VARELA AND EMBODIMENT

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Francisco Varela (1946-2001) made his studies in biology in Chile and in the United States, with the neurobiologist Humberto Maturana, with whom he developed the theory of autopoiesis. According to this theory, the minimal form of autonomy that defines biological life is autopoiesis or self-production, which has the form of a reaction network operationally closed and membrane-bound. The theory of autopoiesis prevents to consider the nervous system as an input-output information processing system. After some years spent in the United States, Varela moved to Paris where he addressed two main directions of research: experimental analysis of brain activity, in particular for what regards the neuronal integration during cognitive tasks; and phenomenological investigation of human consciousness. Within this second direction of philosophical studies, Varela developed an original and controversial approach to cognition [Varela, F., Thompson, E., & Rosch, E. (1991). *The Embodied Mind*. Cambridge, MA: MIT Press; Thompson, E., Palacios, A. and Varela, F. J. (2002). Ways of Coloring: Comparative Color Vision as a Case Study for Cognitive Science. In A. Noe & E. T. Thompson (Eds.), *Vision and Mind: Selected Readings in the Philosophy of Perception*. Cambridge, Mass.: The MIT Press, Behavioral and Brain Sciences].

This approach, that has came to be called the 'enactive' view, is aimed at surpassing the mind/world dichotomy felt by many as a hindrance to the development of a mature psychology.

In Varela's enactive view, the world and the cognitive organism determine each other: the organisms select relevant properties of the physical world and the world selects the structure of the organism during their co-evolutionary history.

An important corollary of the enactive approach is in fact that cognition is *embodied*. This claim represents a crucial step towards the development of a new trend of researches in cognitive sciences, where the cognitive process is investigated without abstracting from the conditions in which it takes place.

In fact, the statement that "the body matters" for cognition brings forth relevant consequences for the conception of the body and the mind and contains indications for the research on the loop between perception, cognition and action.

The statement that "the body matters" for cognition is quite widespread in the frame of the opposition against the classical approach to cognitive sciences, the computationalist-representationalist approach to cognition. But in what way the body plays a constitutive role in cognition? And what should we mean with the term "body"?

The claim about embodiment in cognition can be understood as a statement relative to the role played by the *physical structure of the body* in cognitive, perceptual and motor performances and acquisitions.

However, the conception of the body as simply a physical entity is only one step towards the co-determination of the organism and world which is proposed by Varela.

As a medium of the interaction with the world, Varela conceives the body as a structured set of behavioral repertories, of motor and perceptual capabilities and activities. Embodiment goes beyond the physical structure of the organism since it is principally characterized by the sensorimotor structure of the animal: body-scaling, sensory-motor capacities.

"The actions of an animal and the world in which it performs these actions are inseparably connected. Going through life as a small fly makes a cup of tea appear like an ocean of liquid; an elephant, however, will see the same amount of tea as an insignificant drop, tiny and barely noticeable. What is perceived appears inseparably connected with the actions and the way of life of an organism."

Sensorimotor capacities, or the activity of the animal, are then crucial in the mutual enactment of the world and mind. As the world selects the sensorimotor capacities of the animals that are valid for life and adaptation, animals select the properties of the world that are relevant for their structure.

"the structure of the perceiving animal, understood as the kinds of self-organizing neuronal networks that couple sensory and motor surfaces, which determine both how the animal can be modulated by the environmental events and how sensory-motor activity participates in animal-environment codetermination" [Thompson, 2002, p. 399].

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For consequence, animals with different sensorimotor capacities will segment the world in different ways.

"animals with different sensory-motor capacity would segment the world in different ways. As a corollary we claim that the prespecified world we find in […] is actually the world as described in relation to the sensory-motor capacities of the higher primates." [Thompson, 2002, 2003, p. 399-400]

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The assertion of embodiment as relevance of the proper motor-perceptual activities of the organism is strictly connected to the idea that action and perception are inseparable. Perception and action have evolved together and form an inextricable loop.

"The first step for perceptual theory is to refuse to separate perception from action, or, more generally, from perceptually guided activity." [Thompson, 2002, p. 393].

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The foundation of the embodied view of mind on the existence of a structural connection between action and perception is in harmony with Merleau-Ponty's phenomenology of perception.

Merleau-Ponty affirms that the body's actions and projects are the conditions for entering in a cognitive relation with the world because the objects of the world are perceived as "practicable" objects, in relation to the bodily capabilities and skills. The acquisition of motor habits or skills is then equivalent to the acquisition of new "practicabilities"; in this sense, it extends to both motor and perceptual competences, and

also to the limits of the meaningful world, because it annexes objects which have become "practicables" for the body.

The stick of a blind person is an example of extension of the motor and perceptual possibilities of the body through the acquisition of new skilled actions. Becoming part of the body, the prosthetic stick enlarges its sensory possibilities. This acquisition makes other objects bound to the subject, they become "practicables" to him, in a motor and in a perceptual sense.

Built as it is mainly in opposition to mainstream cognitive science, the enactive trend vigorously defended by Varela is still far from having become a full-fledged theoretical paradigm. However, it has the important merit of having pointed out some weaknesses of mainstream cognitive sciences, in particular their tendency to neglect dynamic phenomena, action, and situatedness. Future research will show whether it is possible to accommodate these aspects of cognition into a comprehensive theory.