E. F., & Aglioti, S. M. (2015). Body visual discontinuity affects feeling of ownership and skin conductance responses. *Scientific Reports*, 5: 17139. doi:10.1038/srep17139

Tieri, G., Tidoni, E., Pavone, E. F., & Aglioti, S. M. (2015). Mere observation of body discontinuity affects perceived ownership and vicarious agency over a virtual hand. *Experimental Brain Research*, 233(4), 1247-1259. doi: 10.1007/s00221-015-4202-3

Researcher's Contacts:

Emmanuele Tidoni
Email: etidoni@gmail.com

Department of Psychology, "Sapienza" University of Rome
Via dei Marsi 78, 00185 Rome, Italy

IRCCS Fondazione S. Lucia
Via Ardeatina, 306; Rome 00142

Centro di Studi e Ricerche in Neuroscienze Cognitive,
Viale Europa 980, 47521 Cesena, Italy