INTERNATIONAL LEXICON OF AESTHETICS

Spring 2019 Edition, ISSN 2611-5166, ISBN 9788857559926, DOI 10.7413/18258630052

EMBODIMENT

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(First published May 31, 2019)

It. *Incarnazione, Embodiment*; Fr. *Incarnation, Embodiment*; Germ. *Verkörperung, Embodiment*; Span. *Encarnación, Embodiment*. The English term literally means the act or process of embodying something, i.e. something becoming part of a body. In the last decades, embodiment has become one of the most ubiquitous, debated, and popular concepts in academic research. It is currently used in a wide variety of research fields, including but not limited to cognitive science, philosophy, neuroscience, anthropology, psychology, ecology, and nursing. Interestingly, although the origins of the notion are rooted in 20th Century philosophy, the Stanford Encyclopaedia of Philosophy lacks of the 'Embodiment' entry, while mentioning it in 153 related entries, such as 'Embodied Cognition', 'Cognitive Science', and 'Phenomenology'.

THE PHENOMENOLOGICAL ORIGIN OF THE CONCEPT

Being originally developed in the field of phenomenology by philosophers such as Husserl (1952) and Merleau-Ponty (1945), the concept of embodiment implies that the body of a living system is a constitutive category of its perceiving, knowing, understanding and doing (Gallagher 2005). In this sense, embodiment refers to the fact that higher cognitive functions – such as imagination, rationality or morality – ground in lower sensorimotor levels. Against Descartes, Husserl attributed a crucial importance to embodiment, making corporeality (*Leib*) a constraint of a purely intellectual understanding of what he called the life-world (*Lebenswelt*) (Zipoli-Caiani 2011). Merleau-Ponty states that perceptual experience emerges from the interaction between mental and environmental domains, so that the subject can primarily be conceived as living "in a direct commerce with beings, things and his proper body" (Merleau-Ponty 1983: 189). Human body (*corps propre*) appears no more as a material thing (*Körper*) as Descartes conceived it, but should be retained a constitutive element of the perceptual world. Accordingly, human motor experience shapes our primary access to the world and our conscious life. For this reason, Gallagher

and Zahavi hold that the philosophy of Merleau-Ponty overcomes Cartesian dualism presenting the body as "a constitutive or transcendental principle" (Gallagher, Zahavi 2008).

Such an embodied approach reshapes the relationship between perception, cognition, and action, emphasizing the role of the human body as a mediator for meaning formation. Mental representations, traditionally considered as "cognitive", clearly contain aspects of perception and action, most obviously present in the neural signatures of mental simulation and likely in many other cognitive operations (Clark 2008).

EMBODIED COGNITION

Scholars have stressed the impact of phenomenology on the development of the cognitive sciences by means of a novel approach to the body that highlights "the way the body structures our experience" (Gallagher, Zahavi 2008). Recently, empirical evidences highlighted the mutual influences between perception and action, inviting researchers to overcome the old paradigm of a mere passive and receptive role of the subject in the perceptual process (Witt 2011). The coupling of perception, action and cognition implied a different conceptual framework, in which mental, behavioral and motor responses concurrently occur and define human experience (Shapiro 2011). An embodied approach to cognitive science holds that traditional decompositions of the cognitive system into inner functional subsystems or modules are misleading, and blind us to arguably better decompositions into dynamical systems that cut across the brain–body–world divisions (Thompson, Varela 2001: 418).

The strict relationship between action and perception implies that what the organism senses is a function of how it moves, and how it moves is a function of what it senses (Hurley 1998). This idea has been successfully applied to different domains of human aesthetic experience. "Embodied Music Cognition" (Leman 2007), for example, is a recently developed epistemological and theoretical paradigm in which cognitive levels of music experience are not considered as separated from perceptual and motor correlates. Music cognition therefore grounds in sensorimotor networks, due to the functional and neurophysiological linkage between cognition, human motor system, gestures and body movements (Leman, Maes 2014; Leman, Nijs, Di Stefano 2017).

