HOW TO REPRESENT OBJECT PERMANENCE IN PREMOTOR CORTEX WITH A CONTINUOUS ATTRACTOR NETWORK.

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Neurons with aligned visual and tactile receptive fields have been reported in several interconnected regions of the parietal cortex (VIP and area 7b), basal ganglia (putamen), and frontal cortex (premotor area 6). In the premotor cortex, some bimodal cells continue to respond to a visual object in the receptive field even after the light is turned off, which suggests that the neural system underlying these responses is bistable. A computational model that can account for this phenomenon is presented based on a recurrent network with a bistable shiftable attractor. The model encodes object location close to the body by a self-sustaining packet of activity on the somatotopic map. Although sensory inputs from different modalities are dynamically aligned on this map, the activity packet does not depend on these inputs and can move continuously on the map using only motion information. The map is also locally stable at a uniform low activity state, corresponding to the absence of an object. The model makes testable predictions for transient responses and what happens when a second object is introduced. This model provides an explicit, plausible sensorimotor mechanism for representing object permanence in body-centered coordinates, and could be used to guide motor behavior in the dark, behind occlusion, or when the target is out of view.