

Is Self-location the Same as Body-location?

Self-location—the subjective feeling of where I am in space—provides an experiential anchor for one’s perceptual experiences and sensorimotor activities. It has been regarded as a key component of bodily self-consciousness (Lenggenhager et al., 2007; Blanke and Metzinger, 2009; Serino et al., 2013; Maselli, 2015). In daily life, one’s sense of self-location overlaps with one’s sense of *body-location* (the sense of where my body is located in space). However, are self-location and body-location the same thing? Is the sense of where I am in space identical to the sense of where I feel my body is located? Addressing this issue is to inquire the self-body relation from the standpoint of spatial awareness. In the study of bodily self-consciousness, many researchers assume that self-location is identical to body-location, or at least do not distinguish between them (Serino et al., 2013; Maselli and Slater, 2014; Guterstam et al., 2015; Szczotka and Wierzchoń, 2023). For example, in Maselli and Slater (2014), self-location was defined as “the experience of the body occupying a given portion of space in the environment.” Here, we investigate whether this assumption is correct. We present a set of VR experiments on full-body illusions to contend that self-location and body-location are *not* the same experiences. The experiments show that it was the sense of *1PP-location* (the experienced location and orientation of one’s first-person perspective) that played an important role in the sense of self-location. We then propose an initial explanation of why 1PP-location is distinct from body-location.

In our experiments, participants were immersed in a virtual environment and stepped onto a Bosu ball (semicircular balance ball) while watching a life-sized avatar step onto a virtual Bosu ball. This instantly caused the participants to wobble involuntarily in order to maintain their balance. Then they saw the avatar splitting into two identical avatars. The bodily wobbling constantly triggered the participants’ proprioception and their vestibular system. The participants’ experiences were measured by questionnaires, skin conductance responses (SCR, physiological evidence), and Color-ball Tests (CBT). CBT was designed to measure the sense of self-location. Participants saw five virtual billiard balls with different numbers spaced evenly apart in front of them. They were told beforehand that five billiard balls would appear one at a time, and that each would appear twice. After that, they orally answered the question: “Which ball do you feel to be closest to you?” Multiple choices were allowed. The results of questionnaires and SCR showed that a *Double Body Effect* was induced in both the synchronous 1PP and synchronous 3PP conditions: the participants felt that both avatars were their own (double body ownership) and that their body was

simultaneously located in the locations of the two avatars (*double body locations*). However, the CBT results indicated that the participants' sense of self-location did *not* split into two and was felt at the location of their visual 1PP in the virtual environment. These data provide a strong case that self-location and body-location can sometimes dissociate.

We therefore contend that self-location and body-location are not the same phenomena. Nevertheless, we are not suggesting Cartesian dualism or disembodiment of the self. Rather, the self is essentially embodied (Merleau-Ponty, 1945; Legrand, 2010). So a question arises: Why self-location is different from body-location? The key is that there is another factor, i.e., the participants' sense of *1PP-location*, that is closely related to, and has great influences on, their sense of self-location. Since we think that both body-location and 1PP-location are maintained and regulated by proprioception-vestibular information, the question becomes: Why is 1PP-location different from body-location? We propose the following explanation (using vision as an example): (1) The ways that proprioception and the vestibular system influence 1PP-location and body-location are not the same. While body-location concerns the proprioception-vestibular and visual information about the torso, 1PP-location is linked to the proprioceptive-vestibular information from the extraocular muscles and the vestibular-ocular reflex. (2) 1PP has certain unique features that the body does not: (i) 1PP is the *origin* of the egocentric spatial framework of one's perceptual experiences and movements. 1PP is the origin *from which* one sees things, hence it itself is not something that is seen. (ii) Each of us is exclusively associated with a particular 1PP. The 1PP that I have is mine and mine alone. (iii) Wherever I go, my 1PP is always *here* because it is my 1PP that defines and underlies what I feel as being "here." These distinctive features can contribute in explaining why 1PP-location is different from body-location, and why self-location and body-location are not the same. It is not that body-location is completely unrelated to self-location. Rather, we think, body-location and 1PP-location are interrelated but different factors that jointly sustain the sense of self-location.

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