EMBODIED AESTHETICS

In the last decades, aesthetics has attracted serious empirical attention from cognitive psychology and neuroscience. In an attempt to lend a biological perspective to the understanding of aesthetics, neuroaesthetics aims at mapping the neurobiological substrates of aesthetics, suggesting that aesthetic experiences emerge from the interaction between neural systems involved with sensory–motor processes, emotion–valuation processes, and meaning–knowledge processes (Chatterjee 2014).

In this field, embodied aesthetics investigates the primary factors that influence aesthetic experience in the human brain, focusing on the human body and on the role played by embodiment (Kirsch, Urgesi,

Cross 2016). Gallese proposed the notion of 'Embodied Simulation' as a key factor for the understanding of human aesthetic experience (Gallese 2005). Embodied Simulation is supported by empirical evidences that suggest that the human and non-human primate brain is capable of inferring (and covertly simulating) the behavior of others not only when the action is directly observed, but also when the effect of others' actions is the only information available. This phenomenon fostered further investigations on the role of action simulation in aesthetic appraisal and appreciation of art forms such as music (D'Ausilio *et al.* 2006). An electroencephalographic (EEG) experiment (Umiltà *et al.* 2012) has explored whether the motor system is triggered by passive observation of abstract art (i.e. Lucio Fontana cuts on canvas) where the action of the artist can only be inferred. The results showed that motor system is triggered by visual perception of the original art works by Fontana and not by high-resolution digitized static images of them, with no influence of familiarity or previous exposure on motor cortex involvement. Authors suggest that cortical activation may be regarded as a form of Embodied Simulation understood as a functional mechanism characterized by the reuse of motor representations when observing others' actions or the visual results of such actions.

EMBODIMENT AND SELF IDENTITY

Another way of conceiving the notion of embodiment has been fostered by research on self and body-ownership. In 1998, Botvinick and Cohen (1998) published a paper on *Nature* presenting the Rubber Hand Illusion, in which watching a rubber hand being stroked synchronously with one's own unseen hand causes the rubber hand to be experienced as part of one's body, i.e. the embodiment of the rubber hand. Starting from this work, researchers have been manipulating the experience of body-ownership shedding light on the multisensory processes that update or disrupt the awareness of our physical and psychological self (see Tsakiris 2017 for a review). Findings show that multisensory integration can update the mental representation of one's body, such as the sense of ownership of body-parts (Longo et al. 2008) or whole body (Leggenhanger *et al*. 2007). Besides the relevance of the Cartesian interoception (i.e. the perception of the body from the *inside*) for body self-awareness, these results evidenced that self-awareness is highly malleable and subject to the influence of exteroception (i.e. the perception of the body from the *outside*), thus paving the way for an embodied model of the self. The exteroceptive model of the self-highlights the malleability of body-awareness given the striking effects that multisensory integration has on body-ownership, while the interoceptive model of the self seems to serve the stability of the body and its mental representation in response to external changes, reflecting thus the biologically necessary balance between adaptability and stability (Tsakiris 2017).

In particular, Tsarikis argues that one's body is processed in a probabilistic manner as the most likely to be "me". Such probabilistic representations are the results of the integration of top-down 'predictions' about the body with bottom-up inputs from unimodal sensory systems. Perceptual learning processes update the body representation to first induce a sense of ownership over the new body and next to incorporate, i.e. to embody, perceptual features of the other's body, in order to minimize this error and maintain a continual sense of 'mineness' (Tsarikis 2017). Interestingly, further findings show that a change in the

perception of a bodily aspect of the self ultimately alter also the affective (Maister,Tsiakkas and Tsakiris 2013) and social processing of others (Maister *et al*. 2013).

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HOW TO QUOTE THIS ENTRY

N. Di Stefano, *Embodiment*, "International Lexicon of Aesthetics", Spring 2019 Edition, URL = https://lexicon.mimesisjournals.com/archive/2019/spring/Embodiment.pdf, DOI: 10.7413/18258630052.

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N. Di Stefano, *Embodiment*, "International Lexicon of Aesthetics", Vol. 2, Milano, Mimesis, 2019.