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Geometric cognition: a hub-and-spoke model of geometric concepts

Here, we develop a model of the neural representation of geometric concepts. From the perspective of a philosophy of mathematical practices, we should consider actual practices in their historical context. We will develop a model for Euclidean geometry. To arrive at a coherent model, we found it necessary to consider earlier forms of geometry. The models will be based on the hub-and-spoke theory. According to this theory, the neural representation of concepts is made in terms of spokes, which are modality-specific brain regions that codify modal features of concepts (e.g., visual and verbal representations). There are also integrative regions – the hub – which blends, in an amodal format, the different aspects codified in the spokes and gives rise to coherent concepts. The hub enables a modality-free codification of further aspects of concepts. Notice that we can address a particular concept directly in terms of ‘spokes’ and a ‘hub’ not has regions in the brain but as ‘parts’ of the concept. Here, we will start by addressing the practical geometry of ancient Greece. Then we consider Hippocrates of Chios’ work. We develop models for these two cases. Finally, we develop the model of the neural representation of geometric objects in Euclidean geometry.