

*Commentary* to Dijkerman & de Haan: Somatosensory processes subserving perception and action. Appeared on **Behavioral and Brain Sciences (BBS)**, **30, 2, 221-222**.

**Body image and body schema: The shared representation of body image and the role of dynamic body schema in perspective and imitation**

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**Abstract:** Our commentary addresses two issues that in our opinion are not developed enough in the target article. First, the model does not clearly address the distinction among external objects, external body parts, and internal bodies. Second, the authors could have discussed further the role of body schema with regard to its dynamic character, the role of perspective, and the role of body schema in imitation.

<C-text begins>Dijkerman & de Haan (D&dH) propose a model that takes into account the role of the somatosensory system in perception and action, in analogy with the dual-route model of the visuocortical system. In our commentary, we address two issues that are not developed enough in the target article.

One of the core aspects of the model that is different from the dual-route model of the visual system is that the former distinguishes between internal and external stimuli; that

is, it considers the somatosensory processing of one's own body and of external objects. First, even though the target article presents a wide review of the literature on body image, we believe the model does not clearly address either the distinction between external objects and external body parts or internal bodies with regard to body image. Second, the target article should have discussed further the role played by body schema. D&dH do not sufficiently underline the dynamic character of body schema. In addition, even though they admit that the neural correlates of visual representation of the observers' own body has received scarce attention, they do not address the behavioral and neural literature focusing on the role of one's own perspective and others' perspective in body schema. Finally, we think that D&dH should take into account the role of the body schema in the imitation of action. Here, we consider these two aspects in turn.

D&dH do not clearly discuss how the bodies of others are processed: Are they considered external objects or external bodies? For example, their model cannot explain fully how others' body parts are recognized tactilely. This issue is important because the results of both neuropsychological and experimental studies on body image suggest that a common supramodal is used for representing the bodies of others, as well as one's own (Bosbach et al. 2006; Buxbaum & Coslett 2001). This is suggested by the inability of autotopagnosic patients to locate body parts on their own body, on another's body, or on a mannequins' body (Buxbaum & Coslett, 2001; Ogden 1985; Semenza 1988; Sirigu et al. 1991) and by the results of a study on healthy participants by Reed and Farah (1995). A possible explanation of how this recognition takes place might be to assume that an external hand is tactilely recognized and activates its corresponding representation in

semantics (as suggested by the link between the tactile object-recognition module and the semantics module, which also includes the semantic knowledge about the body).

However, because of the lack of a direct link between semantics and the internal body image, it is difficult to understand how another body's hand can, for example, be recognized as being a right or a left hand. D&dH should at least add a link between the internal body image and semantics. In this regard, a clarification is needed regarding terminology. They distinguish between body schema, body image, and some form of semantic and conceptual representation of the body. However, in the recent literature, a more clear terminology is proposed. For example, Schwoebel et al. (2004) distinguish between body schema, body image *or* body semantics, and body structural description. In sum, even though D&dH discuss the existence of a semantic and conceptual representation of the body, they do not relate body image to semantics in their model.

They do not discuss enough the role of body schema as far as three aspects are concerned: its dynamic character, the role of perspective, and the role of body schema in imitation. The dynamicity of body schema is clearly demonstrated by the neural and behavioral literature focusing on body schema being enlarged through the use of tools (for a review, see Maravita & Iriki 2004). We believe that D&dH should at least briefly consider this interaction between body and object conceived of as an extension of the body.

Moreover, the target article does not develop enough the role played by perspective taking. The authors dismiss the literature in this field by arguing that there is ample

evidence for egocentric coding of external targets and that the neural correlates of visual representation of an observer's own body have received less attention. However, perspective is an important issue: Perspective is one of the visual characteristics that enables us to distinguish our own body from the body of someone else. According to the use terminology used, *egocentric* refers to the perspective consistent with looking at one's own body, whereas *allocentric* refers to the perspective that is consistent only with looking at someone else's body (Saxe et al. 2006). The results of both neural and behavioral studies have provided evidence for distinct representation of the self and others with respect to visuospatial perspective taking. Much neural evidence confirms our sensitivity to action perspective (Carey et al. 1997; David et al. 2006; Jackson et al. 2006; Knoblich 2002; Ruby & Decety 2001). On the behavioral side, evidence of the role of perspective is more scarce. However, Vogt et al. (2003) suggest the existence of two different priming effects: a visuomotor priming effect, driven by a visual stimulus (a hand), that automatically evokes a motor response; and a motor visual priming, driven by planning, that enhances the visual processing of body parts in the egocentric perspective.

Finally, we think that the D&dH should at least briefly consider the role of dynamic body schema in the imitation of action, as shown by the results of neuropsychological and brain-imaging studies (Buxbaum et al. 2000; Chaminade et al. 2005; Goldenberg 1996). Indeed, a common code that links different body parts and their spatial configuration is independent of different modalities and perspective (Goldenberg & Karnath 2006).

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