Extending the self: Some cold truths on body ownership

31 May 2013, by Alexander De Foe

Where does our sense of intrinsic “me-ness” come from? Credit: ronny-andre

"Who are you?" Some might ponder this question philosophically, while others will answer straightforwardly: "I am my body and my personality". But the boundaries of "self" are not as straightforward as we might think.

In a newly-published paper in the *Journal of the Royal Society Interface*, Joan Llobera, Maria V. Sanchez-Vives and Mel Slater demonstrate a body-ownership illusion in which participants' virtual and physical bodies integrate into the same "body matrix" – a finding that breaks new ground in this burgeoning field of research.

As they point out: "it is extremely simple to generate in people the illusion that a rubber arm is part of their body". Indeed, studies have demonstrated it's quite easy to "trick" people into experiencing a sense of separation from their bodies, or that they have a "third arm", or even that they have an extra-long arm.

We can easily isolate particular parts of our body as "mine" – but the concept of "me" (or whole-body ownership) is much trickier to demonstrate.

The fluidity of "whole-body ownership"

What is it that gives us a sense of whole-body ownership? Or the notion we are separate from our surroundings and other people? Where does that sense of intrinsic "me-ness" come from?

Last year, researchers Lorimer Moseley, Alberto Gallace and Charles Spence introduced the idea of the "body matrix" in relation to this question. The body matrix, as they described it, is a multisensory representation of our whole body and the immediate space around it.

This idea has since become something of a framework, into which other experiments in this field can be placed.

In a typical illusion of body-ownership transfer, a person is asked to stand on one side of a room wearing a head-mounted display. The experimenter, or third party, then stands on the opposite side of the room with a camera attached to a helmet around his or her own head. Sometimes the camera may also be attached to a mannequin's head.

Via a series of multisensory cues, participants tend to report their sense of body ownership has transferred from their own body to the body awareness of the mannequin on the other side of the room.

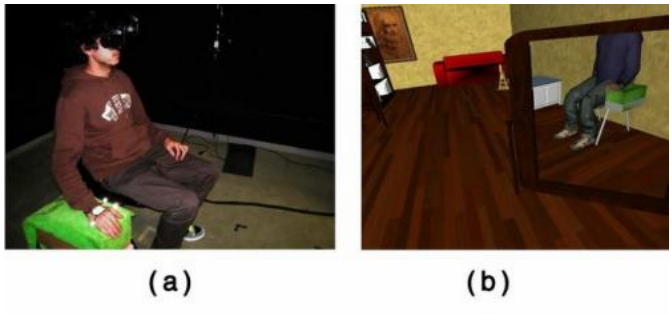
Another popular variation is known as the rubber-hand illusion, as demonstrated in the video above. Typically, a person observes a rubber hand being stroked while his or her own physical hand is synchronously stroked; and this tends to produce a sense that the rubber hand is, in fact, his or her own hand.

Updating the body matrix – where reality and virtual reality blur

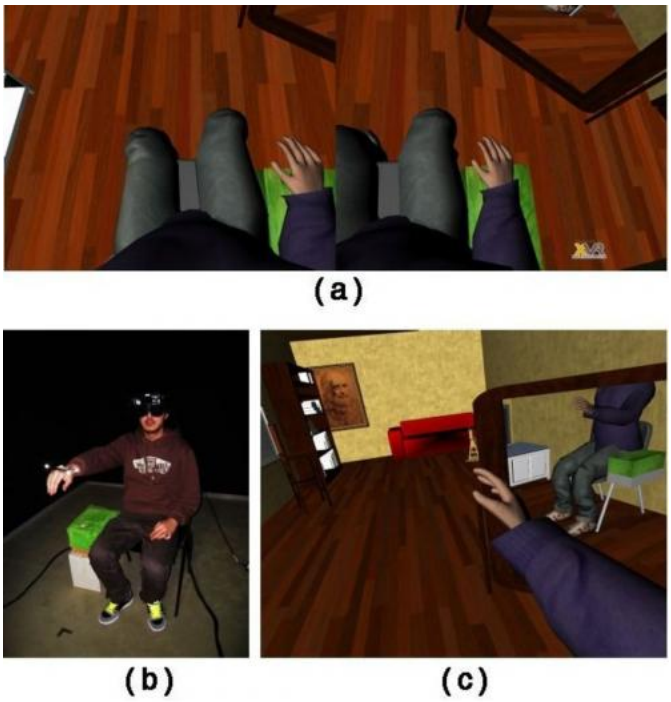
Llobera and colleagues' findings differ from the experiments above in that participants' body

awareness did not transfer per se; rather, it integrated with its virtual-reality double.

They had noted that, during the rubber-hand illusion, the temperature of a person's real hand begins to decrease, which suggests they have disowned the hand and embodied the virtual hand.



The temperature sensitivity recording device, and its virtual counterpart. (a) Shows the position of the participant next to the device (b) the view in the virtual mirror. The real device and virtual counterpart are covered with a green cloth. Credit: Mel Slater



First-person perspective of the body and the view of the virtual mirror: (a) A stereo pair of the scene when the participant looks down toward himself. (b) The participant moving an arm. (c) A view in the mirror of arm movements. (b,c) are not meant to be corresponding images. Credit: Mel Slater

In their study, 40 participants were immersed within a "virtual body" – a head-mounted display – seen from a first-person perspective. For 20 participants, the virtual body mimicked their movements and postures consistently; whereas for the remaining 20, it didn't.

The researchers note that lower sensitivity to temperature changes tends to correlate with the degree of whole-body ownership. So, during their experiment, participants' "temperature sensitivity threshold" was measured before they entered the virtual body, and immediately after.

Sensitivity to temperature changes was shown to be lower in the first group's bodies than for those in the second group.

These results suggest a unification of the virtual and real bodies into one overall entity. Which is to say the physical body provides sensory information that merges with the visual information received via the virtual body.

Moreover, as the authors pointed out, conditions where one's virtual body is in a different physical space (or carries out asynchronous movements) tend to be associated with greater temperature sensitivity.

Although virtual reality research might not yet be in the realms of the film The Matrix, we are making strides in coming to a better understanding of the body matrix.

More information: rsif.royalsocietypublishing.or … 10/85/20130300.short

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