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Algorithmic representations in the human brain that underlie schema generalisation

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Abstract

The human brain represents structure in the external world as “cognitive maps”. However, it remains unknown how it represents structure in one’s own behaviour. Recent findings show rodent medial-prefrontal cortex (mPFC) does this with a structure-sensitive representation, where all future actions are represented simultaneously. Here, using 7T fMRI, we test for this representation and its properties in humans. Using RSA and a computational model, we show this representation in mPFC and orbitofrontal cortex, while entorhinal and orbitofrontal cortices contain a pure abstraction of task structure. Preceding the future actions representation, action plans are ‘loaded’ to mPFC once subjects were given all action-relevant information, suggestively through replay. iEEG data of patients solving the same task shows that sharp-wave ripple rate is increased during this planning time. Together, our findings suggest an algorithm of how human mPFC encodes future actions, and provide evidence for a replay-based mechanism of loading that representation.