
A Hierarchy of Body Representations

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Abstract

We experience our body as a coherent, 3-D, volumetric object. Initial somatotopic maps in somatosensory cortex, however, represent the body as a set of fragmented, 2-D skin surfaces. I will discuss a series of recent experiments investigating different classes of body representation of the hand, which suggest they fall along a continuum from fragmented 2-D maps of individual skin surfaces to coherent 3-D maps of the body as a whole. First, tactile localisation on the skin appears to rely on a purely 2-D representation of skin surfaces. Localisation biases, though consistent from person-to-person, differ qualitatively between the palm and the dorsum. Second, body representations underlying position sense appear to rely on an intermediate representation. Distortions of hand shape are qualitatively similar between the palm and dorsum, suggesting that they do not rely on fully distinct 2-D representations of each surface. However, the magnitude of distortions is reduced on the palm, inconsistent with a representation of the hand as a fully 3-D object. Position sense may rely on a 2.5-D representation of the body, analogous to the 2.5-D sketch proposed in vision by David Marr. Finally, the conscious body image appears to be largely undistorted, with a clear match between the palm and dorsum, suggesting they rely on a fully-integrated 3-D representation of the hand as a volumetric object. Together, these findings reveal a hierarchy of body representations effecting a coordinate transformation from fragmented 2-D maps in somatosensory cortex to a volumetric representation of our body in the world.

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