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Review article

Through the forest of motor representations

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ABSTRACT

Following neuroscience, and using different labels, several philosophers have addressed the idea of the presence of a single representational mechanism lying in between (visual) perceptual processes and motor processes involved in different functions and useful for shaping suitable action performances: a motor representation (MR). MRs are the naturalized mental antecedents of action. This paper presents a new, non-monolithic view of MRs, according to which, contrarily to the received view, when looking at in between (visual) perceptual processes and motor processes, we find not only a single representational mechanism with different functions, but an ensemble of different sub-representational phenomena, each of which with a different function. This new view is able to avoid several issues emerging from the literature and to address something the literature is silent about, which however turns out to be crucial for a theory of MRs.

Contents

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1. Introduction

> The hand has a very complex anatomical structure. Functionally, movements of the hand require a coordinated interplay of the 39 intrinsic and extrinsic muscles acting on 18 joints. Among all the joints of the hand, of particular importance is the carpometacarpal joint of the thumb. This joint is of a saddle type and its immense significance for the hand function emanates from the extra mobility this joint is endowed with, resulting in the opposition of the thumb to the other fingers. The plethora of bones, joints, and muscles of which the hand is constituted gives to this structure amazing biomechanical complexity. From the kinematic perspective, the hand has over 20 degrees of freedom. Thus the question arises: how does the brain control the hand?
>
> [Raos, Umiltà, Murata, Fogassi, & Gallese, 2006: 709]

The importance of investigating the mind starting from the naturalization of the mental antecedents of actions has been recently and excellently brought to the attention of the philosophy of mind (Nanay, 2013b). Accordingly, following neuroscience, and using different labels, several philosophers have addressed the idea of the presence of a single representational mechanism lying in between (visual) perceptual processes and motor processes involved in different functions and useful for shaping suitable action performances: a motor representation (MR).[1] MRs are the naturalized mental antecedents of action – I am excluding mental action here.

This paper presents a new, non-monolithic view of MRs, according to which, contrarily to the received view, when looking at in between (visual) *perceptual processes* and *motor processes*, we find not only a single *representational mechanism* with different functions, but an ensemble of different sub-representational phenomena, each of which with a different function. This new view is able to avoid several issues emerging from the literature and to address something the literature is silent about, which however turns out to be crucial for a theory of MRs. Before developing my account, I need to sketch the basic positions in the literature about MRs.

2. The positions in play

In order to sketch the basic positions held in the literature, a premise on neurophysiology is needed.

A common ground to link visual perception with action is the "Two Visual Systems Model" (TVSM), which suggests the presence, in humans and other mammals, of a separation of two main (see Sections 4.1 and 5.5) visual pathways, grounded on distinct anatomo-functional structures (Milner & Goodale, 1995): one for visual recognition, the ventral stream, and one for visually guided action, the dorsal stream. They can be dissociated due to cortical lesions. Lesions in the dorsal stream (the occipito-parietal network from the primary visual cortex to the posterior parietal cortex) impair one's ability to use what one sees to guide action (optic ataxia), but not object recognition; lesions in the ventral stream (the occipito-temporal network from the primary visual cortex to the inferotemporal cortex) impair one's ability to recognize things in the visual world (visual agnosia), but not action guidance (Jacob & Jeannerod, 2003; see also Jeannerod & Jacob, 2005). Moreover, we have behavioral studies of normal subjects involving visual illusions that can deceive the ventral stream but not the dorsal one; thus, it seems that, unlike ventral perception, dorsal perception is completely inaccessible to consciousness (I'll come back to this in Section 5.2).

Starting from this specification, we now come to the list of the positions about MRs. I should specify that I will just mention the positions in the literature which propose a naturalized account of these mental antecedents of action, namely, those that follow neuroscience in order to build an idea of MRs. Indeed, I agree that, in order to understand MRs, we have to turn to empirical science (Nanay, 2014), something not always pursued in the literature about action-representations.

2.1. MRs are dorsal phenomena, not consciously accessible and represent action goals, bodily movements and action properties

A widely agreed idea about MRs is that they are due to the dorsal stream (Pacherie, 2000, 2011) and, given its encapsulation, MRs are not normally consciously accessible (Pacherie, 2000: sec. 5, 2002: 63, 2006: 14, 2007: 8, 2011: 14; Jacob &

[1] I will ignore the different labels found in literature and simply talk about MRs.