

Apparent motion perception in upper limb amputees with phantom sensations: “obstacle shunning” *and* “obstacle tolerance”

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Abstract (291 words, 300 allowed)

Phantom limbs (PLs) are thought to either hinder or facilitate the successful embodiment of a prosthesis into an amputee’s body representation depending on how they interact with physical objects. In the case of “Obstacle Shunning” (OS), PLs tend to fade off from bodily awareness when their phenomenal space overlaps that of a physical object. Alternatively, PLs can also be experienced to pass through solid objects (“Obstacle Tolerance” - OT). Here we used an innovative paradigm of apparent motion perception of human limbs involving solidity or biomechanical constraints. Depending on stimulus onset asynchrony (SOA), alternation between two static pictures generates the illusory perception that the limb passes through the object (short SOA) or rotates around it along a biologically feasible way (long SOA). Combining multiple behavioural and gaze indices we tested 9 upper limb amputees (4: OS, 5: OT) and 8 able-bodied controls. Upper limb stimuli could be observed either in a first person perspective (1pp), thought to trigger a motor simulation of the illusory movements, and a 3pp, arguably accompanied by mere visual processing. Multilevel logistic regressions showed that amputees’ compared to controls’ illusory percepts were less modulated by the factor perspective, suggesting that the mapping of an observed movement onto a PL relies more on a visual rather than motor strategy. Furthermore, OS participants tended to perceive a hand to go through a solid object while in the OT group, PLs pose the same constraints as for an intact hand. These findings, together with findings in lower limb amputees[#], suggest that the way PLs are experienced in everyday situations is related to apparent motion perception. This has important implication for diagnostics and rehabilitation, considering that currently assessments of altered body representation are mainly based on self-report and explicit measures.

References

[#]Saetta, G., Grond, I., Brugger, P., Lenggenhager, B., Tsay, A., & Giumarra, M. (in press). Apparent motion perception in lower limb amputees with phantom sensations: “Obstacle Shunning” and “Obstacle Tolerance”. *Cortex*.

Short Biography

Gianluca Saetta is a PhD candidate in Clinical and Cognitive Neuroscience at University Hospital of Zurich. He completed his master’s degree in Cognitive Neuroscience and his research internship at University Milano-Bicocca investigating the neurophysiological underpinnings of complex body representation disorders. Combining methods from behavioural neurology, psychology and artificial intelligence, his actual research interests are the multisensory and plastic mechanisms leading to the construction of an unitary and coherent body representation in both healthy participants and in clinical populations. A particular focus is on traumatic amputees with phantom sensations, persons with congenitally absent limbs and individuals with xenomelia.