Constructing space: A theoretical basis for how naive artificial or biological agents can construct spatial notions

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The brain sitting inside its bony cavity sends and receives myriads of sensory inputs and outputs. A problem that must be solved either in ontogeny or phylogeny is to extract the particular characteristics within this “blooming buzzing confusion” that signal the existence and nature of physical space, with structured objects immersed in it, among them the agent’s body. I shall show how a biological (or artificial) agent with arbitrary sensors can discover the existence of one important aspect of space, namely rigid displacements, without any prior knowledge about the structure of its sensors, its body, or of the world. Following an idea of Henri Poincaré, the method involves examining the compensable relations between the sensorimotor contingencies linking sensory and motor variables. Once acquired, the notion of rigid displacement will allow the agent to manifest apparently spatial knowledge in its behaviours.