Learning objects, places and relations in a brain model of visual navigation

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The act of recognizing an external stimulus implies the activation of a piece of knowledge about the stimulus and its relevance to the subject. It therefore becomes necessary to elaborate a semantic model to which the recognition process can make reference. Collett et al. 1986 showed that gerbils learn from experience what objects are relevant and how they can be used in order to better find food in an environment.

We present a brain model of visually guided navigation. The model is designed to be able to extract knowledge about the environment, like what are the common relationships held by the different stimuli in the environment. The knowledge acquired should then be used to improve the interaction by establishing predictions about subsequent events in the environment.

The model's visual hierarchy selects stimuli for attention according to bottom-up saliency and top-down expectations. The parietal cortex implements bi-directional egocentric-allocentric coordinate transformation of spatial locations to build, in cooperation with the hippocampus, a spatial representation of the environment. Space is represented as a succession of records specifying the location of some target relative to some reference

The hippocampus records and links together the stimuli experienced during an episode. So that later sequence recall allows predictions of future events. Similarly, replay of episodic sequences during quiet periods leads to the consolidation of semantic memory in parahippocampal region, namely perirhinal representations of stimuli appearing in a close context become correlated

The simulated animal finds food by recursively retrieving the location of a reference with respect to which the target's location has been learnt. When the target's location has been recorded in the hippocampus relative to more than one reference, the animal first searches for that reference which perirhinal representation is most heavily correlated to the target and the animal's current location.

The model has been fully implemented and simulation results will be shown.