Cognition out of the lab: body perception and interactions with tools in a simulated real-world environment

Acronym: Cool body & tools

The research on the human body and its relationship to perception has demonstrated that the brain integrates information in the so-called bodily self-consciousness. Bodily self-consciousness includes the experience of owning (ownership) and controlling the body (agency), and the ability to locate one's own body in the space (self-location). The research on human body and its relationship to perception has demonstrated that the brain gathers and integrates the bodily information in the so-called body representation, which supports our movements and interactions with the environment and enables us to recognize and distinguish our body from the others. In recent years there has been a growing consensus in the cognitive neuroscience community that the perception of one's own body in space critically depends on multisensory integration of body-related stimuli. Information from afferents in joints, muscles, tendons, and skin as well as visual, vestibular, and auditory signals reach cortical convergence zones in the frontal, parietal, and temporal lobes, where the integration of these body signals occurs. Furthermore, there is a mounting consensus that the representation of the body is affected by the tool-use. But our body perception can also affect our interaction with external object/devices. For instance, the accurate use of robotic devices (e.g., drones) requires simple, yet intuitive and reliable control interfaces. Body-machine interface seems to be a promising approach for an efficient control of distance devices. However, the investigation has been restricted in narrow-spanning and artificially isolated laboratories. The more isolated is the study from the real word, the more it is vulnerable to claims that the results are not relevant to real life where things are far more complex. The present PhD project will try to narrow the gap between traditional studies of body perception and its interaction with external devices in laboratories and studies carried out in more naturalistic environments that are more representative of larger patterns of the real world. The environmental simulation center terraXcube provides us the naturalistic environment to study our body perception and representation in situations similar to everyday life. The facility allows to simulate the Earth's most extreme climatic conditions in order to study their influence on human beings, on ecological processes and on new technologies. Inside terraXcube, within a useful volume of 12m x 6m x 5m, various environmental scenarios can be reproduced, independently and separately controlling environmental parameters such as temperature from -40 °C to 60 °C), pressure (from sea level up to 9000 m), wind speed (up to 100 km/h), relative humidity (from 10% to 95%), rain (0 – 60 l/m2), snow (overhead layout, 5 cm in 1 hour) and day-night cycle simulation (1000 lux). The Phd project will be supervised by Prof. Massimiliano Zampini, head of the Multisensory Research Group of the Center of Mind/Brain Sciences, University of Trento and co-supervised by Dr. Andrea Vilardi, Senior Researcher at Eurac Research.