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Paving the way to cognitive maps

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Cognitive maps in the human brain: How are they organized? How are they anchored to the perceptual world?

To navigate efficiently from place to place, humans and animals rely on internal representations of the spatial structure of the world. These are sometimes referred to as "'cognitive maps'" because they play a functional role that is similar to physical maps. The neural basis of cognitive maps have been studied extensively in rodents, but many aspects of how they are encoded in the human brain remain unclear—indeed, even the claim that humans encode cognitive maps remains controversial among psychologists. In this talk, I will describe work from my lab that addresses two fundamental questions about cognitive maps. First, what format do cognitive maps take? Under the classical formulation, cognitive maps are Euclidean reference frames that extend across space in a global and equipotential manner. However, real-world environments have a complex, articulated structure—buildings are divided into rooms and corridors, while cities are divided into neighbourhoods. Our recent fMRI work has identified neural mechanisms that allow these complex structures to be represented in the brain. Second, how are cognitive maps grounded by perceptual inputs? To use a cognitive map, a navigator must be able to use perceptible features of the environment ("landmarks") to determine where they are and which direction they are facing. Our work has delineated a neural system for landmark anchoring that encompasses the hippocampus, retrosplenial/medial parietal region, and scene-selective parts of the visual system. The importance of these results is emphasized by the fact that cognitive maps are believed to be used not just only for spatial navigation, but also for reasoning, inference, and memory in a wide variety of knowledge domains. By investigating how cognitive maps are organized and anchored in the spatial domain, we hope to shed light on the role that they play in mediating human thought more broadly..

Host:

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Virtual guests are welcome!

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