Sensorimotor Values in Frames

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The main claim put forth in this paper is that what resides at the lower level of any given frame are sensorimotor values. Furthermore, I argue that one could appeal to frames in order to understand the ways in which cognition is grounded on perception.

Frames and Perception According to various theorists of perception, human subjects have a sophisticated and flexible ability to focus attention on coherent features of objects as well as on the relations between these features. Crucially all the information picked up by selective attention during perception is stored in the mind in a representational format. Initially, a rough sketch of the represented object is formed. On subsequent experiences with instances of a given object, selective attention focuses on particular aspects of the object and the resulting perceptual representations are integrated in an object-centered reference frame in a manner that preserves the spatial relations between the object's parts. In this way, a given frame becomes informationally enriched (Barsalou, 1999).

Frames are recursive attribute-value-structures that allow us to account for the ways in which all knowledge is encoded in the human mind. A given frame is a frame of a given type, which has a number of attributes, and which in turn take different values. It is characteristic of frames that the attribute-value-structure is recursive and on the basis of specifying an attribute as a type and adding extra layers of attributes and values one can represent all information falling under a given category/superordinate type. At the same time frames allow space for connections between (attributes of) different types. Crucially, frames could play a further explanatory role. Namely, frames could account for the relation between cognition and perception.

Cognition and Sensorimotor Values The starting point of the present proposal is that concepts are the building blocks of thoughts and that concepts are themselves built out of perceptual representations, e.g. Prinz (2002). Furthermore, we take it that there are no central systems – (and in turn no amodal symbols) – in the human mind to the extent that peripheral systems can be taken off-line to simulate perceptions and actions as explained presently. Note though that defending such a position extends beyond the scope of the present proposal. It should also be clarified that even if all human knowledge is analyzable in terms of sensorimotor representations, the connections between them might well be of a non-sensorimotor nature. Depending on the level of analysis, those connections might well be co-activation patterns of neurons (think of that in terms of Hebbian learning, Associative Long Term Potentiation of neurons or Classical Conditioning) or conceptual abilities. In order now to understand how cognition occurs, it would be of great significance to understand how those perceptual representations are structured in the human mind and how they contribute in thought production.

On recalling a given concept, say the concept TREE, the brain simulates, to use Barsalou's (1999) term, the states of neural activation that underlain perception of the object in question. In terms of frame theory, tokening of any given thought is underlain in representational terms by tokening of a part of a frame or a set of parts of dif-

ferent frames. Thus, frames already provide us with an insight about how stored representations contribute in thought production.

Given the claim that concepts are built out of perceptual representations, and that frames provide a suggestion about how knowledge in the mind is structured, for instance how concepts are analyzed into their components, it is argued that the endpoint of frames (i.e. the endpoint of analysis) is the level at which perceptual or rather sensorimotor representations reside. More specifically, it is argued that the values at the lower level of a frame analysis are sensorimotor values. In this sense, when tokening a given thought, the aforementioned simulation of the original perceptual experience occurs in virtue of reactivation of the perceptual representations. This, in turn, means tokening of the sensorimotor values residing at the bottom-level of the activated concept-frame. Thus, analyzing concepts in frames allows us an insight about the relationship that holds between two levels of analysis; namely, the higher-cognitive and the lower-neuronal level. So, once again, following down an activated "pathway" of a given frame allows us an insight of the way in which a given concept is grounded on sensorimotor information.

But what is sensorimotor information, or values, to put in terms of frame theory? What happened to the traditional neat and intuitive distinction between sensory and motor processes? Do we have enough grounds to bring sensory and motor values together? In reply, I argue that there are good reasons to talk about sensorimotor representations, in the sense that representations used for perception and motor control are involved in thinking. This claim enjoys significant empirical support from Common Coding Theory and evidence suggestive of the claim that the human brain simulates the relevant perceptual states during recalling a given concept/thought. That said, one should always bear in mind that perceptual and motor values are independent and functionally different, and that perception does not causally depend on motor processes, as for instance Noë (2005) and Hurley (1998) suggest. It is thus suggested that by having an understanding of the nature of sensorimotor representations, and values, in terms of frames, we could first of all acquire a clear view about how knowledge is encoded in/by the brain and also about the relation between cognition and perception.

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